

Introduction: Bounded Rationality of Economic Man: New Frontiers in Evolutionary Psychology and Bioeconomics

XIAO-TIAN (XT) WANG

Psychology Department, University of South Dakota, Vermillion, SD 57069, USA (xtwang@usd.edu)

This special double issue of the *Journal of Bioeconomics* on ‘Bioeconomics, Law and Evolutionary Psychology’ takes an interdisciplinary approach to studying bounded rationality of economic man in its ecological, social and institutional environments. The contributors to the special issue come from different disciplines: economics, bioeconomics, psychology, and law. Their research interests involve behavioral decision making, evolutionary biology, law-and-economics/new institutional economics, bioeconomics, experimental economics, game theory, corporate law, risk management, artificial intelligence, and more.

The special issue presents not only an interdisciplinary effort but also diverse methods of investigation. The laboratory experiments usually have a high degree of control and accuracy but are low in ecological validity. Theoretical modeling is high in generality but low in precision. Field studies possess a high ecological validity but are less controlled. In this issue, the diversity of methods used by these authors—theoretical modeling (see Burnham and Smith), computer simulations (see Dudey & Todd, Smith, and Wang in Landa & Wang), field work (Landa, in Landa & Wang), demographical analysis (Silverman & Case), and laboratory experiments (see Fiddick & Cummins, Saad & Gill, and Wang in Landa & Wang,)—all converge to highlight the importance of knowledge about *Homo sapiens* in helping us to understand *Homo economicus*.

Mainstream economics and psychology

In the center of the mainstream or standard (neoclassical) economic model of decision-making resides the anonymous rational man (*Homo economicus*) who performs omniscient probability calculations with unlimited cognitive resources, and maximizes expected utility in the face of scarce resources. This hypothetical rational being does all these feats in a world free of institutions and with zero transaction costs. New institutional economics, in the last forty years or so, has criticized mainstream economics and has incorporated concepts of bounded rationality, institutions, and transaction costs. (See Landa & Wang in this issue).

In contrast to mainstream economics, psychologists often assume that human learning, memory, and decision-making are constrained by limited mental resources. In their

article on the differences between psychological and economical perspectives of human decisions, Zwick et al. (1999, p. 6) wrote: 'Economists assume that environmental resources are scarce but, ironically, consider the mental resources available to the actors whose behavior is modeled to be unlimited. Psychologists, on the other hand, have always been interested in studying the mechanisms that allow humans and other animals to cope with, and adapt to, an environment that is characterized by subjective information overload.'

It appears that mainstream economists and psychologists each focus on only one of the two key components of Herbert Simon's (1956, 1990) concept of bounded rationality: the limitations of the mind, and the structure of the environments in which the mind operates. This notion of bounded rationality was proposed to connect, rather than to oppose, the mainstream economic and psychological perspectives.

As pointed out by McFadden (1999), the economic definition of rationality emphasizes conscious, goal-directed, observable behavior and assumes that each player's objective is to maximize his or her expected utility. Almost all of the elements of economic demand analysis, and of benefit-cost analysis assume that the distribution of preferences in the population remains unchanged even though the preferences of each individual are volatile; this approach is called stochastic rationality. Based on stochastic rationality, mainstream economic theory of rational choice looks only at the distribution of outcomes but postulates practically nothing about biological relatedness, social relationships, group hierarchy, or cost in information search.

Another fundamental tenet of the standard economic definition of rationality is that situational and contextual effects on behavior are mediated only by the incentive structure. Empirical evidence from psychological experiments cast serious doubts on this assumption. Kahneman & Tversky (1979, 1984) showed that it is possible to manipulate the informational structure or context of a decision problem to systematically affect choice behavior, without altering the incentive structure. Therefore, minor modifications in the information structure (e.g., different ways of presenting the same choice problem) can lead to major changes in revealed preferences. They labeled this phenomenon the 'framing effect'.

Realizing the powerful effects of psychological factors, three Nobel laureates in economics, McFadden, Selten and Simon, all call for research effort to integrate psychological findings of behavioral decision-making into economic models (see Gigerenzer & Selten 2001, McFadden 1999, Simon 1990). In addition, Simon (1990) and Selten (see Gigerenzer & Selten 2001) emphasize the importance of human evolution and learning in providing broad strategic contexts and principles that may seem to be 'irrational' in the narrow context of standard economic models.

However, although many judgmental errors and decision-making biases have been demonstrated in the psychological literature of decision making, it is fair to say that the search was limited to individual phenomena rather than general principles. Such general principles may bring order out of ostensibly chaotic effects of content and context and give theoretical coherence to the narrow rules independently derived from specific content and context effects.

What evolutionary psychology has to offer

Evolutionary psychology connects economics and psychology by providing a useful conceptual framework about what constraints our social and physical environments had imposed upon our mental adaptations. This framework should be helpful for us to understand what psychological factors are also of economic relevance and what environments are specifically contextual for shaping consumer preferences.

Evolutionary theories and modern Darwinism bring focus onto a list of socially meaningful and ecologically relevant contexts rather than all possible contexts. A purpose of this special issue is to narrow down the infinite number of possible task contexts and psychological factors that influence human judgment and decision-making.

Evolutionary psychology, as a science of the mind informed by knowledge and principles from evolutionary biology, social and biological anthropology, population genetics, and behavioral ecology, provides insights into the design features of mental processes. From a perspective of evolutionary psychology, the designs of decision rationality and behavioral strategies are generated and shaped by natural selection and sexual selection in the evolutionary environments of adaptation (EEA). The recurrent and enduring tasks in the EEA (i.e., hunter-gatherer's environments) are viewed as universal contexts for the making of human psychology. A short list of these survival tasks investigated by evolutionary psychologists includes social exchange, mating, parental investment, and foraging. Similarly, a rich array of psychological factors underlying economic and market behaviors can be identified using evolutionary concepts of reproductive fitness.

Evolutionary psychology rejects the idea that the human mind is a domain-general, all-purpose, problem-solving device as the mainstream model in economics suggests. At the same time, rather than aimlessly search for all possible cues and contexts as seen in the psychological literature of human behavior, evolutionary psychology offers guiding principles for studying domain-specific mechanisms solving ecologically meaningful and evolutionarily enduring tasks. Consistent with the notion of bounded rationality, evolutionary thinking treats the economic man as being boundedly rational in exploiting the structure of the environments and adapting to limited cognitive resources (see also Dudey & Todd, and Landa & Wang in this issue).

Rational man re-examined in new frontiers of evolutionary psychology and bioeconomics

Five issues on the rationality of economic man from the perspectives of evolutionary psychology and bioeconomics are identified and discussed below.

1. Normative utility theory focuses only on individual utility but not collective utility. This problem was well illustrated by Cooper & Kaplan (1982). In their paper, the authors discuss conditions under which it is essential for the survival of the group that some individuals bet against the probabilities and do not, at individual level, maximize their expected value.

Neoclassical economic models are built upon an assumption of material self-interest where agents maximize individual outcomes without regard to the effects on others and without any consideration of social and ecological constraints. Taking a genetic evolutionary economic approach, and drawing on William Hamilton's (1964) 'kin selection' or 'inclusive fitness' theory, Burnham in this issue presents a model of interpersonal preferences on the basis of genetic relatedness between a decision maker and a decision recipient. In his model, altruistic or selfish decisions are parameterized by the genetic relationship between individuals and by the population size (the total number of people involved in a decisional situation). While being able to predict a variety of behaviors that are considered paradoxical within the standard economic framework, the model demonstrates that for interactions between 'average' individuals, the standard economic assumption is the limiting case of the genetic model as the population/group size becomes arbitrarily large.

Fiddick & Cummins' contribution looks at cooperative behavior in evolutionarily important dominance structure. Their paper summarizes a series of recent experiments employing the Wason selection task (a test of conditional reasoning) to investigate the effects of social status on tolerance of cheating and social reasoning. Fiddick & Cummins consider the implications for cooperative interactions when prior social structures and corresponding social norms exist. In particular, they investigate the influence of social rank/status on perceptions of fairness and tolerance of cheating. Among other findings, the participants who are cued to adopt a perspective of higher social rank are more tolerant of cheating and simultaneously believe that they have been more fairly treated (even when cheated).

2. Standard neoclassical economical definition of the rational man has been criticized for focusing only on logical consistency but not social rationality (see Gigerenzer 1996). In marked contrast, kinship and reciprocity have been center pieces in evolutionary analyses of social behavior. For instance, Hamilton's (1964) kin selection theory has been a powerful source for generating hypotheses about altruistic behaviors in social interactions for which standard economic models fail to account.

Hamilton shows that an 'altruistic design' can spread through a population if it causes an individual to help a kin member whenever the costs (C) to the helper's own reproduction is offset by the benefits (B) to the recipient's reproduction, weighted by the genetic relatedness (r) between the two. In an economic sense, r can be considered the subjective probability that the two agents in a risky transaction have 'inherited' the same helping design. From this perspective, Hamilton's rule ($C \leq rB$) implies a bounded rationality for economic cooperation, joint venture and risk management.

Landa & Wang's contribution shows how social structure and institutions serve as important constraints influencing rational choice in risky situations. Wang's experimental work shows that irrational framing effects disappear when kinship relations, the smallness of group size, and group homogeneity are taken into account. Landa's theory of the ethnically homogeneous middleman group, based on fieldwork, shows that in an environment characterized by contract uncertainty, hence positive transaction costs, traders choose their trading partners based on kinship and other personalistic ties of mutual aid, a phenomenon not predicted by neoclassical theory of exchange. Using a

bioeconomics approach, Landa, in Landa & Wang's paper, like Fiddick & Cummins' paper, shows the importance of prior kinship/ethnic social structures and social norms in a trader's choice of trading partners. By combining the results of Landa and Wang's independent research, the paper shows how Hamilton's theory about ancestral group living helps to understand the effects of kinship and reciprocity in both laboratory experiments and field studies.

Silverman & Case, in this issue, discuss the limitations of Hamilton's kin selection theory in explaining large scale ethnic conflicts. Neo-Darwinian concepts such as ethnic nepotism imply that the origin of inter-group conflict resides primarily in ethnocentrism, defined as the extension of inclusive fitness to extra-familial interactions. Silverman, however, has proposed an alternative view based on the presumption that natural selection favors pragmatism and plasticity in the formation of group alliances. Silverman & Case argue that the motives for inter-group oppression and warfare are economic, whereby out-group prejudices represent rationalizations rather than root causes. Silverman & Case test the economic theory of ethnic conflict in terms of relationships between changes in economic conditions and ethnocentric attitudes based on the economic and census data concerning the years immediately preceding the recent Yugoslavian hostilities.

3. The second component of Simon's bounded rationality, the structure of task environment, has long been ignored in the contemporary studies of behavioral decision making. Thus, questions concerning how people search and utilize environmental cues to make adaptive judgment and decisions form a third new frontier for both economics and psychology.

McFadden (1999) noted that people are often rule-driven rather than cost-benefit analyzing as neoclassic economic models suggest. Smith's paper in this issue explores statistical and evolutionary basis of equal sharing in partnership law, an ancient rule that has not been adequately explained. Utilizing Nash bargaining solutions and basic statistical principles, Smith's model suggests that equal sharing is minimizing transaction-cost. An evolutionary game analysis further shows how psychological dispositions favoring equal sharing may evolve. The analysis suggests that dispositions toward equal sharing and consensual governance in small groups may have evolved during the long period in which humans produced and shared food in small bands.

These evolved rules and heuristics are ecologically rational in that they make use of the environmental regularities. Only until recently have important developments taken place in exploring how decision mechanisms are adaptively matched to particular structures of information in the environments in which they are applied (see Gigerenzer et al. 1999). A central argument is that the effectiveness of a heuristic is determined by its fit to the task environment, its ecological validity. Evolution did not shape the mind to be context-free and rational in general, but rather to be well adapted to its environment.

This view stands in sharp contrast to the mainstream economic vision of unbounded rationality, which often assumes generalized all-purpose mechanisms based on the laws of logic and probability. Taking a fast and frugal heuristic approach which takes into account the costs or limitations in time, processing power, or knowledge, Dudey & Todd in their contribution ask how and how well agents can make good decisions with a

minimal amount of information. They show that humans do indeed make decisions in an ecologically rational manner, using as little information as possible and tailoring their information and option search to the structures available in the environment. It has been found in their simulation studies that simple search-cutoff rules rival the performance of much more complex and information-intensive methods.

Landa in Landa & Wang in this issue also shows that Chinese merchants make decisions in an ecologically rational manner in that traders use a subjective classification system based on the degree of kinship or social distance to predict a trader's degree of trustworthiness, hence minimizing the costs of search of information regarding the trustworthiness of a potential trading partner.

4. One persistent criticism of the psychological approach to studying economic phenomena has been that economics is a subject of large-scale market behavior rather than individual behavior which can exhibit preference volatility. Accordingly, individual differences would be washed out in the overt market behavior. This argument would hold true if variations in individual consumer's perception and preference are just random noise of rational incentives. However, this assumption has proven to be psychologically false and empirically inadequate. Cognitive biases often lead to shifts in the distribution of preferences demonstrated in behavioral decision studies (e.g., Kahneman & Tversky 1979, 1984).

Saad & Gill's paper in this issue examines gender differences in resources allocation using the paradigm of two-person ultimatum game. The authors use evolutionary psychology as their theoretical framework to explain how individual factors such as gender can systematically shift the allocation distributions. For instance, it was found that males made more generous offers when pitted against a female as opposed to a male while females made equal offers independent of the gender of the recipient.

5. It is ironic that on the one hand economics is defined as a study of goal-directed behaviors, but, on the other hand, economic models of decision utility omit any reference point (e.g., the status quo, goal or bottom-line). The use of a single value (the expected value) for each choice option is done at the cost of ecologically critical and socially valuable information about risk distributions. As a result of this focus on expected utility, each choice option is represented by a single value.

In Landa & Wang's contribution, alternative models are considered. Wang's 'bounded risk distribution' model takes into account both the expected value and the variance in payoff. The model assumes that consumers consider not only those options which have the highest mean expected value, but also the positive and negative variation from the mean expected value against task-specific goals and bottom lines. To search for a satisficing solution under the constraints of a task requires a decision about the trade-offs of maximizing the likelihood of reaching a goal and minimizing the likelihood of falling below a minimum requirement. In contrast to the normative concept of maximizing expected utility, a choice alternative yielding the highest expected value may not have a risk distribution that satisfies the task constraints as measured by the goal level and/or the minimum requirement.

Evolutionary and bioeconomics thinking appear to hold the keys to interdisciplinary synthesis. The papers in this special issue collectively present new perspectives concern-

ing social and economic rationality. We hope that our readers find the contributions in this special double issue stimulating.

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