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for Evolutionary Economics**

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The topic

(Evolutionary) economics stands in need of a much more complex model of man than the one explicit (or implicit) in the neoclassical theory. Rather than (just) maximizing utility, the agent of evolutionary economics has habits of thought (Veblen), innovates (Schumpeter), and adopts behavioral routines (Nelson and Winter). She produces change and adapts to change in multiple ways; she is embedded in institutions; and her intentional actions in turn influence the design of the institutions she lives in. She thus fully participates in sociocultural and economic evolution. Today, the cognitive sciences and behavioral economics enable us to build much richer and more realistic models of the boundedly rational economic agent than was feasible hitherto.

Evolutionary theory multiply intersects with economics. Economic agents, as human beings, are the product of biological evolution; they make decisions and behave as evolved (and developing!) organisms. Institutions, technologies, and culture in general also evolve and make the economy evolve. Accounts of economic evolution can now be enriched by borrowing concepts and theories coming from the Extended Synthesis that is currently taking shape in evolutionary biology, and profit from developments in mathematical and computational science. How can these and other developments help evolutionary economics to accommodate a complex, more realistic, model of man and specify its role in economic evolution?

Program

FOUNDATIONAL AND ONTOLOGICAL ISSUES

Naomi Beck [Is the Market Order Moral? Faith and Reason in Hayek's Theory of Cultural Evolution](#)
[Human](#)

Richard R. Nelson [Behavior and Cognition in Evolutionary Economics and Social Science](#)

Ulrich Witt [Evolutionary Economics and Its Individualistic Foundations](#)

COGNITIVE AND EVOLUTIONARY PSYCHOLOGY FOR EE

Karin Knottenbauer [Human Nature in Biologically Inspired Economic Theories](#)

Kevin A. McCabe [Neural Systems for the Efficient Harvesting of Joint Rewards Using Trust Relationships](#)

Katherine Nelson [Human Nature in Evolutionary Developmental Psychology](#)

Nigel Nicholson [Leadership](#)

EVOLUTION OF COGNITION AND KNOWLEDGE AND EE

Christophe Heintz [Economic Routines Adapted to Local Reputation Systems](#)

Bernard Walliser [Learning vs. Evolution: The Point of View of Game Theory](#)

Luigi Marengo [Where Do Alternatives Come From? Towards a Constructive Approach to Collective Choice](#)

INSTITUTIONS, ORGANIZATIONS, AND SOCIO-ECONOMIC NETWORKS

Bertin Martens [The Cognitive Mechanics of Economic Development and Institutional Change](#)

Marco Valente [Evolutionary Modeling of Markets for Heterogeneous Goods](#)

Gerald Silverberg [Innovation as a Complex Collective Search Process](#)

EVOLUTIONARY PRINCIPLES ACCOUNTING FOR ECONOMIC CHANGE

Kurt Dopfer [EvoDevo Goes Micro Meso Macro: Why Biology is the Mecca of Economics](#)

Eugene Earnshaw [Breaking the Bonds of Biology: Natural Selection in Nelson and Winter's Evolutionary Economics](#)

Werner Callebaut [The Place of Evolutionary Economics in an Extended Evolutionary Synthesis](#)

Abstracts

NAOMI BECK

nbeck@uchicago.edu

Social Sciences Collegiate Division, University of Chicago, USA

Is The Market Order Moral? Faith and Reason in Hayek's Theory of Cultural Evolution

The paper examines Hayek's attempt to equate cultural evolution with the emergence of an extended market order. I will argue that this attempt was not very successful and led Hayek to make some unconvincing claims about the roles of reason and faith in the evolution of modern civilizations (namely that the existence of civilization is the product of faith in market forces that surpass individual reason). I plan to focus on Hayek's theory of group selection and use the strategy of comparing his approach to Darwin's. Hayek claimed that cultural evolution is not Darwinian, and since he developed his views on group selection late in life and they are not entirely clear, a comparison with Darwin will provide a useful way to tease out what exactly he meant. It will also offer a poignant contrast, since Hayek's account of the operation of group selection is much less satisfying than Darwin's 'community selection' (specifically because he refused to attribute reason an important role in the development of a moral order).

WERNER CALLEBAUT

werner.callebaut@kli.ac.at

Konrad Lorenz Institute for Evolution and Cognition Research, Austria
& Faculty of Sciences, Hasselt University, Belgium

The Place of Evolutionary Economics in an Extended Evolutionary Synthesis

According to Stanley Metcalfe (1998), "Evolutionary theory is a manner of reasoning in its own right quite independently of the use made of it by biologists. They simply got there first." From Nelson and Winter (1982) to Hodgson and Knudsen (2009), evolutionary economists have prudently demarcated their enterprise from biology. In contrast with this cautionary stance, bioeconomists such as Michael Ghiselin and Jack Hirshleifer have pointed to a presumed common core problematic of economics and biology ('coping with scarcity'). And in the wake of E. O. Wilson's sociobiological imperialism vis-à-vis the social sciences, a growing number of biologists, anthropologists, philosophers, and psychologists now advocate some version of 'generalized Darwinism' and see indications of "the beginnings of an evolutionary synthesis for culture" (Mesoudi 2007).

My paper interprets and evaluates this conflict against the background of current calls for an Extended Synthesis in biology (Pigliucci and Müller 2009). The original Modern Synthesis in evolutionary biology 'chose' Darwinism (evolution by natural selection) as its fundamental theory, interpreted Mendelism in a way that validated this core theory, and used this fusion to ban the alternatives of Lamarckism, saltationism, and orthogenesis. After 1930, disagreements among evolutionary biologists mostly concerned differences in evaluating the relative influences of agreed-upon variables on the evolutionary process ('evolutionary constriction'). Stephen Jay Gould's legendary 'hardening of the Modern Synthesis' toward a selectionist interpretation, which 'black-boxed' development and many other biological phenomena, occurred later, during the late 1940s and 1950s. In a way, evolutionary economics may be said to have entered the first phase of restriction—rejection of Lamarckism and teleology in general—just now (Callebaut 2009). My presentation will concentrate on the conceptual resources, for instance, regarding innovation, that I think an Extended Synthesis incorporating EvoDevo (evolutionary developmental biology) holds in store for an enrichment of evolutionary thinking in economics.

KURT DOPFER

Kurt.Dopfer@unisg.ch

Department of Economics, University of St. Gallen, Switzerland

EvoDevo Goes Micro Meso Macro: Why Biology is the Mecca of Economics

Highlighting biology in its paradigmatic significance, a brief natural history is sketched bringing into taxonomic focus various levels in their ascending complexity. At the level of living systems the distinction is between biological and cultural systems and at that of cultural systems between the cultures of primates and of humans. It is suggested that economics is the study of the economy as a system of cultural rules employed for economic operations. Biology is considered useful in furnishing information about the inherited capabilities of Homo sapiens to evolve human culture and to perform, as Homo sapiens oeconomicus, economic operations. Discussing the overall architecture, the individual is discussed in its ontogenesis, i.e., the development of a phenotype in interaction with its environment, and phylogenesis, i.e., transmission of generic knowledge over generations. As generic information of a kind allows multiple physical actualizations, the population concept is considered center stage in any architecture of natural systems. As it is neither 'micro' (living unit) nor 'macro' (total system), we consider a single information 'bit' and its population as constituting 'meso'. The EvoDevo approach is seen as highlighting adequately the intercausal dynamic between 'micro' and 'meso', with epigenetic information transmission as its distinct feature. The subject matter of economics is arguably 'macro', i.e. the economy as a whole, and a critical issue addressed in the talk relates to the nature of homology between the (biological) ecosystem and the economy. At this point, recent advances in micro- and meso-analysis make biology a highly fascinating field of exploration (also) for economists, with possibly significant theoretical payoff as these are developed into an integrated micro-meso-macro-framework.

EUGENE EARNSHAW

malefax@rogers.com

Department of History and Philosophy of Science and Technology, University of Toronto, Canada

Breaking the Bonds of Biology: Natural selection in Nelson and Winter's Evolutionary Economics

Nelson and Winter's *An Evolutionary Theory of Economic Change* (1982) was the foundational work of what has become the thriving subdiscipline of evolutionary economics. In attempting to develop an alternative to neoclassical economics, they looked to borrow basic ideas from biology, in particular a concept of economic 'natural selection'. However, the evolutionary models they construct in their seminal work are in many respects quite different from the models of evolutionary biology. There is no reproduction in any usual sense, 'mutation' is directed as opposed to blind, and there is no meaningful distinction between phenotype and genotype. Despite these substantial departures from the conceptions of evolutionary biology, I argue that the 'evolutionary' economics of Nelson and Winter is indeed a legitimate extension of Darwinian evolutionary principles to a novel domain, and that the novel features of evolutionary economics models reflect the distinctive theoretical requirements faced by economists. I further contend that reproduction, blind variation, and the genotype/phenotype distinction are all inessential to evolutionary theory, and that their role in evolutionary biology is a domain-specific feature of biological theory specially.

CHRISTOPHE HEINTZ

Christophe.heintz@kli.ac.at

Konrad Lorenz Institute for Evolution and Cognition Research, Austria

Economic Routines Adapted to Local Reputation Systems

Some recent work in cross-cultural experimental economics has shown that in similar (experimental) conditions, prosocial behavior differs across cultures. Pro-social behavior, which is here characterized as behavior that is beneficial to others, is observed in experimental games even in cases where it has an apparent cost. In the dictator game, for instance, subjects are given an initial endowment that they can share anonymously with an anonymous partner. In such experimental settings, people make prosocial choices and share their initial endowment generously. Moreover, these choices vary significantly across cultures. There are, therefore, culturally variable behavioral dispositions for prosociality and altruism.

How can we explain this variation? The results of such games and the cultural variations they reveal can be accounted for by (1) variations in social preferences—the cognitive mechanisms are stable across cultures; (2) variations in ways to interpret the experimental situation; and (3) variations in learned routines; social preferences are possibly relatively stable across culture.

In my talk I will analyze the alternative explanations of the cultural diversity of economic prosocial behavior and the theories on which they are grounded. The main explanation that has been put forward in the recent works of Fehr, Gächter, Henrich, and others appeals to variations in social preferences. Against this view, I will defend the hypothesis that variations in prosocial behavior as observed in experimental games are due to differences in learned economic behavioral routines, exploiting and adapted to the specifics of the local institutions. According to this hypothesis, the preferences are in fact relatively similar across cultures; the variation is due to differences in the learned solutions—which can take the form of ‘rules of thumb’—to common economic or strategic problems and their specific cultural forms.

I will first show that my variation-in-economic-routine hypothesis is as compatible with the experimental data as the variation in preference hypothesis. I will then argue that it is a more plausible hypothesis, on the basis of cognitive and evolutionary considerations and of ethnographic reports.

KARIN KNOTTENBAUER

Karin.Knottenbauer@rwth-aachen.de

Faculty of Business and Economics, Rheinisch-Westfälische Technische Hochschule Aachen, Germany

Human Nature in Biologically Inspired Economic Theories

The aim of this paper is to identify the implicit assumptions of human nature and human behavior in a selection of economic theories inspired by mainstream biological theories. Since there is mutual interdependence between the theories and models taught in business schools and universities on the one hand, and observed behavior in economic reality on the other hand, the concept of human nature depicted in economic models is transported into everyday business life. Every model building, then, has normative implications. This leads on to the questions whether such a concept of human nature is still justified in the light of recent biological theories, and what the specific characteristics of human nature and economic behavior might be beyond biological conditioning.

LUIGI MARENGO

luigi.marengo@sssup.it

Laboratory of Economics and Management, Sant'Anna School of Advanced Studies, Pisa, Italy

Where do Alternatives come from? Towards a Constructive Approach to Collective Choice

Collective choice models usually assume that choice is among exogenously given and non-decomposable alternatives. Often, on the contrary, choice is among objects that are constructed by individuals or institutions as complex bundles made of many interdependent components. In this paper we present a model of object construction in a simple majority voting setting and show that, (1) in general, by appropriate changes of such bundles, different social outcomes may be obtained depending on initial conditions and agenda; (b) intransitive cycles and median voter dominance may be made appear or disappear; (c) decidability may be ensured by increasing manipulability or vice versa.

BERTIN MARTENS

Bertin.MARTENS@ec.europa.eu

DG Trade — European Commission, Brussels, Belgium

The Cognitive Mechanics of Economic and Institutional Evolution

This paper aims to extend the Evolutionary Epistemology hypothesis of evolution as cognition from biology into the realm of human societies, and more specifically to the economic and institutional architecture of human society. It argues that economic systems of production and exchange of knowledge embodied in goods and services enhance the limited cognitive capacities of humans. It explains why transmission of knowledge embodied in goods is cognitively superior to the cultural channels of imitation and symbolic transmission, and explores the conditions under which such 'economic' transmission of knowledge can emerge. These conditions include (a) the emergence of cognitive specialisation among individuals, which decreases their fitness as individuals but increases the fitness of the group, and (b) the emergence of basic institutions, such as property rights and enforcement of these rights, that put constraints on human behavior and thereby reduce the risks inherent to decreased individual fitness. The paper then shows how these institutions coevolve with the degree of cognitive specialization and the level of economic development in society.

KEVIN A. McCABE

kmccabe@gmu.edu

Interdisciplinary Center for Economic Science, George Mason University, Fairfax, VA, USA

Neural Systems for the Efficient Harvesting of Joint Rewards Using Trust Relationships

Recent work in neuroeconomics is starting to uncover the neural systems underlying trust relationships in humans. For purposes of this paper a trust relationship is a repeated interaction (sequence of events) producing mutual rewards, where each elementary event has the following properties: First, it consists of two persons, with the roles of trustor and trustee, where roles may switch across events. Second, decisions are sequential and depend on the strength of the trust relationship, where the choice to trust is risky and the choice to be trustworthy is costly. Given our definition of the event space E , and action space A , we assume the brain implements a strategy $s: E \rightarrow A$. In this paper the goal is to review the literature on trust and trustworthiness in order to formulate hypotheses about how the brain solves the problem of forming trust relationships in order to efficiently harvest rewards requiring joint decisions.

KATHERINE NELSON

knelson@gc.cuny.edu

Graduate Center, City University of New York, USA

Human Nature in Evolutionary Developmental Psychology

The classical computational models of cognitive psychology have been challenged in recent years from several directions that reflect embodied and culturally embedded concerns. I will present the case that understanding cognitive psychology from a developmental and evolutionary perspective reveals a more dynamic multi-causal system of cognitive processes than the classical models account for, similar to the EvoDevo approach in biological theorizing. This 'naturalist' approach unites the biological organism with its essential social and cultural conditions in a biocultural model. Examples from several developing cognitive skills indicate that adult 'errors' in everyday thinking are residues of processes that have been effortfully modified during the early years of cognitive development. Implications for the operation of the 'economic mind' will be drawn out.

RICHARD R. NELSON

rrn2@columbia.edu

School of International and Public Affairs, Columbia University, USA

Human Behavior and Cognition in Evolutionary Economics and Social Science

The tradition of evolutionary theorizing, broadly defined, about technological, economic, and institutional change goes back way before Darwin. The common hallmark of the theories by Mandeville on the 'evolution' of the warship, of Smith on the division of labor and economic organization, and of Hume on political institutions, is the argument that complex and sophisticated human-made structures develop over a long period of time as the result of a series of incremental changes made by agents, who had particular aims in mind at the time, but who never foresaw the structures that would emerge over the long run from this cumulative process. In contemporary social science there are pockets of evolutionary theorizing that make similar assumptions about human behavior and cognition in economics, and particular fields of empirical inquiry that evolutionary economics overlaps, like study of technological change, changes over time in business organization and practice, and institutional structures more broadly. In most of the writings in these literatures, human beings and the organizations they manage are seen as purposeful, and often quite sophisticated regarding how they pursue their ends. But their rationality is, in Herbert Simon's terms, 'bounded'. At any time much of what they do is the result of the habits and routines they have developed. But they also are capable of effective problem solving, and creative innovation. And what they do and what they know is very much influenced by the collective and evolving cultures in which they live.

I note that, while there are similarities, it is obvious that the 'evolutionary' processes in these literatures differs in important ways from biological evolution. In a very real sense the evolutionary processes here can be regarded as cultural learning processes.

In my presentation I will develop these themes. To make them more concrete, I will focus especially on the evolutionary writings on life cycles of technologies and industries.

NIGEL NICHOLSON

nnicholson@london.edu

Department of Organisational Behaviour, London Business School, UK

Leadership

For intelligent animals living in groups the need to coordinate the efforts of members is central to the reproductive fitness of both individuals and the group. There are several ways of achieving this, but one of the most efficient is leadership—where group members accept the authority and direction of one member in order to achieve shared goals. Leadership is visible in all primate species, and many other social mammals. Likewise for humans it seems to be an evolved capability. Across species, the form it takes varies enormously, and in the case of humans it has undergone great changes over human history. A coevolutionary perspective requires us to pay close attention to the environmental context, including, importantly, the characteristics and needs of followers. In contemporary society leadership is of considerable interest to us all, and is much written about, but theorizing is weak and there is no accepted general analytical framework. Towards this end, I shall present a new model to examine the adaptive challenge and the diverse responses that can be observed, in order to explain leader emergence, leader effectiveness, and the causes of leadership failure. The analysis takes us in several directions. One is to reexamine organizational design and other contingencies as predictors of the fitness of leaders. Another is to examine the self-regulatory processes that underlie various adaptive strategies. It also suggests we should look more carefully at the psychology of followers, and what are the payoffs for their acceptance of a leader.

GERALD SILVERBERG

gerald.silverberg@maastrichtuniversity.nl

UNU-MERIT, Maastricht & IIASA, Laxenburg, Austria

Innovation as a Complex Collective Search Process

Innovations are known to arrive more highly clustered than if they were purely random. Their distribution of importance is highly skewed and appears to obey a power law or lognormal distribution. Technological change has been seen by many scholars as following technological trajectories and being subject to 'paradigm' shifts from time to time.

To address these empirical observations, we introduce a complex technology space based on percolation theory. This space is searched randomly in local neighborhoods of the current best-practice frontier. Numerical simulations demonstrate that with increasing radius of search, the probability of becoming deadlocked declines and the mean rate of innovation increases until a plateau is reached. However, for 'richer' technological environments, a 'trough' separates myopic from long-range search due to the effect of R&D duplication. We then extend this model by seeding the lattice with draws from a lognormal distribution for technology 'difficulty'. Firms are rewarded for successful innovations by increases in their R&D budget. We compare two regimes. In the first, firms are fixed in a region of technology space. In the second, they can change their location by myopically comparing progress in their local neighborhoods and probabilistically moving to the region with the highest recent progress. We call this the moving or self-organizational regime (SO). The SO regime always outperforms the fixed one, but its performance is a complex function of the 'rationality' of firm search (in terms of search radius and speed of movement). The clustering of firms in the SO regime grows rapidly and then fluctuates in a complex way around a high value that increases with the search radius. We also investigate the size distributions of the innovations generated in each regime. In the fixed one, the distribution is approximately lognormal and certainly not fat tailed. In the SO regime, the distributions are radically different. They are much more highly right skewed and show scaling over at least two decades with a slope around one, for a wide range of parameter settings. Thus we argue that firm self-organization leads to self-organized criticality.

MARCO VALENTE

valente.marco@gmail.com

Faculty of Economics, University of L'Aquila, Italy

Evolutionary Modeling of Markets for Heterogeneous Goods

Though evolutionary economics' core arguments are rooted in technological innovation, a large part of evolutionary models have been constrained by the assumption of homogeneity of traded goods, focusing mainly on process innovation. Such a simplifying assumption prevents the analysis of the emergence and evolution of markets for new products, which is where the evolutionary perspective can be expected to provide the most relevant contributions. In this paper we discuss two of the most prominent difficulties in developing models for heterogeneous markets: the representation of consumers' choice and innovators' strategies.

Consumers' decisions are essentially a problem of solving tradeoffs in terms of price and different (and frequently contrasting) qualities. Experimental psychology suggests that, coherently with the bounded rational paradigm, people tend to apply simple decisional routines that are robust to informational noise. A generalization of one of these algorithms used to represent consumers' decisions provides a flexible and generalized 'demand function' for heterogeneous products.

Economic models meant to study the effects of complexity on innovation usually borrow from models developed in other fields, such as biology or physics. However, these models are designed to assess general properties of purposeless search agents in complex spaces. We propose a new model for complexity that, though maintaining all the relevant properties of standard models for complexity, is also far more apt to represent the purpose-driven research behavior required in economic models.

The paper concludes with a discussion on the major obstacles for the diffusion of the evolutionary approach as a policy tool. We sustain that more rigorous methodological protocols can and should be applied to develop and assess evolutionary models, and that more efforts should be applied to promote less quantitative, and ultimately more realistic, policy perspectives.

BERNARD WALLISER

walliser@mail.enpc.fr

Centre de Recherche en Analyse Socio-Economique de l'Ecole Nationale des Ponts et Chaussées,
Paris, France

Learning vs. Evolution: The Point of View of Game Theory

In game theory, evolutionary processes share a decision process in four steps (matching, information, reasoning, choice) that has some prior and common limits. The decision process can be specified in terms of four different types according to the players' cognitive capacities: deductive reasoning, belief-based learning, reinforcement learning, and evolutionarily acquired skills. For each type and especially the middle and more realistic ones, the main criticisms are stressed and some propositions are made. In fact, a player can use these types alternatively according to the prior complexity of the decision problem and the results already improved. Some types may even be combined instantaneously in hybrid models, for instance when biological evolution selects learning rules.

ULRICH WITT

witt@econ.mpg.de

Evolutionary Economics Group, Max Planck Institute of Economics, Jena, Germany

Evolutionary Economics and its Individualistic Foundations

Evolutionary economics is a paradigm for explaining the transformation of the economy. In its current form it is basically a theory of economic growth, industrial dynamics, and structural change. It is claimed to be 'evolutionary' mainly because of its application of selection models and the corresponding population thinking to explain economic change by analogy to the theory of natural selection. Although most contributions to evolutionary economics share a common understanding of economic behavior characterized by Simonian bounded rationality, the focus on selection operating on populations tends to belittle the role of individual behavior for understanding economic change. Given this situation, a couple of important questions concerning the future direction of research into evolutionary economics can be raised. Does evolutionary economics need an individualistic foundation, i.e., theoretical recourse to the motives and actions of the economic agents—or is the very idea of an individualistic foundation a genuine offspring of neoclassical economic thought? How would the perspective on economic behavior to be taken in such an individualistic foundation compare to the perspective on human behavior taken by evolutionary psychology? How relevant is the human genetic endowment (the heritage from the evolution of man) for understanding economic change as a form of cultural evolution based on human learning? Why, in such a perspective, is the widely neglected motivational aspect of human behavior more important for understanding long-term tendencies in economic change than the cognitive constraints on, and anomalies of, human decision making—and what follows from this for the research agenda of evolutionary economics? In the talk, an attempt will be made to provide answers to these questions.
