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THE RELEVANCE OF EVOLUTIONARY SCIENCE FOR ECONOMIC THEORY AND POLICY

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Abstract

NSF's "Dear Colleague Letter" reflects the widely perceived need to go beyond current economic theory in the formulation of public policy. At the same time, there is a profound lack of unity among the disciplines that comprise the behavioral, social, and economic sciences. This white paper emphasizes the relevance of **evolutionary science** as a way to integrate the SBE sciences, similar to the integration that is more advanced in the biological sciences. Modern evolutionary science is broadly construed to include cultural in addition to biological evolution and the study of neural and psychological mechanisms (proximate causation) in addition to the environmental factors that brought the mechanisms into existence and result in the expression of specific behaviors (ultimate causation). It provides an exceptionally useful set of theoretical and empirical tools for integrating the many disciplines in the biological and SBE sciences required to formulate economic theory and public policy for the 21st century. The task of integration is already in progress and can be applied to the formulation of public policy without a long academic time lag. We therefore call for **integration across disciplines** and **evolutionary science as an integrative framework** to be recognized as a funding priority by NSF.

The evolutionary biologist E.O. Wilson (1998, p. 197) has criticized the standard economic model for being "hermetic" and "Newtonian". It is Newtonian in the sense that it attempts to cast all economic phenomena into simple general laws, and hermetic in that standard economic models are sealed off from the complexity of actual human behavior and the biophysical world.

Wilson's assessment is not just an outsider's view. The core model of economics is being challenged by insiders more than at any time since the Great Depression. It is therefore timely that NSF has issued its call for white papers concerning future research in the Social, Behavioral, and Economic Sciences.

This white paper emphasizes the relevance of **evolutionary science** for economic theory and public policy at all scales, from the improvement of urban neighborhoods to international relations. Modern evolutionary science is broadly construed to include cultural in addition to biological evolution and the study of neural and psychological mechanisms (proximate causation) in addition to the environmental factors that brought the mechanisms into existence and result in the expression of specific behaviors (ultimate causation). It provides an exceptionally useful set of theoretical and empirical tools for integrating the many disciplines in the biological and SBE sciences required to formulate economic theory and public policy for the 21st century.

The task of integrating evolutionary science with economic theory and policy has already begun, thanks in part to the National Evolutionary Synthesis Center (NESCent), NSF's largest evolution-related center. Working with the Evolution Institute, a new think tank for formulating public policy from an evolutionary perspective, NESCent sponsored a catalysis meeting on Nov 13-15 2009 titled "The Nature of Regulation: How Evolutionary Theory Can Inform the Regulation of Large-Scale Human Social Interactions". A highly interdisciplinary group of over 30 experts attended the meeting on Nov 13-15 2009, with an even larger group participating from a distance. Based on this meeting, a two-year project was organized to continue the task of integration, which held its first meeting on August 26-29 2010. This preparation enables the 53 scientists and scholars signing this document to articulate the relevance of evolutionary science for economic theory and policy with a single voice.

Diagnosing the Need for Change

NSF's SBE program already appreciates the need for change in its "Dear Colleague" letter, but it is important to diagnose why the prevailing paradigm has been slow to change and why an explicitly evolutionary perspective is needed, beyond the many existing perspectives in the SBE sciences.

The U.S. House of Representatives Subcommittee on Investigations and Oversight (July 20, 2010) refers to the currently dominant macroeconomic model as the DSGE (Dynamic Stochastic General Equilibrium) model. We use the broader term *general equilibrium (GE)* to describe the standard economic model—a basic assumption is that an equilibrium state exists and there is always a tendency to gravitate toward it. In spite of the well-publicized failures of the GE model and the theoretical foundations upon which it is built, it still dominates

economic textbooks and policy debates. The Hearing Charter of the above committee summarized the current situation this way:

> Economic analysis is used to inform virtually every aspect of domestic policy. If the generally accepted economic models inclined the Nation's policy makers to dismiss the notion that a crisis was possible, and then led them toward measures that may have been less than optimal in addressing it, it seems appropriate to ask why the economics profession cannot provide better policy guidance.

One of the most serious shortcomings of the GE model is its assumptions about human behavior. Economic agents are endowed with a kind of supernatural rationality. Not only can consumers and firms instantaneously and effortlessly assemble all available information to make optimal decisions in the present, they can also assign accurate subjective probabilities to any possible future event. Furthermore, the mathematical tractability of the optimization models almost always requires the assumption of identical preferences (or the "representative agent") or even an *ad hoc* and imaginary social welfare function. All models make simplifying assumptions in the interest of tractability, but GE assumptions are so wildly at odds with known scientific understanding of human behavior and decision making that the model is of little use in describing or predicting actual behavior outside a narrow set of parameter values.

Along with many others, we believe that economic theory and public policy need to be based on a better conception of human propensities in all their variety. A key challenge facing the SBE sciences, however, is to develop a unified understanding of these propensities (Gintis 2006). Unity does not currently exist among fields such as anthropology, economics, history, political science, psychology, sociology, and their various subfields. It is here that evolutionary science—broadly defined at as we did at the beginning of this white paper--can help SBE achieve a unification similar to the unification of the biological sciences that took place in the 20th century (and continuing). The biological sciences have maintained separate disciplines but they are consistent with each other and with lower-level processes to a much greater extent than the SBE disciplines. Evolutionary science is largely responsible for this unification and is the best candidate for unifying the SBE sciences, especially when the human capacity for open-ended behavioral and cultural change is viewed *from* an evolutionary perspective, rather than as an *alternative* to the evolutionary perspective, as it so often has in the past.

Far from the caricature of genetic determinism, contemporary evolutionary science affirms that culture and behavioral development within the lifetime of individuals is just as important as genetically established behavioral mechanisms for an adequate understanding of human propensities relevant to economic theory and public policy. Expressed human propensities reflect the interaction of genetically innate psychological mechanisms with local environmental conditions, often compounded over many generations. Economic theorists and policymakers ignore the importance of cultural differences at their peril when they consult only the GE model or a conception of universal human psychology that is expressed uniformly within and between societies.

The aforementioned complex interactions are best understood from an overarching evolutionary perspective. If the complexity of this enterprise appears too daunting, consider

that biological processes are also dauntingly complex at all scales, from the molecular processes within a single cell to ecosystem processes, yet evolutionary science is doing a very good job of making sense of it. It is time to put the same theoretical framework to use in understanding our own species, both from a basic scientific perspective and in the formulation of public policy.

How Evolutionary Science Can Help NSF Build a Science of Economics for the Real World

Based on our individual research programs, the NESCent catalysis meeting, and the ongoing NESCent working group project, we offer the following specific observations about how evolutionary science can inform economic theory and public policy, in part by integrating the SBE disciplines.

1. Evolution can help make sense of the empirical findings from behavioral economics. Behavioral economics started out by identifying "anomalies" in human behavior, beginning in the 1950s and 1960s with the Allais paradox, Ellsberg paradox and others. These are anomalies against the background of the GE model but need to be understood as key products of gene-culture coevolution. This enterprise is now in progress and should have a high priority for NSF funding. "Hot topics" include:

• The identification and explanation of socially-driven human propensities such as other-regarding behavior, sensitivity to norms, a sense of fairness and reference-dependent preferences.

• The importance of individual differences, based both on genetic polymorphisms and mechanisms of phenotypic plasticity.

• Understanding the neural and genetic bases of human preferences, including the impact of the environment and social interactions on gene expression and neural development.

• The nature and importance of cultural variation and change, based on the interaction between psychological mechanisms that evolved by gene-culture coevolution and local environmental conditions, often compounded over many generations.

2. Evolution can help decision makers understand the large-scale and long-run consequences of economic policies, particularly environmental and social policies. The assumptions of the GE model are constructed to validate the concept of the invisible hand, whereby individual preferences result in outcomes that are benign at the level of the whole society. These assumptions can be valid for a narrow range of contexts but for most contexts the relationship between individual and group welfare is much more complex. Individuals behave in ways that benefit themselves at the expense of others or for short-term gains at the expense of their own long-term welfare. Even when individuals manage to form cooperative groups, the problems listed above appear at the level of between-group interactions, where they can take place with even more destructive force than before. In this fashion, "rational" behavior on the part of

lower-level agents becomes part of the problem for the long-term welfare of large-scale society. Evolutionary science offers an extensive body of theory for studying conflict and cooperation at multiple levels that can be used to promote large-scale cooperation and long-term sustainability in our own species.

3) The proximate-ultimate distinction is as important for economic theory and policy as it is for evolutionary science. One of the most important distinctions in evolutionary science is between ultimate and proximate causation, which reveals the need for two separate and complementary explanations for all products of genetic and cultural evolution. Ultimate causation explains why a given trait exists, compared to many other traits that could exist, based largely on the winnowing action of selection. Proximate causation explains how the trait exists in a mechanistic sense. The two explanations are often conflated in the SBE disciplines. It is especially important to recognize the many-to-one relationship between proximate and ultimate causation, whereby many functionally equivalent solutions can evolve in response to a given environmental challenge. Failing to distinguish between design features and specific implementation of design features can result in the loss of ability to detect correlations and policies that work against the background of some implementations but not others.

4) Non-adaptive products of evolution are best understood from an evolutionary perspective. The GE model is based upon the assumption of rational behavior and even some of its alternatives are based upon the concept of bounded rationality. Yet, evolutionary processes often result in traits that aren't "rational" (= adaptive) in any sense. Two important classes of non-adaptations are costly byproducts of adaptations and adaptations to past environments that are mismatched to current environments. For example, nutritional adaptations that evolved by genetic evolution in past environments are now malfunctioning in modern environments, causing an epidemic of ailments such as obesity, diabetes and immune system dysfunctions. Best practices can fail to spread because mechanisms of social transmission that were adaptive in small-scale society are malfunctioning in large-scale society. Costly byproducts and mismatches exist for cultural evolution no less than genetic evolution. In other words, some cultures cause people to behave inappropriately in their current environments by virtue of how they were adapted to their past environments. It is very difficult to address or even recognize these problems except from an evolutionary perspective.

Conclusion

The National Science Foundation is the major funder of economic research in the U.S. and therefore the world. We welcome the evaluation of funding priorities that has resulted in its call for white papers. It is time to consider a diversity of options. Yet, when we expand the view beyond the DSGE model to include all the disciplines comprising the SBE sciences, we encounter a different problem—a diversity of perspectives and a profound lack of integration among them. The challenge for NSF's SBE program is to broaden the range of research that it funds without suffering from a lack of integration.

The scientists and scholars signing this white paper represent all disciplines in the human social and behavioral sciences and many disciplines in the biological sciences. In addition to

our disciplinary training, we speak a common language provided by evolutionary science. We call for NSF's SBE program to recognize the integrative value of evolutionary science in its revised funding priorities for the future.

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