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Neuroeconomics and Identity

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Abstract.

This short paper discusses majority and minority views in economics regarding the value of neuroscience for economics – and thus the value of the neuroeconomics research program. It argues that neuroeconomics' reception ultimately depends on whether economists adopt a philosophy of science thinking closer to what exists in other sciences. It then argues that an inadvertent product of this debate is whether people can be identified as relatively independent agents. The paper concludes with comments on what this debate implies about the conception of the decision-maker as a relatively independent identity.

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Neuroeconomics and Identity¹

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Economists are strongly divided over whether there even ought to be a neuroeconomics, which they generally understand as the application of neuroscience to economics to deepen explanations of economic behavior. The majority of economists, supporters of the standard theory of decision-making in economics (which they regard as the heart of economics as the science of how resources are allocated), are opposed in principle to there being a neuroeconomics. A minority of economists, those primarily associated with behavioral economics, believe neuroscience is important to the theory of decision-making. Behind this division lies a fundamental disagreement in philosophy of science reasoning regarding what counts as good explanation in economics. This paper examines this division from this perspective. My view is that neuroeconomics' reception in economics ultimately depends on whether economists adopt a philosophy of science thinking closer to what exists in other sciences.²

I will first briefly review the basis for the majority view, and then contrast the minority view, emphasizing the key division between economists in philosophy of science reasoning. Then I will turn to an issue which I see as an inadvertent a product of this debate: whether people can be identified as relatively independent agents. Economics emphasizes individual behavior, which presupposes that as economic agents people possess relatively independent identities. The basis for this position (I will show) exists in the standard theory of decision-making. Behavioral economists have challenged this theory, and this calls into question standard theory's basis for saying that people can be identified as relatively independent. The question I then address is whether behavioral economics offer alternative grounds for saying that people possess relatively independent identities. My conclusion is that it is not entirely successful in this regard, but that neuroeconomics, seen as a neuroscience extension of the basic behavioral model, offers a possible way of making the case.

1 Why neuroscience doesn't matter for most economists

The main reason the great majority of economists seriously doubt that neuroscience has any value for economics, and are consequently resistant to there even being a field called neuroeconomics, is that they believe that neuroscientific data and neuroscientific theories

¹ Presented at the Duke University Center for Interdisciplinary Studies in Science and Cultural Theory, April 12, 2013. I thank Roy Weintraub, Kevin Hoover, and members of the audience for comments.

² There is an alternative understanding of neuroeconomics I do not discuss associated especially with the work of Glimcher (2003), who believes the brain can be modeled using the principles of standard economic theory.

should not be thought relevant to economics and explanations of decision-making.³ They hold this view because the standard theory of decision-making in economics – the revealed preference approach⁴ – is formulated in such a way that choosers’ preferences – long thought by economists to be the drivers of choice – can only be indirectly inferred from their observable choices. It follows that choosers’ preferences have no independent evidentiary standing in explanations of choice behavior. It further follows that there can be nothing about possible foundations for people’s preferences in neuroscience, or cognitive psychology, that can add anything to what can be explained and predicted about choice behavior using the evidence of people’s observed choices. Essentially, then, for most economists neuroscience and cognitive science are redundant to economics because they adhere to revealed preference theory.

To be clear, revealed preference theory does not abandon the concept of preference. Rather, given that preferences are unobservable, it employs an account of what preferences *must be* to account for people’s observed choice behavior. Importantly, economists assume that people’s observed choice behavior is generally ‘rational,’ meaning that that people behave consistently in conditions of scarcity in economies with free, competitive markets.⁵ Reasoning backward, then, from this view of behavior to what preferences *must be* – an exercise in (abductive) logical reasoning – they articulated a set of formal assumptions called axioms said to necessarily apply to the idea of a preference as an ordered relationship between any two objects (e.g., *A* is preferred to *B*).⁶ Were people’s actual preferences then to respect all these axioms (which was assumed had to be the case), it followed that they possessed what are called ‘well-defined preference orderings.’ An important theorem (the von Neumann-Morgenstern utility function theorem) then stated that were a set of preferences well-defined, then they could be represented by a distinct (monotonic) individual utility function (von Neumann and Morgenstern, 1944). A utility function is thus a formal construction that is imputed to choosers based on their observed choices and the assumption that their preferences obey the required axioms.

It might be asked, however, do people actually have utility functions? For proponents of revealed preference theory, this question is ill-formed. You can’t say whether or not people possess utility functions because utility functions are not observable natural properties we might or might not find they have, but are rather constructed formal representations that can be ascribed to them in order to explain what we believe we generally observe in their

³ An influential statement of this position is Gul and Pesendorfer (2008).

⁴ The revealed preference approach has its basis in Samuelson’s (1938) weak axiom of revealed preference.

⁵ One way to understand consistency is to say that people’s choice behavior is such that they cannot be used as ‘money pumps,’ or be deprived of all their resources in trades with others.

⁶ Arrow and Debreu (1954) is the standard source for this analysis. The justification of the axioms governing preferences is due primarily to Savage (1954).

choice behavior. Conventionally, then, economists say that decision-makers behave ‘as if’ they possessed utility functions based on having well-ordered preferences. Note, then, how the ‘as if’ utility function view effectively bars investigations of neural and cognitive processes from standard economics choice theory. Even if there were valuable evidence regarding people’s preferences from which we might develop theories of preference (e.g., Lichtenstein and Slovic, 2006), this would be of no interest to economists, as essentially all that needs to be known about preferences is already delivered in their axiomatic treatment as well-ordered.

We may distinguish, then, four connected philosophy of science positions implicit in this theory. First, the basis for the theory is empirical evidence regarding choice behavior, and what counts as empirical evidence is what is observable. Second, what is observable is rational behavior, that is, behavior understood to exist in competitive markets. Third, unobservable phenomena, namely, preferences, can be inferred as theoretical entities, if this inference is logically adequate. Fourth, this ‘as if’ conception can be employed as a general framework for explaining economic behavior as long as it produces successful predictions.

This last position was articulated as the doctrine of instrumentalism.⁷ Its central – and controversial – tenet is that explanations in economics need not be realistic. Thus it really doesn’t matter if the idea of people having utility functions seems odd or unrealistic as long as the utility function idea functions as an adequate instrument of prediction. Let me, then, turn to behavioral economists’ reaction against this view *en route* to saying why neuroscience matters for some economists.

2 *Why neuroscience matters for some economists*

In the first place, behavioral economists reject the ‘as if’ utility function foundation for explaining economic behavior because they think its account of decision-making is unrealistic and does not predict well (e.g., Camerer, 2006). In particular, they point to the considerable empirical evidence, originally compiled by psychologists but increasingly by behavioral economists, that people commonly do not obey the axioms assumed to underlie the idea that people have well-ordered preferences. This evidence constitutes a bottom-up disconfirmation of revealed preference theory that directly challenge its instrumentalist credentials.

But more seriously, behavioral economists also reject the kind of reasoning the standard view employs to infer from observable choice behavior that people have well-ordered

⁷ This view was stated by Friedman (1953).

preferences as unscientific. That inference assumes choice behavior is rational in the sense of being consistent in a competitive market system. The standard view allows people may sometimes fail to be rational and behave consistently, but lays out nonetheless how their preferences *ought* to be understood in order for them to be rational and behave consistently. Thus the further critique behavioralists advance is that inference in the standard view of decision-making is normative rather than descriptive. Its basis is a view of how people ought to act in competitive market systems, not an account of how they do act, which the evidence suggests is often inconsistently.

A behavioral theory of decision-making based on how people actually do act was first advanced by Herbert Simon (e.g., 1976) who explained rationality in decision-making as procedural (rather than substantive). Procedural rationality is an algorithmic or rule-formulated explanation of decision-making framed in terms of the idea of decision-makers as information-processing agents rather than utility maximizers. Information-processing is a causal process dependent upon natural mechanisms inherent in the constitution of decision-makers. Causal mechanisms of course are unobservable and thus must also be theoretically inferred. But the inference involved makes no claims about how people ought to act to achieve certain goals. Thus the extent to which that they may called rational is that their behavior is rule-governed.

Simon was a cognitive psychologist influential in the development of behavioral economics, but he was active before the development of brain imaging technologies. The current availability of these technologies has transformed contemporary behavioral research by extending what can be learned about the psychological dimensions of decision-making behavior through inferences about underlying causal mechanisms that have a basis in brain functioning. For example, behavioral economists argue decision-makers engage in dual processing, where some actions are the result of 'reasoning' and some decisions are 'intuitive' (Kahneman, 2003). Brain imaging lends support to this view in connection with the fact that different parts of the brain process different types of activity. But brain imaging significantly extends what can be said about this processing, because it potentially allows us to explain the integration of different types of processing through the functional relationships of the brain.

If we still say, then, that people's economic behavior reflects their preferences, it follows that neuroscience, together with cognitive psychology, could be quite relevant to economics. But for economists in large numbers to share this conclusion would require that they give up their normative account of rationality (well-ordered preferences and 'as if' utility functions), and adopt methods of theoretical inference which are generally standard throughout the sciences.

Simon's theoretical shift raised another issue for economics with respect to its status as a science. The formal axiomatic approach to choice came into economics under the influence of mathematics. While the postwar formalization of economics transformed economics (Weintraub, 2002), it did not threaten its disciplinary boundaries, which if anything were reinforced relative to other social sciences which were not formalized. But making the idea of causal mechanism an important part of the theoretical structure of economics arguably makes the boundaries between economics and other disciplines less sharp since deep arguments regarding how causal mechanisms operate can be transdisciplinary. So I suggest that one factor in economics' resistance to the information processing model of economics agents is that it could be seen as weakening economics' claim to investigate a separate domain of behavior.

3 Why the standard economics view of decision-making cannot sustain a conception of the decision-maker as a relatively independent identity

We should be concerned about this issue of individual identity for two reasons. First, from the point of view of causal reasoning, in order to understand how a cause brings about an effect one needs to know the location and scope of that cause in instances in which it occurs. Economics assumes people's behavior has causal impact on markets. If individuals are independent causal agents, then the joint effects of their actions can be aggregated up over individuals. If they are not independent agents, then we err if we explain joint effects through a one-by-one sum-of-individuals type aggregation. Second, for reasons separate from our concern with causal processes, and due to our cultural and political heritage, we regard the relative independence of people as normatively important.

Standard economics is popularly perceived to be individualist as implied by the idea that people are motivated by their own individual interests, and indeed utility function analysis supports this perception. Why is it, then, that the standard view of decision-making cannot sustain a conception of the decision-maker as a relatively independent identity? The basis for individual identity in standard economic theory is the idea that each person has their own ('as if') utility function. This view, however, depends upon people having well-ordered preferences, since it is a theorem of the theory that people can only be ascribed utility functions should their preferences obey the axioms required of having well-ordered preferences. But we know from considerable accumulated empirical evidence that people's preferences do not invariably conform to these axioms, and so we are not justified in ascribing individual utility functions to them. Imagine that one reason why people's preferences are non-conforming is that they are influenced by other people's preferences (as for example, children's preferences are influenced by their parents' preferences). Then the choices people make with non-conforming preferences cannot be directly attributed to

them alone. Thus people do not have relatively independent identities if this must depend on having one's own preferences.⁸

Perhaps behind the conviction many people have that people have relatively independent identities is the fact that they have separate bodies. But there is nothing in standard decision-making theory about people's bodies. Indeed there is not even a physical ground to utility functions as logical constructions out of well-ordered preferences. Earlier in the history of economics hedonist decision-making theory actually supposed utility functions were desire-based, and so did employ a separate bodies assumption. But revealed preference theory expressly eliminates this physical ground, and substitutes a constructed 'as if' utility function for a naturally based one.

4 *Why information-processing theories and neuroeconomics in particular might sustain a conception of the decision-maker as a relatively independent identity*

Information-processing theories of decision-makers have two clear advantages when it comes to accounting for individual identity. On the one hand, they do not make use of the problematic 'as if' utility function, and on the other hand, as naturalistic theories they recognize that people have separate bodies, and so have grounds for saying that each body, human or animal, is a relatively independent information-processing agent. Indeed that people have separate bodies is important to the leading approach in behavioral economics termed prospect theory⁹ which assumes that all decision-making occurs from some reference point. That is, all decision-making is always from some 'there' (which is not the case in standard decision theory), which if not necessarily identical with the human body at least locates the decision-maker in some distinguishable location.

At the same time, however, information-processing models of decision-making as they have been developed in psychology and cognitive science assume that decision-makers process information in multiple ways and in effect possess multiple information-processing centers. If we understand people as information-processors, then their having multiple information-processing centers implies that they are made up of multiple selves and are therefore not identifiable as single selves. Some dual-self models, for example, distinguish between myopic or short-sighted and planning or far-sighted selves (Thaler and Shefrin, 1981; Fudenberg and Levine, 2006). If these different selves or different types of processing activity alternate over time in a person's overall decision-making, then though people are physically distinguishable in having separate bodies, from a decision-maker

⁸ There is a further argument that utility function characterizations of people fail to individualize them. Saying that people are individualized by having their own preferences is circular, and thus tells us nothing.

⁹ Following the work of Daniel Kahneman and Amos Tversky (1974). For an overview of prospect theory, see Barberis (2013).

perspective might rather be seen as a succession of identifiably different people. Moreover, these distinguishable selves of people could interact with the distinguishable selves of other people to the advantage or disadvantage of the other selves that inhabit their respective bodies, so that the world is effectively populated by selves of people rather than whole persons.

Proponents of dual or multiple self models in economics have a broad brush strategy for arguing that people are integrated, relatively independent identities, namely, that people exercise self-control so as to ensure they function independently. There are a number of ways in which self-control is theorized. For example, when game theory is used as a modeling template, people's different selves are conceived of as interacting strategically in 'games,' and the equilibrium outcomes of these games ensure that a person's collection of selves functions as a single self (e.g., Ross, 2005). But explanations of this kind also have an 'as if' quality to them that leaves one feeling something is missing descriptively. I will argue, then, that neuroscience has an advantage in explaining how people's multiple processing systems function as overall single decision-makers since neuroscience clearly describes processing as a connected system. To do this, however, I interpret neuroscience in terms of concepts from neuroeconomics.

What might be neuroeconomic about neuroscience? As an investigation of multiple types of concurrent processing, neuroscience examines a system of distributed cognition, that is, cognition that occurs in multiple distinct yet interrelated locations. This is essentially the idea of a division of labor, a concept fundamental to the idea of an economic system. Economics, of course, understands the interrelatedness of an economic division of labor through the function of the price system. The interrelatedness of a brain division of labor occurs through brain circuitry, but in each case there is a mutual dependence of different activity centers which justifies reference to a single system. So the ideas of distributed cognition and division of labor are parallel.

However, there is a difference between these two ideas in that economics' division of labor idea has been developed to explain interaction between many people whereas the neuroscience's distributed cognition idea has been developed to explain interaction between many parts of the brain. Suppose, then, we interpret neuroscience's distributed cognition idea in a neuroeconomic way as referring to interaction between many people, so that we should say human cognition is distributed both within and across people. On the assumption that systems of distributed cognition describe mutual dependence and interrelatedness between different cognition centers, then the internal functioning of interacting parts of the brain depends on the external functioning of many interacting people and vice versa.

Consider, then, that when economists investigate divisions of labor in economic systems, one thing they are interested in is how technological change transforms these systems. From a neuroeconomic perspective on neuroscience, we would accordingly need to recognize that the technologies of interaction in these two cognition domains have undergone different rates and kinds of change. The internal system of distributed cognition in the brain has evolved but only very slowly over an extremely long period of time. In contrast, external system of distributed cognition in economic systems has evolved rapidly, as for example is manifest in the very recent dramatic development of machine computation. It is interesting, then, that the accelerated development of external systems of distributed cognition, which are related to and dependent upon internal systems of cognition from which they arose, now exhibit reflexivity in the investigation of the brain carried out with the scanning technologies of neuroscience.

I said that I would argue that neuroscience has an advantage in explaining how people's multiple processing systems function as single decision-makers in order to make a case that people possess relative independent identities. With the neuroeconomic view of distributed cognition above, that argument can be outlined by being explicit about the technology of magnetic resonance imaging (MRI). As neuroscientists know, individual brains are not scanned *de novo* but relative to a 'bench mark' normal brainset constructed from a sample of individuals (Dumit, 2004). To understand mental illness, brain dysfunction, or other specific cognitive characteristics, people are thus individualized relative to populations of purportedly like persons. Generalizing to decision-making as information process, neuroeconomics thus operates with a conception of identifiably distinct decision-makers, relative to the normal brainset constructed from populations of decision-makers. Accordingly, if we regard MRI technology as a component of an evolving wide system of distributed cognition, then the evolution of that overall system in its connected external and internal domains has produced as one of its (unintended) effects a specific means of showing that people exist as distinct identities.

5 *What sort of identity conception?*

To be sure, the concept of identity is used in many ways in popular culture, literature, and elsewhere in science, and this way of explaining it will likely disappoint many who believe it involves other things. It can be responded, however, that when we look at the world naturalistically, we arguably find ourselves with few resources for supposing individuals have relatively distinct identities. From a normative perspective, this is worrisome since it is a widely held conviction in contemporary society that individuals are distinguishable and important.

Economics has long had a special role in this story, since it has been seen as the one science of individual behavior. But the development of behavioral science has cast doubt on the adequacy of standard theory's utility function account of the person, and this raises the question of how individuals are to be represented in behavioral science. Do they have any role, or are causal mechanisms not individual-respecting? The argument above is that a particular conception of the identity of the decision-making individual is available in what has emerged in neuroscience, and that this conception has specifically neuroeconomic foundations.

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