

Economics and Cognitive Science
By
Douglass C. North
Washington University, St. Louis

I

The neo-classical approach to analyzing the performance of an economy assumes that in the face of pervasive scarcity individuals make choices reflecting a set of desires, wants or preferences. The theory is derived from the aggregation of those preferences in the context of fixed resources, private goods, and given technology. (Schofield, 1995, p 192) The result has been a powerful set of tools to analyze resource allocation at a moment of time in developed economies under the assumption that the markets being modeled were governed by impersonal forces of supply and demand. The competitive model enshrined in general equilibrium theory makes a major contribution by demonstrating that a decentralized system of market forces would generate an efficient system of resource allocation. In this context beliefs played no role in decision making.

But valuable as this model has been for the development of an elegant body of theory it is a very imperfect tool for solving economic problems both at a moment of time but particularly over time. Frictions--read transaction costs--arise from imperfect information and imperfect enforcement of agreements and markets are the creatures of political forces. In the real world of imperfectly competitive markets beliefs determine the choices of the actors. Their motivation is derived from their private information and expectations about price movements. Moreover since some goods are public goods--not only the traditional ones of national defense and public security--but in particular property rights and the rule of law they are traditionally created through the political system which entails not only knowledge about the preferences for such goods, but the incentives to produce them, given peoples beliefs about others' willingness to pay for them. Preference based models of either markets or elections are relatively simple. Beliefs, on the other hand, are anything but simple since they involve some description of how people learn, update, and model the world they live in. And it is modeling beliefs that is at the heart of all theorizing in the social sciences.

Let us begin by modeling situations in which the substantive rationality assumption of the economist works well: consider choices in competitive posted-price markets. The chooser need only choose the quantity to buy or sell as the competitive environment so structures the situation that price can effectively be viewed as a parameter and only the quantity need be chosen. But as soon as we move away from this simple competitive model and the price depends on the behavior of other buyers and sellers the complexity of the decision increases.¹ Indeed, the interesting issues that require resolution come from the interaction of human beings in economic, political and social markets. Knowledge of other people's actions and beliefs is an essential prerequisite to constructing useful models. But so too is a knowledge of their preferences since it is some melding of preferences and beliefs that determine choices. The strategic interaction of

¹ If all choices were simple, made frequently with substantial and rapid feedback, and involved substantial motivation, then substantive rationality would suffice for all purposes. It would be both a predictive and descriptive model of equilibrium settings, and learning models based upon it could be used to describe the dynamics out of equilibrium. For an elaboration of the conditions that make for a choice environment consistent with substantive rationality see Denzau and North, 1994, pp

human beings is the subject of game theory and the vast literature on the subject that has evolved is a testimonial to its current appeal in the social sciences. But the current status of game theory itself makes clear that what has been missing in most game theoretic models is "a description of the players reasoning processes and capacities as well as a specification of their knowledge of the game situation" (Bicchieri, 1993, p127). What is missing is a theory of how human beings learn.

But the puzzle I seek to unravel is still deeper than that. It is how do humans evolve and believe in theories in the face of uncertainty. Let me explain. Frank Knight (1933) made a fundamental distinction between risk and uncertainty. In the case of the former, probability distributions of outcomes could be derived with sufficient information and therefore choices made on the basis of that probability distribution (the basis of insurance). But in the case of uncertainty no such probability distribution is possible and in consequence, to quote two of economics most eminent practitioners "no theory can be formulated in this case" (Arrow, 1951 p. 417) and again "In cases of uncertainty, economic reasoning will be of little value" (Lucas, 1981, P 224). But human beings do construct theories all the time in conditions of pure uncertainty-- and indeed act on them and sometimes die for them. Communism is the most famous modern secular example but all religions are based on faith. But it is not just overall ideologies like communism or complete religions that concern us. It is the widespread existence of myths, taboos, prejudices and simply half baked ideas that serve as the basis of decision making. Indeed most of the fundamental economic and political decisions that shape the direction of polities and economies are made in the face of uncertainty. You have only to open up a newspaper and read the headlines to observe such decisions every day.

Therefore the central questions that confront economists in cognitive science are not only how human beings learn and meld beliefs and preferences to reach decisions and hence the choices that underlie economic theory but also how and why do they develop theories in the face of pure uncertainty, what makes those theories spread amongst a population or die out, and why do humans believe in them and act upon them? In the remainder of this essay I intend to explore these issues in the expectation that down the road cognitive science may give us some definitive answers that can serve as the basis for major breakthroughs in economics and social sciences generally. In section II I shall complicate the neo-classical model with additional constraints that arise with imperfect information and uncertainty; section III will explore these issues over time; section IV will examine the nature of ideologies; and the final section (V) will explore the challenges these issues pose for cognitive science.

II

Neo-classical theory assumes that preferences are stable and that choices are made within a framework of constraints--constraints imposed by income and technology but missing are the constraints imposed by the institutions of a society. The reason for their absence is that the chooser is implicitly endowed with certainty about alternatives that arises from perfect information and in such a world institutions are unnecessary. Institutions exist to structure human interaction in a world of uncertainty or as Ronald Heiner put it in a article of fundamental importance, "The Origins of Predictable Behavior" (1983) arise from the effort of individuals in the face of pervasive uncertainty to reduce that uncertainty by limiting the choices available to the players and thereby making behavior predictable. Without institutions there would be no order, no society, no economy, and no polity. Therefore the construction of an institutional framework has

been essential building block of civilization.

Once we recognize this fundamental role of institutions in reducing uncertainty we must restructure the theoretical framework we use in economics and the social sciences. Institutions not only provide the incentive structure of a society at a moment of time and therefore constrain the choice set but also they are the carriers of the process of change. Therefore whether we are modeling economic performance at a moment of time or over time institutions are central to the theoretical construct. But what are institutions and where do they come from?

Institutions are made up of formal rules (constitutions, statute and common laws, regulations), informal constraints (conventions, norms of behavior, and self imposed codes of conduct), and their enforcement characteristics. Institutions reflect the beliefs of the players--or at least of those players able to shape the rules. Therefore behind beliefs are language and the cultural heritage of the players--the subject of the next section of this essay. What I wish to explore further in this section is the way the institutional context influences choices. Let me return to the instance where the substantive rationality assumption works well. It works well because the perfectly competitive market constrains the choices of the players. Or to put it directly the rationality model works best when the institutional framework constrains the choice set and what passes for rationality is in good part a function of the institutional framework. Note carefully however that the scaffolding, to use Andy Clark's term, will not necessarily produce efficient economic results. Indeed the scaffolding may so structure incentives that "rational" actors will make choices that produce inefficient economies. Indeed the source of poor economic performance--poverty, low incomes, and stagnation--are a consequence of just that, institutions that structure incentives that discourage productivity improving activities. Since institutions are a creation of the belief systems of those players who can shape the rules of the game we must examine the way diverse belief systems emerge which takes us to the role of time.

III

Time, in this context, is the dimension in which human learning occurs and the cultural heritage, or to use Hayek's term, the collective learning of a society embodies the past learning of a society. We can briefly characterize this historical process as follows: Given the genetic architecture of the brain with its proclivities for language (Pinker, 1995) and cooperative behavior (Cosmides and Tooby, 1995) tribal groups evolved very differently. They did all evolve diverse languages but their degree of success at solving the problems of human cooperation have varied immensely. As specialization and division of labor developed tribes evolved into polities and economies but the diversity of experience and learning produced increasingly different societies and civilizations with different degrees of success in solving the fundamental economic problem of scarcity. As the complexity of the environment increased human beings became increasingly interdependent and more complex institutional structures were essential to capture the potential gains from political and economic exchange.

Ever since Adam Smith economists have recognized that the Wealth of Nations is a function of specialization, division of labor and the size of the market. But what economists have only lately come to realize is that as the market gets larger more and more resources must be devoted to transacting--that is to coordinating, integrating, and enforcing agreements. But there is more to the process than that. With small, personal exchange it pays to cooperate since the players interact repeatedly. But with impersonal exchange, to use the game theory analogy, it

pays to defect. Historically it has been the creation of political and economic institutions that have altered the payoff to reward cooperation. But throughout most of history and still today in many societies the necessary institutions--particularly the political ones--are not forthcoming. It entails a fundamental restructuring of a society to create a world of impersonal exchange--a restructuring that has typically not been forthcoming. Since institutions reflect the belief system of a society then we must turn to the diverse cultural heritages of society to see why the collective learning has not been conducive to creating the necessary institutions. The learning process appears to be a function of 1) the way the existing belief system filters the information derived from experiences, and 2) the different experiences confronting individuals and societies at different times. In some cases the initial belief system has not been congenial to institutional innovations that would permit impersonal exchange; in other cases the experiences were not those that would incrementally alter the belief system to create such institutions.

Avner Greif (1994) has explored the contrasting cultural background of Genoese and Maghribi traders in the late medieval Mediterranean trade and the consequent different institutional frameworks they evolved to deal with the impersonal markets of long distance trade--the former evolved bilateral enforcement mechanisms which entailed the creation of formal legal and political organizations for monitoring and enforcing agreements, an institutional framework that lent itself to further evolution of increasingly complex trade, the latter who had adopted the cultural and social attributes of Islamic society perpetuated a personalized structure that did not permit further expansion. The former went on to evolve more productive markets, the latter eventually disappeared in the face of increasing competition.

The role of ideas and belief systems in shaping societies is not altogether new. Max Weber's celebrated The Protestant Ethic and the Spirit of Capitalism (1958) argued that protestantism was the underlying source of capitalism but Weber's cultural source (protestantism) was too narrow--it was broadly the Judeo-Christian tradition--and he failed to make the connection between beliefs and the consequent institutions (North in Davis, ed. 1995). What still requires explanation is the diversity of belief systems and their cognitive basis.

IV

The pervasive human attempt to reduce uncertainty is the key to understanding the way belief systems evolve. In order to make uncertain situations "comprehensible" humans will develop explanations.² The pervasiveness of myths, taboos and particularly religions throughout history (and prehistory, as well) suggests that humans have always felt a need to explain the unexplainable and indeed it is probably an evolutionarily superior trait to have any explanation rather than no explanation.

Merlin Donald (1991) maintains that there have been two stages in the cultural development of human thought--the mythic and the theoretic. The former, which characterized thought before Greeks evolved the process of thought and argument, was characterized by the use of external formalism but were employed in the service of myths and narratives. While analytical theorizing has been with us ever since it is clear that this earlier form of thought

² In an original and stimulating study Young Back Choi develops an analytical framework similar to the one being developed here in which he terms the ubiquitous human search for explanation in the face of uncertainty paradigm seeking and the result conventions (rather than institutions). See his *Paradigms and Conventions*, Ann Arbor: The university of Michigan Press, 1993.

continues to play a critical role in the formation of ideologies. Indeed the cultural heritage of a society provides the means to reduce the divergence of perceptions that will arise from diverse experiences and constitutes the means for the intergenerational transfer of unifying perceptions. Cultural learning not only encapsulates the learning from past experiences but also provides shared explanations for phenomena outside the immediate experiences of the members of the society in the form of myths, taboos, and dogmas.

Ideologies are organized belief systems frequently having their origins in religions which make both proscriptive and prescriptive demands on human behavior. They both incorporate views about how the "world works" and how it should work. As such they provide a ready guide to making choices. But I do not wish to confine myself to organized ideologies like communism. The ideological stereotypes that dominate making choices in political and other contexts--such as conservatives and liberals--are "looser" constructs that guide choices in the face of uncertainty just as surely as more organized structures. But whether organized or "loose" ideologies play a complementary role to institutions in making behavior predictable. While institutions structure the external environment between human beings, ideologies structure the mental "environment" thereby making predictable the choices of individuals over the range of issues relevant to the ideology. But what makes individuals susceptible to having their mental environment structured?

V

The ubiquitous drive to create order from disorder is the fundamental driving force which leads humans to scaffold both the mental models they possess--ie belief systems--and the external environment--ie institutions. Part of the scaffolding is an evolutionary consequence of successful mutations and is therefore a part of the genetic architecture of humans and part is a consequence of cultural evolution. Just what the mix is between the genetic architecture and the cultural heritage is in dispute. Evolutionary psychologists have stressed the genetic architecture in the scaffolding process at the expense of the role of the cultural heritage.³ Others such as Stephen J. Gould have suggested that there is a lot of slack in the genetic architecture which gives greater scope to cultural evolution. Certainly many of our personal preferences are genetically determined such as hunger, thirst, sex and perhaps some of our beliefs, but some preferences and most beliefs must be surely acquired.

Ken Binmore maintains that our genes probably do not insist that we prefer or believe certain things but they are responsible for organizing our cognitive processes in terms of preferences and beliefs. He maintains that we come equipped with algorithms that not only interpret the behavioral patterns we observe in ourselves and others in terms of preference-belief systems but actively build such models into our own operating systems. The evolutionary advantage of such an inductive process is that new behaviors are tested against past experience in our internal laboratory. Humans enjoy the benefits of having the potential to learn a second best strategy in any game. Interactive learning is a 2 stage affair in which we first receive a social signal that tells us how to behave then test the behavior against our preferences to see whether we wish to follow its recommendation.⁴

³ The Adapted Mind, Barkow, Cosmides, and Tooby, eds. Oxford: The University Press, 1992 is an excellent statement of this perspective.

⁴ Ken Binmore Game Theory and the Social Contract II, Chapter 2 Evolution in Eden, Draft Ms.

