

Naturalized Rationality, Evolutionary Psychology and Economic Theory

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Abstract

The rationality assumed by mainstream Rationalistic Economics (RE) and the irrationality purportedly revealed by Behavioral Economics (BE) are like a Hegelian “thesis” and “anti-thesis.” Well aware of this conflict, proponents of RE have pursued several strategies to reconcile RE’s rationalistic thesis with the ample evidence supporting BE’s irrationalistic anti-thesis. Yet, none of these attempts appear satisfactory, which casts serious doubt on the possibility of reconciling RE with BE. Recently, Robert Aumann, 2005 Economics Nobel Laureate, has suggested a novel approach to this conflict, indeed, a new paradigm (Rule-Rationalism, or RR), which is supposed to synthesize RE and BE in terms of an innovative evolution-grounded notion of rationality. One aim of this paper is to cast further doubt on the possibility of reconciling RE with BE by showing that Aumann’s suggested non-standard reconciliation fails. Another, related, aim is to show that RR does not genuinely present an alternative to RE and standard BE, but, rather, falls well within the bounds of the latter. Yet another aim is to address two fundamental issues in philosophy and psychology that RR involves—namely, the possibility of naturalizing practical rationality in evolutionary terms, and the scope of evolutionary explanations in psychology and economics. These aims are interwoven, as is reflected in the structure of the paper’s central argument. We begin by arguing that practical rationality cannot be naturalized in evolutionary terms. Based on this we then argue that RR fails to synthesize RE and standard BE, yet that it may still be a new and better paradigm than either one of them. Next, we argue that evolutionary explanations in psychology and economics are of a limited scope. Based on this, we then conclude the paper by arguing that RR does not form a new paradigm in economics after all, and is, instead, tantamount to a call for evolutionary explanations in BE (when possible).

Keywords: Aumann, Rationalistic Economics, Behavioral Economics, Neuroeconomics, practical rationality, act rationality, rule rationality, naturalized rationality, intentional agency, Evolutionary Psychology, Human Behavioral Ecology

1. Introduction

The assumption of rationality—that people act in their own best interests, or seek to maximize utility—underlies most of economic theory.¹ Indeed, utility maximization is the central paradigm of mainstream economic theory, or Rationalistic Economics (RE) as we shall call it (Simon 1999; Tomer 2007, 466-467; Aumann 2008, 2; Etzioni 2011). Yet, ample evidence has accumulated suggesting that subjects deviate systematically from utility maximization. This evidence has led to the development of Behavioral Economics (BE), a core claim of which is that rationality is bounded, and that subjects are irrational to the extent that they do not always seek to maximize utility.² Thus, a core assumption of RE and a core claim of BE are like a Hegelian thesis and anti-thesis.³

In an attempt to reconcile their core rationalistic thesis with the evidence supporting BE's irrationalistic anti-thesis, proponents of RE have pursued four main strategies (Etzioni 2011, 1101-1108). First, marginalize the recalcitrant findings—i.e., acknowledge their validity but insist that their implications are rather limited. Proponents of this strategy generally insist that the recalcitrant findings merely illuminate relatively minor foibles, or that the required departures from RE are not very radical, but merely relax simplifying assumptions of RE that are not central to this economic approach. Second, reframe the irrational as rational—i.e., reinterpret the recalcitrant findings to make them fit RE's core thesis: no matter how strange or irrational a particular economic decision might seem,

1. The rationality of *actions* or practical rationality of the sort referred to here differs from the rationality of *beliefs* or theoretical rationality that involves evaluation of the reasons for and against beliefs. Unless otherwise indicated, hence forward we shall mean by 'rationality' practical rationality. There are of course close ties as well as important analogies between theoretical and practical reason (Audi 1990 and 2004). But we shall almost completely ignore these ties-cum-analogies.

2. For a nuanced account of the development of BE, see Sent 2004. Actually, BE consists of quite a few strands as well as individual practitioners whose work does not fit neatly into any one of these strands. However, since there is enough commonality in these strands, they do form a whole (Tomer 2007).

3. RE also assumes unbounded willpower as well as unbounded selfishness, which BE also rejects (Mullainathan and Thaler 2000). Notice that the tension between RE and BE with respect to rationality, willpower, and selfishness does not entail that RE and BE completely exclude each other. As Camerer and Loewenstein (2004, 3) have aptly put it: "At the core of behavioral economics is the conviction that increasing the realism of the psychological underpinnings of economic analysis will improve the field of economics *on its own terms*—generating theoretical insights, making better predictions of field phenomena, and suggesting better policy. This conviction does not imply a wholesale rejection of the neoclassical approach to economics based on utility maximization, equilibrium, and efficiency. The neoclassical approach is useful because it provides economists with a theoretical framework that can be applied to almost any form of economic (and even noneconomic) behavior, and it makes refutable predictions."

construct a rational explanation for it. Third, cut some, rather limited slack in RE's core thesis to accommodate the recalcitrant findings—e.g., relax the conditions on rationality, thereby admitting recalcitrant behavior within the bounds of rationality.⁴ Fourth, delegate the recalcitrant factors to exogenous realms—i.e., divide the social world between realms of behavior that adhere to the laws of RE and those that are governed by different rules, and then confine economics to the former realm. However, none of these strategies appear satisfactory (*ibid.*), which casts serious doubt on the possibility of reconciling RE with BE.

Building upon ideas that have long been “in the air,” Robert Aumann, 2005 Economics Nobel Laureate, has recently suggested a novel approach to the conflict between RE and BE, indeed a new paradigm (Rule-Rationalism, or RR), which is supposed to synthesize RE's rationalistic “thesis” and BE's irrationalistic “anti-thesis” (Aumann 2008; see also Aumann 1997, § 2.3, and van Damme 1998). One aim of this paper is to cast further doubt on the possibility of reconciling RE and BE by showing that Aumann's suggested non-standard reconciliation in terms of RR fails. A second, related aim is to show that RR does not really form a *new* paradigm in economics that might supplant RE and standard BE. A third aim is to address two fundamental issues in philosophy and psychology that RR involves—namely, the possibility of naturalizing practical rationality in evolutionary terms, and the scope of evolutionary explanations in psychology and economics. Indeed, at the core of the paper is an extended argument that weaves all these themes together.

In the first part of the paper (§ 2), we outline RR and explain how it is supposed to synthesize RE and BE by way of a novel notion of rationality (“rule-rationality”), which Aumann suggests as an alternative to the standard notion of rationality used in economics (“act-rationality”). Unlike act-rationality, rule-rationality relies on the notion of evolutionary fitness (to be defined below). Our critical examination of RR centers on this crucial aspect of rule-rationality. By parity of reasoning, it applies to other accounts of rationality in evolutionary terms to which we shall return in due course.

In the second part of the paper (§ 3), we argue that practical rationality cannot be naturalized by way of evolutionary fitness (§§ 3.1-3.4). On this basis we then argue that due to the reliance of RR on the notion of evolutionary fitness, rather than synthesizing RE and BE, RR is to be viewed as a version of BE (§ 3.5).

As such, RR may still be better off than RE and other versions of BE, and if so should

4. The main difference between the second and third strategies may be characterized as a difference in the direction of fit: while the second strategy seeks to fit the recalcitrant findings to a preconceived notion of rationality, the third strategy seeks to fit the notion of rationality to the recalcitrant findings.

supplant them. In the third and final part of the paper (§ 4), we argue that the scope of evolutionary explanations in psychology and economics is rather limited (§§ 4.1-4.5). On this basis, we then argue that due to the central role that evolutionary fitness plays in grounding the notion of rule-rationality, RR cannot really supplant standard versions of BE but can at most supplement them (§ 4.5); indeed, it is tantamount to a call for evolutionary explanations in BE (when possible).

2. Rule-Rationalism

2.1 Act-Rationality vs. Rule-Rationality

At the core of RR lies a distinction between two notions of rationality: “act-rationality” and “rule-rationality.” “[W]hen making [an act-rational] decision, economic agents choose an act that yields maximum utility among all acts available in that situation” (Aumann 2008, 2). In contrast, “under rule-rationality people do not maximize over acts. Rather, they adopt rules, or modes of behavior, that maximize some measure of total or average or expected utility, taken over all decision situations to which that rule applies; then, when making a decision, they choose an act that accords with the rule they have adopted. Often this is the act that maximizes their utility in that situation, but not necessarily always; the maximization is over rules rather than acts” (ibid., 2). In the following two sections we illustrate these rather abstract definitions drawing on Aumann’s discussion of the Ultimatum Game (ibid., 6-7).⁵

2.2 Ultimatum Game Scenarios I—Behavioral vs. Rationalistic Economics

In the Ultimatum Game, two players are offered the opportunity to win a certain amount of money. One of the players (the proposer) suggests how to split the money, while the other player (the responder) may accept or reject the offer. If the responder accepts, both get the share agreed to, otherwise none of them receives any money. According to standard, act-rationality-based utility theory, responders should behave on the principle that any monetary amount is preferable to none. However, responders tend to reject unfair offers although this means missing out altogether. As a result, their behavior seems to manifest a clear violation of act-rationality.

Behavioral economists consider this apparent violation of act-rationality as evidence for the involvement of irrational elements—e.g., wounded pride, self-respect, a desire for revenge, etc.—in economic decision making. In their view, the *apparent* violations of act-rationality are *genuine* violations, which should be accounted for in terms other than

5. Originally introduced by Güth et al., (1982).

utility maximization. When responders in the Ultimatum Game behave as they do, they are driven not by reason alone but by various psychological factors that have nothing to do with utility maximization. And, they argue, these psychological factors should find their due place in accounts of economic decision making.⁶

Alternatively, the apparent violation of act-rationality at issue may be *explained away* by considering the psychological factors in the explanation of economic decision making as simply broadening what counts as utility for rational agents: the satisfaction of anger or of the desire for revenge in the Ultimatum Game is a kind of utility that enters into the agent's rational choice of an appropriate response. Pride, insult, self-respect, and revenge are legitimate sources of utility and disutility, so responders are behaving entirely according to norms of act-rationality when rejecting an unfair offer; they actually get positive utility from taking revenge, and would get negative utility from accepting an insulting offer.⁷ On this view, then, act-rationality is not really violated in cases such as those illustrated by Ultimatum Game scenarios.⁸

2.3 Ultimatum Game Scenarios II—Rule-Rationalistic Economics

6. Among those arguing for the *utility-independent* role of emotions in economic choice behavior (in Ultimatum Game scenarios and others) are Elster (1998), and Rick and Lowenstein (2008). Some appeal in particular to the agent's sense of fairness, for example, Thaler (1988), Rabin (1993), and in some respect also Boudon (1998). The latter appeals to the agent's commitments or principles (among which might be fairness) that enter into decision making, yet have nothing to do with enhancing utility (indeed they might go strongly against utility). Still others appeal to framing effects in decision making, most famously, Tversky and Kahneman (1981 and 1986., and see also the various articles in Kahneman and Tversky 2000).

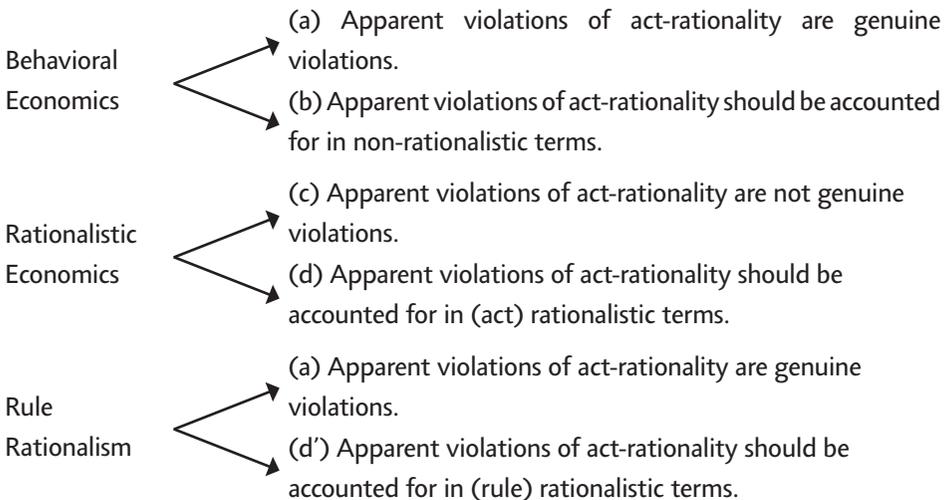
7. See, for example, Fehr and Schmidt (1999) who incorporate a variable of fairness in their utility function, and Bolton and Ockenfels (2000) who replace a utility function with a motivation function that the agent aims to maximize, and in which various psychological factors are represented as variables. Roth 1995 provides a good survey of various approaches to emotions that aim to explain their operation in terms consistent with the maximization of utility.

8. Aumann focuses in his discussion on RE's (1) "reframing the irrational as rational" approach to apparent violations of act-rationality, and ignores completely the three other RE's approaches to these apparent violations: (2) marginalizing them, (3) cutting some slack in RE's assumptions, (4) delegating the apparent violations to exogenous realms. What may explain Aumann's sole focus on (1) are the following assumptions that seem to underlie his discussion: (a) that violations of act-rationality in the Ultimatum Game say, if genuine, are not really marginal; (b) that one cannot really cut a slack in RE's assumptions by defining down what is entailed by being act-rational; (c) that apparent violations of act-rationality as in the Ultimatum Game should be treated within economic theory, and not be delegated to some other field. Since in this part of the paper we outline Aumann's approach, we will follow him in assuming (a)-(c), and therefore also in focusing solely on (1). Notice, however, that nothing in our critical discussion of Aumann's paradigm in the next two parts of the paper (Parts 3 and 4) will hang on these assumptions.

One major response, then, to the apparent violation of act-rationality in the Ultimatum Game is the BE approach of considering it a genuine violation. Another major response is the RE approach of explaining it away as a mere apparent violation. RR suggests a path between the two, synthesizing them by combining major features of both. Like BE it takes act-rationality to be genuinely violated in the Ultimatum Game. However, like RE it aims to account for the decisions of agents in rationalistic terms—viz., in terms of a certain kind of utility maximization. On this view, while it is not act-rational for the responder to reject an unfair offer, it is rule-rational to do so. As a rule, one should reject lop-sided offers, for the reputational reason of being treated more even-handedly in the future—an outcome of high overall utility. Given that the Ultimatum Game involves an anonymous, one-shot, interaction, it is clear that no reputational gain can be had by rejecting whatever offer is proposed. Nevertheless, people follow this rule even in this situation because doing so usually is act-rational, specifically, in almost all—or perhaps even all—natural, “real-world” negotiations, which are not anonymous. In contrast, following alternative rules that *accept* such lop-sided offers might result in the agent’s being act-rational in Ultimatum Game scenarios but would reduce overall utility across negotiation situations, and thus would not be a favorable rule overall.

2.4 Diagrammatic Presentation

The differences between the approaches of BE and RE to apparent violations of act-rationality, as well as the way RR synthesizes these approaches, can be presented diagrammatically as follows:



RR synthesizes BE and RE by combining element (a) of the former economic paradigm

with a modified version (d') of element (d) of the latter paradigm which preserves the gist of (d)—viz., that apparent violations of act-rationality should be accounted for in *rationalistic* terms.

2.5 Behavioral, Rationalistic or Rule-Rationalistic Economics?

In Aumann's view, the RR approach to apparent violations of rationality by economic agents is to be preferred to both the BE approach and the RE approach. It is to be preferred to the former because it purportedly shares with the prevailing paradigm in economics the view of economic agents as rational. And it is to be preferred to the latter approach because it provides a deeper and more satisfactory account of decision making.

According to the RE approach, which denies that we have before us *genuine* violations of act-rationality, the emotions—viz., self-respect, wounded pride, a desire for revenge, and so on—are accorded a utility value. Yet the utility of these psychological factors is left unanalyzed. No account of their utility is provided in more fundamental terms, such as their evolutionary or other purpose or function. No answer is provided to questions such as: What purpose does it serve to feel insulted, or to take revenge? What is the function of self-respect? Without providing some answer to these questions, the RE attribution of utility to the operation of such psychological factors seems ad hoc and question begging, thus threatening to trivialize the very explanation that RE's appeal to utility maximization aims to provide.⁹

The RR approach offers a potentially richer and deeper explanation, both methodologically and conceptually, of the *rational* operation of these psychological factors in the decision making process. It does so by rather plausibly suggesting that such factors may be taken to have evolved genetically or memetically as mechanisms for the implementation of rules that usually, though not always, maximize utility. A combination of these factors, for example, may be considered the mechanism for implementing a rule such as "Reject lop-sided offers" in situations such as the Ultimatum Game. By following such a rule the responder (normally, but not necessarily always) establishes a reputation

9. Fehr and Schmidt (1999), for example, construct a utility function that includes a variable for fairness. Clearly the same can be done with respect to any psychological factor presumed to play a de facto role in decision making. However, without having some substantive answer as to why such a factor, a sense of fairness for example, ought to play any role whatsoever in determining the utility function it amounts to little more than fitting the utility function to the data. Zamir (2001) also points out a similar difficulty with such accounts. As he notes, such accounts merely provide a description of the phenomena in need of explanation. Such descriptions do not constitute an *explanation*. Thus, he argues that "[i]t may be useful to have a utility function, incorporating 'motivations' or 'fairness', that captures observed behavior fairly well, but it is more challenging to explain these attributes from the very basic assumptions of rationality" (ibid., 3).

within her community that promises progressively greater benefits in future negotiation situations, benefits that serve to enhance the responder's fitness, defined as "the expected number of offspring" (Aumann 2008, 3).¹⁰

Although, from the responder's perspective, she is merely acting on the basis of her emotions, she is in fact acting on the basis of a mechanism that has survived evolutionary pressures precisely because it instantiates a rule that maximizes fitness. Thus, in acting on their emotions, responders in the Ultimatum Game are de facto maximizing some measure of total or average or expected utility—viz., fitness. In so doing, they optimize a rule so as to do well "in general," but not necessarily always.¹¹

2.6 Rule-Rationality and Evolutionary Fitness

Fitness, then, plays a key role in Aumann's RR approach to apparent violations of rationality by economic agents. It serves as the link between the operation of seemingly irrational elements in the subject's decision making process and a notion of rationality understood in the traditional RE terms of utility maximization.

According to Aumann, "rationality is a product of evolution. Rationality has evolved, alongside of physical features like eyes, stomachs, limbs, and breasts, because it maximizes fitness. A person shopping around for lower prices is maximizing fitness, because the money saved can be used to purchase food, theater tickets for a date, shelter, attractive clothing, education for the children, and so on – all of which increase fitness" (Aumann 2008, 4). Thus, by viewing rationality from the prism of evolutionary theory, we can explain the operation of *seemingly* irrational psychological factors in decision making as

10. Fitness, in this sense, provides the basis for a formal definition of natural selection which is the agent of adaptation in Darwinian evolution (Travis and Reznick 2009, 106). Aumann's use of this notion reflects his commitment to evolutionary psychology. In the literature on evolutionary psychology, however, the notion usually used is that of adaptation rather than fitness. So adaptation is the notion that will take center stage in the third part of the paper, where we discuss the role of evolutionary psychology in Aumann's paradigm as well as in economic theory in general.

11. Notice that an analogous account cannot be deployed within the framework of the RE approach to the emotions. Viewing the emotions from the prism of act-rationality, this approach takes the satisfaction of an economic agent's emotion in a given situation as a kind of utility that enters into the agent's rational choice of an appropriate response in that *specific* situation. So, it can account for the utility of a satisfied emotion in a given situation in terms of the contribution of this satisfaction to fitness only if the satisfaction at issue does contribute to fitness enhancement. However, the satisfaction of an emotion and fitness enhancement may part ways in specific situations: I may be getting positive utility from taking revenge; indeed, it may become the goal of my life. Yet this may cost me my life. The big advantage of rule-rationality over act-rationality, insofar as evolutionary explanations of choices in terms of fitness are concerned, is that the former but not the latter may be indifferent to disparities between the positive utility of satisfied emotions and fitness enhancement.

having survived evolutionary pressures by their instantiating rules that increase fitness. And, because the operation of these psychological factors increases fitness *by virtue* of increasing overall utility, we can see their operation as contributing to the rationality of the agent, contra BE.

At the same time, we also evade the difficulty of ad hocery raised above against RE's attempt to broaden what counts as utility to resolve the threat of irrationality. Without some substantive account that justifies such broadening, the strategy is no better off than defining utility by revealed preferences. Yet, defining utility in this way trivializes the notion, making any choice by an agent utility maximizing, and thus rational, by definition (Sen 1977),¹² it would be in danger of turning the notion of utility into a target that automatically moves to wherever the arrow is aimed (Bermúdez 2009, 2).

RR resolves this problem by providing a substantive account of the utility of the purportedly problematic intervening psychological factors in terms of fitness maximization. Of course, crucial for the appeal to fitness to play this explanatory mediating role is that we understand utility in terms of fitness enhancing goods. And indeed Aumann makes this "substantive relation" between fitness and utility maximization explicit. To avoid a trivialization of the notion of utility "one must define [it] more substantively—in terms of basic desiderata like time, money, family welfare, life, health, food, and so on—which are indeed closely related to fitness. With such a definition, an act that maximizes utility is then indeed act-rational, and a rule that usually maximizes it, rule-rational" (Aumann 2008, 17).¹³

As we shall argue in the next part of the paper, Aumann's suggested synthesis of BE and RE is hindered in large part because of this way of thinking about the "substantive relation" between rationality and fitness.

12. As Sen points out, however, despite this feature of the revealed preference approach it does not lead to a mute theory. For, it imposes a requirement of internal consistency of observed choices, and this might well be refuted by actual observations (Sen 1977, §§ II and III; see also Kadnick 2006, § 2.3).

13. Compare Sen's claim that "once we give up the assumption that observing choices is the only source of data on welfare, a whole new world opens up, liberating us from the informational shackles of the traditional approach" (Sen 1977, 339-340). Indeed, in Sen's view, a person whose revealed preferences fulfill the requirement of internal consistency and is thus rational according to the standard economic wisdom, yet behaves unrelatedly to happiness or other substantive concerns must be a bit of a fool. "The purely economic man is [...] close to being a social moron [...] or a] rational fool," as he puts it (*ibid.*, 336). Accordingly he proposes a view of rationality that does take into account the substantive interests of mankind. For an illuminating discussion of revealed preference (or operational) accounts of utility and substantive accounts, see Bermúdez 2009, Chap. 2.

3. Aumann's Paradigm and the Evolutionary Approach to Practical Rationality

3.1 The Basic Argument

Our basic argument for the failure of Aumann's proposed synthesis of BE and RE is based on a more general argument against the possibility of naturalizing practical rationality by way of evolutionary fitness. Schematically put, our basic argument runs as follows:

- (a) Rationality is in the normative "logical space of reasons."
- (b) Fitness maximization is in the factual "logical space of nature."¹⁴
- (c) Thus, an account of rationality in terms of fitness maximization must be incorrect. Rationality cannot be naturalized by way of evolutionary fitness.
- (d) But Aumann's synthesis takes utility maximization to be in the last analysis some sort of fitness maximization. It rests on an account of rationality in terms of evolutionary fitness maximization.
- (e) Thus, Aumann's synthesis fails.

Step (d) follows from our discussion in § 2, and it does not require further elaboration (though we will return to an important presupposition of this premise in the last part of the paper). So, in the rest of § 3 we shall elaborate on the other steps of the argument.

3.2 Step (a): Rationality is in the "Logical Space of Reasons"

3.2.1 The Deontological Dimension of Rationality

Act-rationality is *prescriptive*: "it tells people how they should behave to advance their self-interest" (Aumann 2008, 13-14). Relatedly, act-rationality is also *justificatory*—i.e., its dictates may *justify* our behavior: in their lights our behavior may look reasonable, or proper, or right. Indeed—and this is the other side of the same coin—in case we violate these dictates we may be subject to blame or reproach for acting improperly, or unreasonably rationally speaking. To be act-rationally justified in having done something, one's action must not violate the dictates of act-rationality. The action is, then, permissible and one cannot be rightly blamed for doing it. Contrariwise, if one acts in violation of the dictates of act-rationality one is act-rationally unjustified and blameworthy. Thus, act-rationality has a *deontological dimension*: it has to do with obligation, permission, requirement, blame, and the like (cf. Alston 1988).

As we shall argue in the next section (§ 3.2.2), any notion of practical rationality worthy of the name must share these aspects of act-rationality, or be *normative* in all of

14. We borrow the notions "logical space of reasons" and "logical space of nature" from McDowell (1996) and Sellars (1997).

these respects. Any such notion must be, to paraphrase Wilfrid Sellars, in the logical space of reasons, of prescribing and justifying (Sellars 1997, 76). This needs argumentation because, as we shall see in § 3.2.3, *non-normative* notions of practical rationality might be proposed on the model of available non-normative notions of theoretical rationality. Indeed, Aumann himself takes rule-rationality to be a genuine notion of practical rationality, yet appears, at times, to consider it a non-normative, or “positive concept [...] that] describes how people *do* behave [rather than how they *should* behave]” (Aumann 2008, 14).

3.2.2 *Rationality and Intentional Agency*

Some of our behavior, and much of the behavior of other animals is a function of invariant responses to detected stimuli, which can be characterized in terms of what cognitive ethologists call “innate releasing mechanisms” —namely, fixed patterns of behavior that are more complex than reflexes, often involving a chained sequence of movements rather than a simple reaction, and yet seem to be instinctive. Such mechanisms are triggered by specific stimuli; they always take the same form; they occur in all members of the relevant species; their occurrence is largely independent of the individual creature’s history; once launched they cannot be varied; and they have only one function (Bermúdez 2003, 7-8). Behavior of this type, then, is automatic, mechanical, inflexible, context-bound, and not under the control of the animal. When behaving in this way an animal is no more than a stimulus-response system.¹⁵

It is also the case, however, that much of our behavior and some of the behavior of other animals consist of flexible and plastic responses to the environment, which are the result of complex interactions between internal states: organisms respond flexibly and plastically to their environment in virtue of the fact that their representational states respond flexibly and plastically to each other, usually through the influence of stored representations on present representations (Bermúdez 2003, 9). Typically, behavior of this type is goal-directed: it is best explained either in terms of the purposes and the desires that it is intended to satisfy or, more minimally, simply in terms of those that it does satisfy. Relatedly, it may involve intentional agency in which case ends and information

15. A classic example of this type of behavior is the egg rolling behavior of Greylag Geese. A goose of this species will roll a displaced egg near its nest back to the others with its beak. The sight of the displaced egg triggers this mechanism. If the egg is taken away, the Goose continues with the behavior, pulling its head back as if an imaginary egg is still being maneuvered by the underside of its beak. Moreover, it will also attempt to move other egg shaped objects, such as a golf ball, door knob, or even an egg too large to have possibly been laid by the goose itself.

about ends/means contingencies interact-rationally to produce intentions to act.¹⁶

Corresponding to varying degrees of flexibility and plasticity intentional agency forms a spectrum onto which different types or levels of rationality can be mapped. Indeed, a recurring theme of recent work on animal cognition has been the importance of escaping from a crude dichotomy between an inflexible, rigidly context-bound stimulus-response system on the one hand, and full-fledged conceptual, inferential, and mindreading abilities on the other. It is becoming continuously clearer that various finer distinctions between locations on this spectrum should be drawn (Hurley 2006). How exactly to do this—most especially, how to incorporate into this scheme animals that are devoid of language and are of limited conceptual capacities—is a matter of controversy (Bermúdez 2003 and 2006; Fodor 2003; Hurley 2006; Milikan 2006).¹⁷ Fortunately, for our purposes we need not get into this vexed issue but rather elaborate a bit on another, though related, aspect of intentional agency.

To be an intentional agent or to act intentionally is to act for a reason (Audi 2006, Chaps. 4-5). This means, firstly, that for every intentional action there is a corresponding practical argument whose premises represent the structure of the causal and explanatory basis of the action, namely, the set of wants and beliefs—the motivational and cognitive elements—that explain why it is performed (*ibid.*, 103).¹⁸

In addition, it means that the practical argument corresponding to the action is realized either inferentially, by an actual process of practical reasoning, or merely behaviorally (*ibid.*, 114-115). The case of inferential realization, in which an agent acts on the basis of practical reasoning, is the paradigm of action for a reason, and does not really need an example. An example of a behavioral realization would be a spontaneous action that expresses the agent's motivating want and is guided by her belief where neither the want nor the belief is entertained or otherwise occurrent in the agent's consciousness.¹⁹

16. An example of a relatively plastic, though non-intentional behavior is the navigational behavior of wild animals such as the Tunisian desert ant and Clark's nutcracker (Hauser 2001, Chap. 4). An example of intentional behavior by wild animals is tool use (*ibid.*, Chap. 2), and perhaps also social play and predatory and antipredatory behavior (Allen and Bekoff 1997, Chaps. 6-7).

17. A closely related controversy is of whether propositional attitudes such as belief can be ascribed to animals, and if so how related they are to propositional attitudes that may be ascribed to humans (Stitch 1979; Davidson 1982; Allen and Bekoff 1997, Chap. 5).

18. This most important thesis goes back to Aristotle, and seems also to be held by Hume and Kant (Audi 2006, 103).

19. A few philosophers—e.g., Davidson (1970), and Harman (1976)—maintain the thesis that for an action to

Finally, the equivalence between intentional action and action for a reason also means that whether the practical argument corresponding to the action is realized inferentially or behaviorally, the explanatory basis of the action is the same: in both cases the action is explained by the motivational and cognitive elements of its corresponding practical argument which are invoked for this purpose either directly (in case of inferential realization) or reconstructively (in case of behavioral realization) by the agent, or indeed someone else (*ibid.*, 114).²⁰ In other words, the system of answers to the question what to do of practical reason is one and the same system of answers to the question “why?” of action explanation (Rödl 2007, 44-55; see also Anscombe 1963, §§ 37-40).²¹

From the normative and explanatory nexus of practical reason, then, springs intentional agency.²² But the close ties between practical reason and intentional agency via this nexus are also the source of the centrality of the normative dimension of rationality: if practical rationality is characterized by the role it plays in making an action intentional—i.e., the space of reasons is coextensive with the space of intentional action (Hurley 2006, 167), or better still, acting intentionally *is* being of a rational mind (Rödl 2007, 49)—and if normativity is a central feature of practical rationality in this role, then normativity is a constitutive feature of practical rationality. Any notion of practical rationality worthy of

be intentional its corresponding practical argument must be inferentially realized (cf. Audi 2006, 233n1). But as Audi (*ibid.*, Chap. 5) convincingly argues, this requirement is too strong, and for an action to be intentional it is sufficient that its corresponding practical argument be realized behaviorally. See also McDowell 2006, §§ 2, 3 and 8. McDowell’s example of behavioral realization is of a person who, following a marked trail, at a crossing of paths goes to the right in response to a signpost pointing that way (*ibid.*, 129).

20. Animals, who unlike us enjoy only limited, domain specific intentional agency—they occupy “islands of intentional agency” to paraphrase Hurley (2006)—and who lack a public language, cannot explain their behavior in these terms. This does not mean, however, that animals cannot have second order thoughts within their islands of intentional agency (unless it is assumed with e.g., Bermúdez (2003) that such thoughts require a public language, a rather implausible assumption as Fodor (2003) argues). Relatedly, it does not mean that animals are incapable of the self-determination—or the capacity to step back from their natural inclinations to act in a specific way and rationally assess this act—that we are capable of qua intentional agents (McDowell 2006, §§ 2, 3 and 8), though unlike our rather general self-determination, theirs would be limited to the islands of intentional agency that they occupy.

21. The view of intentional agency outlined here implies the guise-of-the-good thesis according to which doing something intentionally is thinking it good. This thesis has been attacked recently by philosophers with an empiricist bent—e.g., Velleman (1992). However, in light of Boyle’s and Lavine’s (2010) effective defense of the guise-of-the-good thesis, we consider this thesis as sound.

22. Intentional agency may require more than this nexus (Korsgaard 1997, 221; cf. Rödl 2007, 49-51). But even if the nexus at issue is only necessary for intentional agency, that would suffice for our purposes.

the name must be normative.²³

3.2.3 *Internalism vs. Externalism*

In grounding the normativity of practical reason in what is constitutive of intentional agency²⁴ we have also provided support for an internalist approach to practical reason according to which the reasons that rationalize intentional actions must be cognitively accessible to the agents performing these actions: in our account, what an agent is doing is an action if and only if her reasons for doing it explain why she is doing it. This is no mere coincidence, since non-normative accounts of rationality go hand in hand with externalism, or the view that justifying reasons need not be cognitively accessible to agents. Thus, an argument for the normativity of rationality must be ipso facto also an argument for an internalist conception of reason, a point on which we would like to elaborate a bit.

A prominent example of an externalist view is the reliabilist account of theoretical reason (Bonjour and Sosa 2003, 24-26). According to reliabilism, a belief is justified if and only if it is produced by a reliable cognitive process, or a process that makes it objectively likely that the belief is true.²⁵ And since a reliable process in this sense need not be cognitively accessible to the holder of the belief, reliabilism does not require cognitive accessibility of the justifying grounds of a belief.

An example of an externalist account of practical reason may be the view that an agent is behaving rationally if and only if her behavior is produced by processes that are likely to be conducive to utility maximization and which need not be cognitively accessible to her. As we shall see in § 3.4, rule-rationality may be considered externalist in

23. The notion of rationality emerging from our discussion here is a reasoned assessment notion that concerns itself in the first place with the mental processes that lead to behavior. In contrast, both the act-rationalistic and the rule-rationalistic notions are consequentialist act evaluation notions that concern themselves first and foremost with the patterns of behavior resulting from inner mental processes. (For the difference between these types of notions of rationality, see Kacelnik 2006.) Implying that the most basic or primary notion of rationality is of the reasoned assessment type—that “the notions of rationality and reasoning are correlative notions” (Bermúdez 2006, 136)—our discussion in this section also implies that consequentialist notions of rationality must be derivative or secondary notions. This point has an important consequence to which we shall turn in footnote 30.

24. Notice that this grounding is rather different from recent attempts to extract moral or other norms from what is constitutive for action, or to resolve major metanormative problems on this basis. Thus, our grounding is immune to criticisms of these attempts. For a thorough critical examination of these attempts, see Enoch 2006.

25. There are actually quite a few versions of reliabilism, but the differences between them are unimportant for our purposes. For the appeal of reliabilism to philosophers with a naturalistic bent, see Fodor 1995.

this sense, and so may two more related conceptions of rationality.²⁶

In grounding rationality in processes that may be beyond the cognitive ken of agents, and thus also beyond their voluntary control, externalist conceptions of (theoretical or practical) rationality are not prescriptive; they are not concerned with what rational subjects should or ought to believe or do: ought, as Kant reminds us, implies can (Kant 1929, A 548/B 576).²⁷ For the same reason they are also not deontological: they have nothing to do with obligation, permission, requirement, blame, and the like. From the externalist perspective, for a belief or action to be rational is not for the belief or action to be permissible or unblameworthy. And to be irrational is not to be blameworthy. Thus, the externalist conception of rationality is non-normative.

In contrast, internalist conceptions of rationality are normative. Thus, in order to show that rationality is of a normative nature, we had to argue that it must be an internalist conception, which is what we did by grounding it in intentional agency. For this reason, it also cannot be taken for granted that the norms of practical reasoning are constitutive of practical rationality; that to behave rationally is to follow the principles of practical reasoning and to be responsive to their dictates. To argue that the normativity of practical rationality stems from its conceptual ties with the norms of practical reasoning is to get things backwards. One must first show the normativity of practical rationality by showing that it must be an internalist conception, from which would follow, as we saw, its close ties with practical reasoning, rather than the other way around.

3.3 Step (b): Evolutionary Fitness is in the “Logical Space of Nature”

Unlike rationality, evolutionary fitness is neither prescribing nor justifying. To say that maximization of fitness is an evolutionary driving force in developing traits such as a tendency to behave (act or rule) rationally is not to say that evolution justifies these traits or that we should or ought to have them or behave as they cause us to behave. To say this

26. See also Audi's outline of an externalistic conception of action according to which “an action is intentional when it *in fact* is produced or sustained in an appropriate way by a suitable set of one's wants and beliefs, say non-waywardly produced or sustained by an overriding want for something and a (rational) belief that the action is necessary for achieving it. This condition may hold even if, in principle, one could not introspectively come to know or justifiably believe that one has those grounds for action” (Audi 1990, 233). As Audi notes, such behavioral externalism “cuts us off from our actions in a way that seems to make us more like spectators of our own doings than their agents. Agents can [...] know (or at least form justified beliefs concerning) what they are about, in a sense implying a capacity to know for what reason(s) they are acting; they are not in the position of observers whose only route to such knowledge (or justified belief) is observational” (ibid.). Highly relevant here is Moran 2001, Chap. 4.

27. “The action to which the ‘ought’ applies must indeed be possible under natural conditions.”

is merely to say how things *are*, and not how they *ought* to be. It is to express something factual rather than something normative. In Immanuel Kant's memorable words,

That our reason has causality [...] is evident from the *imperatives* which in all matters of conduct we impose as rules upon our active powers. '*Ought*' expresses a kind of necessity and of connection with grounds which is found nowhere else in the whole of nature. The understanding can know in nature only what is, what has been, or what will be. We cannot say that anything in nature *ought to be* other than what in all these time-relations it actually is. When we have the course of nature alone in view, '*ought*' has no meaning whatsoever. It is just as absurd to ask what ought to happen in the natural world as to ask what properties a circle ought to have. All that we are justified in asking is: what happens in nature? What are the properties of the circle? (Kant 1929, A 547/B 575)

Nature is governed by laws, but it does not follow these laws or behave in accordance with them. The laws of nature do not prescribe but rather describe, and it is not up to nature whether its behavior falls under them. In the spectrum in between mere automatism and intentional agency nature is clearly at the far end of the automatism side. So the whole language of deontology is inapplicable to it. It would be meaningless to say that nature's behavior was permissible, and that it cannot therefore be blamed for it. And it would be just as meaningless to consider nature's behavior as improper or wrong, and to take it to be blameworthy or irresponsible. All this is particularly true of evolution, which unlike rationally governed intentional actions, just blindly happens. Unlike intentional actions which are in the normative logical space of reasons, evolutionary fitness is in the non-normative logical space of nature.

3.4 Step (c): Rationality cannot be Naturalized by way of Evolutionary Fitness

Since practical rationality is a normative concept and fitness maximization lacks this dimension, practical rationality cannot be explicated or defined in terms of fitness maximization. A notion of utility that rests on fitness maximization is not a notion of rationality at all.

This is true of rule-rationality, as this notion rests in the last analysis on fitness maximization. But it is true, more generally, of any account of rationality in evolutionary terms that might be suggested. Such is the case, for example, with the notion of B-rationality ('B' is for biological) that has been recently suggested by the Oxford zoologist Alex Kacelnik (2006). B-rationality may be a useful notion in evolutionary biology. Yet, since it is defined in terms of fitness maximization it is not really a notion of rationality at all. And the same considerations apply to the human behavioral ecology model which considers humans not as utility maximizers but as fitness maximizers (Sternly and Jeffares

2010, 380).²⁸

Another, closely related way of seeing this is via the internalism/externalism distinction. Practical rationality, we saw, is an internalist concept: it takes the reasons that rationalize intentional actions to be in the cognitive ken of intentional agents. In contrast, evolutionary processes and their relation to behavior need not be in the cognitive ken of agents. So a notion of rationality that is based on the notion of evolutionary fitness—be it of the rule-rationality, or of the B-rationality, or of the human behavior ecology model type—must be an externalistic concept that does not require that justifying reasons be cognitively accessible to agents. Thus, the concept of rationality and the concept of fitness maximization are foreign to each other.

The notion of practical rationality cannot be founded then on the notion of evolutionary fitness. It is, of course, perfectly legitimate to define the word ‘practical rationality’ in terms of the meaning of the word ‘fitness maximization.’ One is certainly fully authorized to mean by a term whatever one likes. Nevertheless, just as defining the word ‘white’ in terms of the meaning of the word ‘black’ does not turn black into white, defining ‘practical rationality’ in terms of fitness maximization does not turn the notion of fitness maximization into a notion of rationality.^{29,30}

28. Aumann, of course, identifies the two (see § 2.6).

29. In response, Aumann may possibly bite the bullet and argue that while fitness maximization may not be a genuine notion of rationality, what economists, himself included, are interested in is rationality in the sense of utility maximization. Thus, insofar as fitness maximization is a notion of utility maximization, that is all the rationality he needs for his paradigm. Yet, is the notion of fitness maximization *really* a notion of utility maximization? After all, the notion of utility is a normative notion while that of fitness is not a normative one. So, the response at issue seems to be begging the question against our argument: it actually assumes what our argument rejects—viz., that a fundamentally non-normative notion may be of the same type as a fundamentally normative notion. Our rejection of this assumption presupposes that normative notions cannot be analyzed or defined in non-normative terms. We are also committed to the related view that normative properties cannot be reduced to non-normative properties. So another, closely related response to our argument that is open to Aumann is to attack these two related presuppositions of ours. This is not the place to go into the vexed issue of our two presuppositions; suffice it to say that there are very strong arguments in their support (e.g., Smith 1994, Chap.2, and Bilgrami 2005, 7-15). In any case, we hereby put them on the table.

Moreover, the very fact that economists find puzzling apparent violations of the norms of (act) rationality—i.e., that apparently people do not behave as they *should* according to these norms, or in the best of their interest—attests to their commitment to a normative notion of rationality. And if so, this is another reason why Aumann cannot really respond to our argument by biting the bullet as suggested above.

30. A consequence of our discussion in § 3.2.2 is that the most basic or primary notion of rationality is of the reasoned assessment type. Yet, both act and rule-rationality are consequentialist act evaluation notions (see

3.5 Step (e): Losing Touch with Rationalistic Economics

RR seeks to synthesize BE and RE by combining stance (a) of the former (according to which apparent violations of act-rationality should be considered as genuine violations) with stance (d) of the latter (according to which the apparent violations at issue should be accounted for in rationalistic terms).³¹ A central feature of this paradigm, however, is that it bases the rationalistic terms of stance (d) on fitness maximization. And by the previous section this turns the rationalistic terms of stance (d) to non-rationalistic terms, thereby transforming stance (d) to stance (b) of BE (according to which the apparent violations of act-rationality should be accounted for in non-rational terms). Thus, due to the central place it must give fitness maximization if it is to have its advantage over RE, RR actually loses touch with the latter theory. Short of having one leg—(a)—in BE, and another leg—(d')—in RE, RR has both legs—(a) and (d')—turned-(b—in BE. Rather than combining a rationalist thesis with a behavioral anti-thesis into a rationalist and behavioral synthesis, RR boils down to the behavioral anti-thesis.

4. Aumann's Paradigm and the Evolutionary Approach to Human Psychology and Behavior

4.1 Two Evolutionary Accounts

Despite its failure as a synthesis between RE and standard BE, the evolutionary approach to human psychology and behavior that RR presupposes (§§ 2.5-2.6), may still make this paradigm a serious and interesting alternative to both RE and standard BE. This immediately raises the question of the alleged explanatory value of the evolutionary approach at issue. Does this approach really give RR any explanatory edge over its rivals? Does RR really provide a deeper and better account than do RE and standard BE, and so should supplant them?

Aumann's evolutionary approach can be read in two ways. On the first reading, it

footnote 23). This means that for act or rule-rationality to be genuine notions of rationality they must have some substantial common denominator with the reasoned assessment notion of rationality. However, while act-rationality fulfills this requirement, rule-rationality does not fulfill it: act-rationality can be analyzed in terms of the *normative* notion of utility maximization, thereby sharing a central feature of the reasoned assessment notion of rationality. Yet, since rule-rationality is non-normative, it cannot be analyzed in these terms (see footnote 29). Thus, because of the non-normativity of rule-rationality, this notion does not have any other substantial common denominator with the most basic notion of rationality—i.e., the non-normativity of rule-rationality strikes rather deep.

31. See § 2.4.

takes human behavior to be generated by psychological mechanisms that are evolutionary *adaptations*: these mechanisms evolved because they produced behavior in our ancestors that enabled them to survive and reproduce. Thus read, Aumann's approach is akin to the Evolutionary Psychology research paradigm within the evolutionary approach to psychology (Buller 2000; Dowens 2008; Staratt and Shackelford 2010): like Evolutionary Psychology, Aumann's approach focuses under this reading on the question of whether a trait is an *adaptation*, rather than on whether it is currently *adaptive*.³²

On the second reading of Aumann's evolutionary approach, it is mainly interested in the current adaptivity of human behavior. Thus read, Aumann's approach is akin to the Human Behavioral Ecology research program within the evolutionary approach to psychology (Borgerhoff Mulder 1991; Downes 2010): like Human Behavioral Ecology, Aumann's approach focuses under this reading not so much on the question of whether the proximal psychological mechanism that triggers a specific behavior is an adaptation as on the question of whether the behavior triggered is currently adaptive.^{33,34}

32. For the adaptation/adaptive distinction, see Gould and Vrba 1983, 4-6, and Sober 2000, 85. As illustrated by the following examples, a trait can be adaptive without being an adaptation, and an adaptation without being adaptive: a sea turtle's forelegs are adaptive insofar as they are useful for digging in the sand to bury eggs, but they are not adaptations for nest building (Sober 2000, 85). And vestigial organs such as our appendix or vestigial eyes in cave dwelling organisms are adaptations but not currently adaptive (Dowens 2008, § 4).

33. This reading of Aumann's evolutionary approach fits better than the first reading the original synthesizing goal of RR: fitness enhancing adaptations in ancestral environments need not be fitness enhancing in modern environments. So, for an evolutionary account of rule-rationality in terms of fitness enhancement to preserve the rationality of agents (which is a main aspect of Aumann's synthesizing move), it must focus on current adaptivity (as the second reading does) rather than on evolutionary origin in adaptation (as the first reading does). At this stage of our discussion, however, the emphasis has shifted from the synthesizing goal of RR to its explanatory value. And here both readings will do: both may provide an evolutionary, albeit different, explanation of why people behave as they do.

34. Another major approach to human evolution is Richerson and Boyd's (2005) gene-culture co-evolution approach, according to which gene evolution molds cultural evolution, while culture affect the relative fitness of different genotypes in many ways. While this approach differs in important respects from both Evolutionary Psychology and Human Behavioral Ecology, it shares with the latter the explanatory element relevant for RR—viz., the emphasis on current fitness. Thus, the aforementioned differences would be rather unimportant for our purposes.

Still another evolutionary approach to human behavior and culture is the "memes" approach, according to which cultural evolution is the outcome of competition between cultural units, or "memes," that replicate and are selected in a way analogous to but separate from genes. For reasons we cannot get into here, this approach is highly problematic (Jablonka and Lamb 2006, 206-212). Indeed, even Dawkins, who contributed perhaps more than anyone else to its popularity has backed off his meme-talk (Dawkins 1982, 111-112). So we can

In this part of the paper we shall argue that the scope of evolutionary explanations in psychology is rather limited. This we shall do by arguing that culture involves the extension of human capacities in radically novel directions, which are neither adaptations (contra Evolutionary Psychology) nor adaptive (contra Human Behavioral Ecology)—§§ 4.2-4.4. We shall then show that this is true in particular with respect to economics, and on this basis conclude that RR cannot supplant standard BE but at most supplement it (§ 4.5).

4.2 Man the “Symbolic Animal”

While very similar in many respects to other inhabitants of the animal kingdom, most especially to the great Apes, humans are unique among those inhabitants in their highly complex and sophisticated ways of using symbols in both thinking and communication. Indeed, it has been rather plausibly argued that this use of symbols is the distinctive mark of humankind; that man is the “symbolic animal” (Cassirer 1944, Chap. 2; Jablonka and Lamb 2006, Chap. 6).

Closely related to this characteristic of humankind is its unique civilization and culture. While other animals may also have cultural traditions of a sort (de Waal 2001, Chaps. 5-8; Jablonka and Lamb 2006, Chap. 5), human cultural traditions are unique in their extreme and overwhelming richness, variety, and sophistication. Social animals may have socially transferable systems of patterns of behavior, preferences and products of activity.³⁵ But only human beings compose music and do mathematics, send missiles into space and build cathedrals, write books of poetry and philosophize, alter at will the genetic nature of their own and other species, interpret themselves and others, and exhibit an unprecedented level of creativity and destruction, rewriting the past and molding the future. In these respects, *Homo sapiens* is totally unlike any other species. And it is undoubtedly its symbolic system that opened the way to humankind’s unique civilization. Due to this system “man lives not only in a broader reality [than other animals], he lives so to speak, in a new *dimension* of reality” (Cassirer 1944, 43).

Culture has brought then a dramatic qualitative change into human life, “transforming the very core of our being” (de Waal 2001, 29). It opened new ways of adapting oneself to one’s environment (Richerson and Boyd 2005). Yet, at the same time, it has enabled the development of human traits and behavior that even if adaptive, pace Evolutionary Psychology, are not adaptations. Indeed, as we shall now argue, a great many cultural

safely ignore it in our discussion.

35. Cf. de Waal’s (2001, 30-32), and Jablonka’s and Lamb’s (2006, 160) closely related definitions of culture.

inventions and the traits and behaviors that they involve must be of this sort.

4.3 Spandrels and Exaptations

Consider first the now familiar phenomenon of *spandrels*—traits that are by-products of selective processes (Lewontin and Gould 1977; Gould 1997) which “just come along for the ride,” as Fodor (2007) put it. A famous example of a spandrel is the “male-mimicking” genitalia of the female spotted hyena that arose as a by-product of the evolution of female dominance and superior size, an adaptation built by high testosterone titers, which induce masculinized genitalia as an automatic result (Gould 1997). In all likelihood at least some of the mechanisms underlying human behavior are spandrels. Indeed, it has recently been suggested that certain specific aspects of the faculty of language may be by-products of preexisting constraints rather than end products of a history of natural selection (Hauser et al. 2002, 1574).

If there is reason to think that some of the mechanisms underlying human behavior are spandrels, there is a better reason still to think that a great many of these mechanisms are *exaptations*—i.e., features that were evolved for certain usages (or for no function at all) and then “coopted” or re-appropriated for other roles (Gould and Vrba 1983).³⁶ A classic example of exaptation is how feathers which initially evolved for insulation were coopted for flight (ibid.).³⁷ Another example is how the African Black Heron uses its wings to prey on small fish (ibid.). Yet another example is the hypothesis that mirror neurons, which are widely held to underlie social cognition, develop from visual and motor neurons through associative learning processes (Heyes 2009 and 2010). Still another is the Cheney and Seyfarth (2008, 143) suggestion that skills such as the ability to learn from others, invent new behaviors, and use tools piggybacked and built upon mental computations that had their origins in social interactions. A related example is their hypothesis that many of the rules and computations found in human language first appeared as an elaboration of the rules and computations underlying social interactions (ibid., 269-270; cf. Hauser et al. 2002, 1578). One more example is Darwin’s thesis, supported by recent findings that the configuration of emotional facial expressions has evolved from a functional role in

36. As the great master of evolution himself said, “throughout nature almost every part of each living being has probably served, in a lightly modified condition, for diverse purposes, and has acted in the living machinery of many ancient and distinct specific forms” (Darwin 1886).

37. The conversion of the adaptation of feathers for insulation into an exaptation for flight set the basis for subsequent adaptations and exaptations, one of which forms our next example (Gould and Vrba 1983, 7-8). Yet, the possible interplay between adaptations and exaptations that this exemplifies is of no consequence for our discussion.

regulating sensory intake. These ancestral configurations may later have proven useful as social signals, assuming a new function without needing to change their basic form (Susskind et. al., 2008).

As the last four examples illustrate, exaptations may already be found rather far back in the evolutionary history of mankind. Thus, mirror neurons are found in monkeys (Heyes 2010). Intentionally modified stone tools already appeared ca 2.6 Myr BP (Stout et al. 2008, 1939). Speech capacity emerged by ca 200,000 BP with *H. Sapiens*, or maybe earlier and gradually over a much longer period (Renfrew 2008, 2042). And, as already said, the configuration of emotional facial expressions is rather ancient. However, exaptations must have become particularly widespread in our rather recent history, since the end of the Pleistocene period, say, ca 10,000 years BP. The reason for this is as follows.

At the end of the Pleistocene culture and society started developing rapidly and massively in ways unprecedented before (Renfrew 2008, 2042-2043). However, the biological basis of our species, the human genome, has been established for much longer, at least since the out-of-Africa dispersals of some 60,000 years ago (ibid., 2042).³⁸ Thus, many cultural domains and inventions must have coopted or re-appropriated traits and capacities that were naturally selected for other purposes; they must exemplify exaptations rather than adaptations (Sperber and Hirschfeld 2004; Dehaene and Cohen 2007; Renfrew 2008).

A concrete example of a cultural innovation that illustrates this general point is the practice of writing and reading. This practice was invented ca 5400 years ago by the Babylonians. Moreover, until very recently, only a very small fraction of humanity was able to read and write. Thus, it is impossible that human brain regions evolved specifically for the purpose of reading. And indeed, it has recently been found out that word reading utilizes brain areas that were initially unrelated to reading but rather to object and scene recognition, a function significantly different from the mapping of written language onto

38. This does not imply that humans have not continued to be subject to natural selection since the out-of-Africa dispersals or even during the last 10,000 years known as the Holocene period (e.g., the domestication of animals at the beginning of the Holocene introduced a new selection pressure that produced human lactose tolerance - Richerson and Boyd 2005, 191-192). Rather, it means that the bulk of our species genetic make-up has remained relatively constant during the last 60,000 years or so—i.e., that most genetic variation amongst humans occurred before they migrated out of Africa (Downes 2010, 250-251). This is suggested e.g., by the fact that variations among populations of different continents account for only about 10% of all genetic differences (Staratt and Shackelford 2010, 232). But notice that it does not preclude the possibility of some genetic variation occurring during the Holocene, for which there is also some evidence (Hawks et al. 2007). In any case, as we shall illustrate by two major examples of cultural inventions, one in this section and the other in § 4.5, many such inventions are too recent for significant genetic adaptation to their existence to be possible.

sound and meaning (Dehaene and Cohen 2007). A brain mechanism that evolved for a certain purpose has been re-appropriated by a cultural invention, and began to fulfill a completely different purpose;³⁹ even if its new use is adaptive, it is not an adaptation for this use.

Many cultural domains and inventions must have involved, then, the extension of human traits and capacities in radically novel ways that were not anticipated by evolution. These extensions must have exemplified exaptations rather than adaptations. As we shall argue next, it is very likely that, pace Human Behavioral Ecology, many such extensions are non-adaptive.

4.4 Non-Adaptive Extensions of Traits and Capacities

To see what we mean by non-adaptive extensions of traits and capacities and how they may emerge, consider the simple cultural tradition of the famous Japanese macaques of Koshima Island, the discovery of which set off the cultural revolution of primatology (de Waal 2001, 194-204; Jablonka and Lamb 2006, 178-179). Wanting to study these macaques in the early 1950s, Japanese primatologists used sweet potatoes to lure them from the forest to the sandy seashore, where they were easier to observe. This worked well, but had unexpected consequences. At one point, a juvenile female macaque known as Imo started washing the potatoes in a nearby stream, thereby removing the soil from them. The new habit spread to other monkeys, at first to juveniles and then to adults, gaining in complexity: the monkeys switched from the stream to the nearby sea, and started to bite the potatoes before dipping them into the salty water, thus seasoning them as well as washing them.

In addition to potatoes, the macaques were fed by wheat, which was difficult to collect and eat because inevitably it became mixed with sand. And here again Imo's genius proved highly instrumental. Her solution to this problem was to throw the mixed sand and wheat into the water, where the heavier sand sank while the wheat floated, making it easy for her to collect it. This new habit also spread to other monkeys and after some while most of the macaque community collected wheat in this way.

These sea-related habits of the macaques gave rise in turn to further habits. Infants that were carried by their mother when she washed the food became used to the sea, and started playing and bathing in it. Swimming, jumping and diving became popular. In addition, adult males began eating fish that the fishermen had discarded, a habit which

39. Indeed, as the case of reading shows, re-appropriations of this sort may profoundly alter cortical organization (Dehaene et al. 2010).

also spread in the community.

Since the scientists first started feeding the macaques in Koshima, a new life-style, or cultural tradition of a sort, has developed. One modification in behavior produced the conditions for the generation and propagation of other modifications, and a whole set of socially transferable patterns of behavior had evolved. Indeed, and this is the important point for our purposes, at least one of these evolving behavioral patterns—viz., the water playing habits—was not adaptive: even if the capacity to feel pleasure evolved in the first place for its adaptive utility, in the context of the macaque culture it no longer serves only adaptive purposes. Water playing has no adaptive value for the macaques. So, the pleasure it involves cannot be considered a mechanism in the service of enhancing adaptation. Rather, it should be considered a goal unto itself. What explains the macaques' water playing is not some other (unconscious) interest, but the very interest in water playing. They water play for the sake of water playing and not for some other hidden purpose.

What is true of aspects of the very simple cultural tradition of the macaques of Koshima is many times truer of human culture. Even if the exaptations that underlie a great many of our cultural practices (§ 4.3) emerged from adaptations rather than spandrels, many of them are like the macaques' practice of water playing in being pursued for their own sake, and not in the (unconscious) interest of evolutionary fitness. After all, what's the adaptive value of, e.g., listening to music, doing mathematics, writing philosophical articles, reading novels, reflecting on ourselves and on human nature, decorating our homes, performing a religious ritual, etc.? It may be possible, of course, to ascribe some strained adaptive value to at least some of these practices. Thus, according to Pinker (1997, 543), "fictional narratives supply us with a mental catalogue of the fatal conundrums we might face someday and the outcomes of strategies we could deploy in them. What are the options if I were to suspect that my uncle killed my father, took his position, and married my mother?" Short of vindicating, however, the view of these practices as adaptive, such ascriptions rather strengthen our claim that these practices are pursued for their own sake, or for the sake of several non-adaptive motives. "What if," elaborates Fodor (1998), albeit sarcastically, on Pinker's suggestion, "it turns out that, having just used the ring that I got by kidnapping a dwarf to pay off the giants who built me my new castle, I should discover that it is the very ring that I need in order to continue to be immortal and rule the world? It's important to think out the options betimes, because a thing like that could happen to anyone and you can never have too much insurance."⁴⁰

40. Thirty years after the publication of Gould and Lewontin's (1979) seminal criticism of adaptationism, says

Moreover, not only are many of our cultural practices non-adaptive, but also, as we know all too well, many of our cultural practices may be counter-adaptive. “Human cultural practices can be orthogenetic and drive towards extinction in ways that Darwinian processes, based on genetic selection, cannot” (Gould and Lewontin 1977, 584). Man is a child of nature, but also of culture: adaptationist processes play an extraordinarily important role in shaping us, but we are also shaped by cultural processes that may well be non- or even counter-adaptive. As we shall now see, this conclusion reflects on RR.

4.5 Back to Economics

What is true of human psychology and behavior in general must be true of economic psychology and behavior. Thus, based on extensive theoretical and empirical literature about money Lea and Webley (2006) argue that major aspects of the extraordinary and reinforcing power of money are best explained by what they call Drug Theory rather than by the more standard Tool Theory. Drug Theory’s basic explanatory concept is that of a functionless motivator that obtains its motivational effect by a parasitic action on a functional, evolutionarily adaptive system. In contrast, Tool Theory’s basic explanatory concept is that of a motivator that, although of no biological significance in itself, is used instrumentally to obtain biologically relevant incentives. Tool Theory has been the standard account of the motivational power of money. But as Lea and Webley argue, (i) there are a number of significant phenomena that cannot be accounted for by a pure Tool Theory of money motivation; (ii) supplementing Tool Theory with a Drug Theory enables these phenomena to be explained; and, (iii) the human instincts that, according to a Drug Theory, money parasitizes include trading (derived from reciprocal altruism) and object play. According to Lea and Webley, then, money use has non-adaptive aspects. Moreover, money use cannot be the result of some evolutionary process that occurred within the hominid period: money has emerged only within the last 3,000 years or so (ibid., 162), too short a time for significant genetic adaptation to its existence; besides, individuals born into cultures that have never used money quickly come to use it if they move into a money-using culture. Thus, aspects of money use provide a nice illustration from the economic sphere of our general claim that many cultural inventions are neither adaptations nor adaptive. Indeed, the conceptual framework developed by Lea and

Rasmus Nielsen in a recent commentary in *Evolution*, “evolutionary biologists are [...] arguably, much more reluctant to invent adaptive stories without direct evidence for natural selection acting on the traits in question. We still regularly encounter very naïve adaptive stories, particularly about human behavior, but rarely in journals [...] with high standards of peer review, and rarely from researchers with a background in evolutionary biology” (Nielsen 2009, 2487).

Webley to deal with these aspects of money use may be employed in a more general account of non-adaptive cultural exaptations.

Clearly, RR cannot apply to those aspects of our economic psychology and behavior that are neither adaptations nor adaptive. So the fact that there are such aspects implies that it cannot supplant non-evolutionary accounts of economic behavior such as those provided by standard BE but *at most* supplement them—i.e., it can *at most* deepen these accounts when it comes to aspects of economic behavior that *are* adaptations or adaptive. Thus, consider once again the Ultimatum Game scenarios with which we started the paper. Recent research concerning the psychological mechanisms underlying the rejection of unfair offers in such scenarios strongly suggests that they are driven by a feeling of moral disgust, which is a cooption of the rejection impulse characteristic of distaste, an impulse that can already be found in sea anemones, which evolved about 500 million years ago (Chapman et al., 2009; Rozin et al., 2009). Insofar as moral disgust plays an important role in the regulation of social behavior of humans it has a significant adaptive value. And reference to this fact does indeed deepen accounts of economic behavior that is driven by this feeling and is of explanatory value. To that extent RR improves on standard BE. However, stripped as it should be of its alleged alternative account of rationality (§3), it is nothing but a call for employing evolutionary explanations in economics (when possible).

5. Conclusion

In conclusion, then, the appeal of RR to evolutionary explanations is a double-edged sword. On the one hand, such explanations may sometimes, though certainly not always, deepen accounts of economic psychology and behavior, and in that respect be of explanatory value. On the other hand, due to this very appeal to evolutionary psychology RR can neither fulfill its stated goal of synthesizing BE and RE, nor supplant any of these approaches, but at most supplement the former. Indeed, short of a new paradigm in economics, Aumann's suggestion is tantamount to a call for evolutionary explanations in BE.

As we argued in our four-fold move: (A) Practical rationality cannot be naturalized in evolutionary terms (§§ 3.1-3.4), and for this reason (B) RR fails to synthesize RE and standard BE, yet may still be a new and better paradigm than either one of them (§3.5). However, (C) evolutionary explanations in psychology and economics are of a limited scope (§§4.1-4.5), and for this reason (D) RR is not a new paradigm in economics after all and remains well within the bounds of BE (§4.5).

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