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## WORKING PAPER SERIES

### **Cognitive Economics: Foundations and Historical Evolution**

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# Cognitive Economics: Foundations and Historical Evolution

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## **An approach to human behavior in economics**

The motivation for the 2002 award of the Nobel Prize in Economic Sciences to Daniel Kahneman and Vernon L. Smith sheds light on a hidden on-going revolution that is radically modifying the assumptions of neo-classical economics: the cognitive approach to human behavior.

At the beginning of the ceremony at the Stockholm Concert Hall, Professor Lars-Göran Nilsson delivered a Presentation Speech in which he explicitly recognised the success of the new emerging approach that challenges the traditional foundations of economic analysis:

“Your Majesties, Your Royal Highnesses, Ladies and Gentlemen,

Economic theory relies on the assumption that economic agents may be likened to a "Homo oeconomicus". This fictitious individual is usually governed by self-interest and makes his economic decisions by rationally evaluating the consequences of different alternatives, even in complex situations where the outcome is difficult to predict. Despite such strong assumptions, this approach has proved to be highly rewarding and has enhanced our understanding of many economic phenomena.

Empirical testing of postulates in economic theory confronts theoretical predictions with findings from real-world markets and economies. In general, however, since "field data" are affected by factors which scarcely allow for control and measurement, the identification of causal relationships is problematic. Whereas economists have had to overcome such obstacles by using ingenious statistical methods, many natural scientists have been able to rely on controlled experiments to test their theories.

These common descriptions of theoretical and empirical economic science may well have historical validity. But nowadays, they both have to be modified. With increasing confidence, researchers in psychological economics have been able to demonstrate that in some situations, individuals do not behave like "Homo oeconomicus". Researchers in experimental economics have developed methods for controlled laboratory experiments in economics. A number of scholars have contributed to this development, including previous Laureates: Maurice Allais and Herbert Simon thus brought psychological perspectives into decision theory, while John Nash and Reinhard Selten conducted early experimental studies. But this year's Laureates are the key figures in these two fields.

[.....]

Professor Kahneman: Insights from cognitive psychology have been instrumental in establishing new theoretical and empirical results; in ongoing research, they guide thought-provoking attempts to reformulate many aspects of economic and financial theory. The new bridges across disciplines can largely be

attributed to your innovative research on the boundary between economics and psychology. Professor Smith: Economics used to be regarded as a non-experimental science. This is no longer so; nowadays, economic experiments are routinely conducted in specialised labs all over the world. Scale or ethics may limit economic experimentation, but the methods you have developed continue to enrich our empirical toolbox. Both of you have laid the foundations for an exciting renewal of economic research. It is a great honour for me to express, on behalf of the Royal Academy of Sciences, our warmest congratulations. I now ask you to stop forward and receive your Prizes from His Majesty, the King. ”

The revision of the traditional theory of rationality has therefore reached a critical juncture where its inspiring principles and its status as the micro-foundations of economic analysis are being seriously called into question. Experimental results were already questioning the validity of the standard model of rational action in the 1950s: notably Allais's paradox of 1952 and the empirical study of decision processes in firms conducted by Cyert, Simon and Trow in 1956. On the one hand, Simon's approach based on bounded rationality and problem solving was criticising, on the basis of field experiments, the scarce realism of the economic theory based on the neo-classical assumption of full rationality. On the other, the pioneering works by Allais on expected utility theory violations, and the subsequent discoveries by Kahneman and Tversky, that introduced new powerful methods of empirical research based on cognitive psychology, proved the systematic discrepancy between the predictions of the traditional theory of decision-making and real behavior.

Cognitive psychology then became a fundamental area of inquiry to understand human activities in the economic arena, a discipline which is bearing a new theory of human behavior in economics. We wonder whether Economics is moving towards new foundations, that are strongly rooted into a cognitive approach to human action.

In the attempt to first answer this question, this introduction will discuss the main features of the cognitive representation of human behavior in economics, exploring the most relevant implications to the study of economic institutions and their evolution, and searching for the historical roots of this approach. Now some general remarks before attempting a historical reconstruction of the cognitive roots of Economics.

The cognitive approach to Economics proposes an interdisciplinary approach to the study of human problem-solving, choice, decision-making and change, to explain the nature and evolution of organizations and economic institutions, in a context characterised by structural uncertainty.

Just like psychology, neurobiology and philosophy, cognitive economics has its micro-foundations in the understanding of human mental activities and it elaborates its models in relation to these disciplines and their advancements. As a consequence, the progress in the understanding of the activities of the mind that are relevant to explain economic actions will be crucial to allow the development of new micro-foundations. Obviously, interactions with disciplines studying the mind may also produce negative effects insofar unsolved or much-discussed questions within these disciplines can be imported into cognitive economics, which hinder autonomous progress in this area.

What is meant by “model of mind”? Cognitive sciences offered, in fact, different and sometimes contrasting positions about how the human mind works. Although some of these different approaches - which only five years ago seemed irreconcilable -, present today a good degree of convergence, a multifarious panorama of different models of the mind is still present. Despite economists are not explicitly called on to autonomously elaborate a model to explain the mind - though the history of economic thought offered some relevant examples to that end, i.e. Marshall, Hayek and Simon -, it is certainly right and proper to say that economists give particular attention to the different theories and that they use the results reached by cognitive science to build their models. However, even though there are evident interferences among the disciplines related to cognition, a common core of shared basic principles is clearly emerging. Some of these principles

will be discussed in the rest of this introduction together with the analysis of recent developments in the interface between psychology and economics and their historical roots. In general, those who now accept a cognitive approach to economics share

“the idea that the choices people make are determined not only by some consistent overall goal and the properties of the external world, but also by the knowledge that decision-makers do and don't have of the world, their ability or inability to evoke that knowledge when it is relevant, to work out the consequences of their actions, to conjure up possible courses of action, to cope with uncertainty (including uncertainty deriving from the possible responses of other actors), and to adjudicate among their many competing wants” (Simon 2000, p. 25).

Knowledge and personal knowledge are therefore the cornerstones of decision-making: this implies the individual ability to perceive external stimuli and to modify them through interpretation, representation and imagination. Learning can be considered as the engine that allows us to build up a representation of the situation and to carry out the steps that precede actions. We are aware that all categories, such as learning, framing, perception etc., need to be further explored to achieve a better representation of human behaviors in economics; however, the level they have been developed to so far is in our view sufficient to re-formulate many of the principles of human action in economics. The rest of this introduction will be devoted to a brief historical reconstruction of the cognitive approach to economics, while stressing the role of economists who directly and indirectly influenced the birth of cognitive sciences<sup>1</sup>.

### **Historical roots: from Marshall to Hayek**

The central historical event that promoted Cognitivism as a new impulse for social sciences was the interdisciplinary Cognitive Revolution in 1952-3, with the introduction of the concept of feed-back into the analysis, the rise of cybernetics and, more generally, the emergence of what has been called the Mind's New Science (Gardner 1985).

It would not be surprising to expect that such an approach, which considers the relevance of mental processes for economics, started after the cognitive revolution. This is not the case. First of all at least one economist, Herbert Simon, was one of the direct supporters of such revolution. Secondly, in the history of economic thought preceding the cognitive revolution there are some authors who put mind's workings at the basis of some aspects of the economics analysis.

Before providing his relevant contribution to economics, Alfred Marshall attended to philosophy and neurobiology (Marshall 1867-8; Raffaelli 1994 and 2002). In some articles of the '70s he described a very detailed model of the mind and its functioning. Marshall utilises this model on the workings of mind to describe the nature and role of organizations, the processes of emergence of routines, and the mechanism of innovation and creativity in hierarchical structures. And not only this. In some relevant sections of his *Principles* (1890), he holds the idea that mental models matter in explaining economic processes: for example, he stresses the role of personal learning in the problem-solving process. His ideas in this field were obviously based on the neuro-biological knowledge of his time. In spite of this, he largely anticipated the analytical approach proposed by March and Simon and by Khaneman and Tversky almost a century later. Marshall can therefore be considered as the father of the cognitive approach to organizations.

We should not forget that Marshall also gave some relevant contributions to the concept of evolution – quite different from the Schumpeterian tradition - that characterises the contemporary approach to self-organization analysis and which could develop into a particular branch of cognitive

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<sup>1</sup> For a wide historical reconstruction, see Rizzello 1999. For one the first explicit applications of the cognitive approach to economics see Viale 1997.

economics. In fact, Cognitive economics applies a concept of evolution that seems in some respect different from that proposed in the Schumpeterian tradition, that includes Alchian, Nelson and Winter. This concept of evolution can be defined as the Marshallian approach to explaining economic change, which lays special emphasis on the relevance of endogenous changes and the self-organizations analysis (Foster 1993 and 1997, Hodgson 1997; Foss 1997; Witt 1997; Rizzello 2003).

Yet Marshall' position is not isolated. For example, when considering the old Institutionalism we could find some interesting contributions by Veblen, which is linked to a modern cognitive approach. The author devised a notion of mind to explain the processes of institutional transformation, which had been ignored for many decades. Yet today, while scholars are becoming aware of the relevance of psychological aspects in economics, Veblen's theory on institutional evolution and transformation is having a revival. What emerges from this literature seems very interesting. According to Veblen, the mind is an active tool, able to "effect events in the course of nature" and "exert a causality on things" (Veblen 1994: 176). As Viano pointed out (2003), this idea on the mind is very close to Kant's. Furthermore, Veblen elaborated a modern conception of "routine", as knowledge incorporated in mechanical implements, developed many years after in the evolutionary literature<sup>2</sup>. Another tradition contributing to the birth of a cognitive approach is that inaugurated by Carl Menger. The Austrian school of economics includes one the most important economists who produced seminal works to renovate economics based on a cognitive approach: Friedrich von Hayek. Hayek developed many insights of his mentor Carl Menger, namely the methodological subjectivism and the relevance of the nature and role of institutions for economics. According to Menger (1963), scarcity is a subjective condition, which depends on the personal individual characteristics and on the capacity of the subject to perceive and represent external data. Action happens in a context characterised by uncertainty and, as indicated by Hayek in particular, the criterion of choice in conditions of perfect information is unacceptable. Hayek stressed the point that the most relevant problem for economics is to explain how individuals acquire information, and produce and use knowledge. Hayek differentiates between information and knowledge. The former has an objective dimension. It is contained in languages, symbols, signals etc. In order to make decisions people acquire information. This is a costly process, constrained by the limits of the human mind in the acquisition and processing of information. However, individuals act by using knowledge and not information. Personal knowledge, in fact, is the fruit of the subjective elaboration of external information, through a series of mental and neuro-biological processes, which start from perception and representation and end up in actions. Hayek provides a detailed description of all these processes in his book entitled *The Sensory Order*, which is still a milestone for the cognitive approach (Hayek 1952 and 1963).

Hayek claims that the mind is a framework that orders perception through acts of interpretation, which produces and elaborates symbols. The human neuronal structure classifies external sensorial data by means of a process of associating classes of stimuli into classes of responses. The significance that we give to each perception depends upon the genetic characteristics of the individual the previous activities of classification of external stimuli (experience). The mind does not receive sensations in a passive way. On the contrary, it is an active tool that interacts with the external environment. Furthermore, the mind continuously builds the image of itself and the world and rebuilds them tacitly and without awareness (Hayek 1952).

This image of itself and the world is the framework that allows us to attribute significance to external information by means of personal and idiosyncratic interpretations. More importantly, this allows us to construct knowledge. Through a learning process that takes place over the years,

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<sup>2</sup> On the role and relevance of cognitive aspects in Veblen's concept of evolution scholars are not in full agreement. See the special issue of the *Cambridge Journal of Economics* (Vol. 22, No. 4) edited by G. Hodgson, published in July 1998 and, for some different opinions, see Viano 2003.

genetic traits and personal experiences, in turn, continuously redesign the neuronal circuitries that represent the image of ourselves and the external world, depending on both personal activities and the action of innate bio-regulatory circuitries. This mechanism explains how the brain ensures the polarity between environmental adaptation and the protection of its internal integrity.

The evolution of the mind – i.e. the evolution of our ability to build and process images and symbols in order to generate knowledge – happens through the balancing of ontogenesis and phylogenesis. Starting from its native structures, the brain evolves by building new nervous circuitries. They result from the feedback with the relatively inelastic (but not completely rigid) nature of our *a priori* mental schemes that interpret external information in a path-dependent way (Hayek 1952).

This way the Austrian tradition - and Hayek in particular -, links the micro-foundations of economics directly to the psycho-neuro-biological nature of the choice and, more generally, of human decision-making. Nevertheless, this aspect is not the ultimate Austrian contribution to the cognitive approach. From Menger onwards, the Viennese school proposes that the entire analysis of the economic processes is carried out in an institutional context. According to this tradition, institutions are not simple exogenous frameworks; on the contrary, their nature and role are strictly connected to the limits of the human mind. As suggested by Hayek, institutions arise spontaneously as “results of human action but not of human design” (Hayek 1967). Some rules and institutions tend to self-consolidate because they have a crucial role in social co-ordination, that is they simplify and standardise the framework where people must utilise their limited mental faculties to operate in the complex systems. Hayek, in particular, stresses the existing link between mind and institutions (Hayek 1942).

This tradition - linking mind and institutions - continues today in that part of the recent New Institutional Economics literature that explains the evolution of institutions by means of the spreading of shared mental models and rule-based behavior (Langlois 1985, 1986 and 1998; Rizzello – Turvani 2000 and Budzinski 2001). It also tends to use the good analytical tools offered by the social cognitive learning theory – elaborated by Bandura (1977)– in better understanding the cognitive behavioral foundations of cultural evolution (Rizzello – Turvani 2002). As stressed by Loasby (2000), the human ability to share rules and institutions rests on the architecture of the brain which permits differentiation, “but which also makes possible what Adam Smith [in his *Theory of Moral Sentiment*] called sympathy, the capacity of imagining oneself in the situation of another” (p. 8) <sup>3</sup>.

In the Austrian tradition there are at least two more courses of contemporary economic analysis. One concerns the role of cognitive frames in organizations as a co-ordination process, ranging from entrepreneurial imagination and representation to the homogenisation of differentiated individual motivation and dispersed knowledge. We may also refer to a long-lasting tradition, which includes Hayek, Kirzner, Metcalfe and Witt, whose contributions could, in some respects, urge to reconsider the relevant psychological elements of the Schumpeterian theory of the entrepreneur.

In a similar vein, it might be interesting to explore - along the lines of Lachmann (1943) and in the light of a new cognitive perspective linked to the Austrian approach - the role of expectations in economic life as suggested by Keynes, and to compare it with the tradition inaugurated by Muth and further developed by Lucas and Sargent<sup>4</sup>.

As indicated earlier, some relevant aspects in Marshall’s philosophical and economic works were proposed again many decades later by Herbert Simon. Simon shares with Marshall both the idea

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<sup>3</sup> More generally, Loasby (1999) makes clear the relevance of Marshall’s thought for the cognitive approach to economics.

<sup>4</sup> As Walliser (1989) points out, rational expectations tradition concerns “homo cogitans” and cognitive rationality, which is considered different from instrumental rationality, that aims to explain the actions of “homo economicus”.

that the nature of organizations is linked to the workings of human mind and the opinion that human knowledge tends to be codified in routines.<sup>5</sup>

The cognitive approach to economics in Hayek's and the Austrian tradition provides good tools for a dynamic institutional analysis while Simon's cognitive approach to economics sheds new light on the nature, role and evolution of organizations.

The seeds of a new impulse to the cognitive approach to economics and organizations, after Marshall and Hayek, can be found in two celebrated books: *Organizations*, published by March and Simon in 1958, and *A Behavioral Theory of the Firm*, published by Cyert and March in 1963.

These books were conceived in the 1950's, when March and Simon were at Carnegie, and participating in the development of a new Graduate School of Industrial Administration. At the Graduate School, along with Richard Cyert and Herbert Simon, March developed a new approach to the understanding of human behavior in organizations and institutions; their work opened the black box of organizations, proposing a new vision and allowing a deeper understanding of the organizational life. New ideas, now considered "classic", such as bounded rationality, problem solving, ambiguity, organizational learning, and standard operating procedures, were generated and explored.

To better understand the impact of these two books on the traditional approach, we should remember that the economic theory at that time was really poor and limited in its capacity to explain human behaviors *within organizations*.

The theories inherited from the past that attempted to explain the nature of organizations were on the ground: on the one hand, there was Taylor's so-called "scientific" management approach; on the other, the theory of planning, based on Walras' general equilibrium theory and Barone theorems on welfare economics. Finally, the theory of bureaucracy originated by Max Weber, and later developed by Merton and others.

In the first approach, organizations were depicted as mechanical processes, in line with the historical effort to rationalise and mechanise large parts of the economic production at the beginning of the century. Charlie Chaplin's "Modern Times" (1936) give us the vivid imagine of this vision of the modern organizations. This way of depicting organizations was to some extent coherent with the second view, namely the neo-classical theory of the firm: a technological approach in which firms actions and sizes were explained on the basis of optimal decisions made on the ground of known and given technologies.

However, despite these limits, neo-classical economics gave a strongly influential contribution to the organizational analysis, with the debate on the efficiency of planned systems: the relation between centralisation and decentralisation of economic activities and the limits of the "invisible hand", were the key issues of this question.

### **From Planning to Organizational Learning: Simon and March revolution**

The debate began in the early years of this century, when the dilemma concerning the feasibility of a collectivist planned economy was raised by the appearance - on the European political scene - of

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<sup>5</sup> With reference to the literature of those years on cognitive economic field, another economist should be mentioned, who left us with a relevant contribution on the role of the imagination in human decision-making. The representation of the decision-making process, based on images production, exploration and exploitation, was recently applied to economics by Beach and Mitchell (1987), through the formulation of the "image theory". In a glance to the past and in the history of economic thought, we discover that imagination was considered relevant to explain decisions by March, Shackle, Simon (Augier-Kreiner 2000) but it was neglected in the traditional decision-making. Along the lines of this course of research, recent literature (Patalano- Rizzello 2002 and Patalano 2003) indicates that the contribution of Boulding is very relevant to explain the role of imagination in the decision-making process (on the relevance of the process of shared imagination, see also Witt 1998 and Denzau-North 1994, on the organization and institutional dimensions, respectively).

parties inspired by socialism as an ideology and a political Utopia. The problem was to answer the question whether a socialist (collectivist) economic system based on public ownership of the means of production and on planning could work.

The controversy took partly the form of a clash between the two rival economic schools of neo-classical theory and Marxian theory, but this contrast seemed to lose much part of its relevance when Barone showed that a planned economy can be treated with the analytical tools of general economic equilibrium theory; it was therefore formally possible to prove the workability of a planned economy: that is, the viability of the 'pure logic of socialism' and particularly the existence of equilibrium in planned economies.

Barone employed the Walrasian model to provide formal demonstration of the fact that equilibrium can exist in a planned economic system.

He implicitly assumes that the distributed computation of equilibrium performed in the markets by the 'invisible hand' can be replaced by calculations performed directly and intentionally by an alternative institution within planned organizations, i.e. what might be called the 'Central Planning Office'.

This brought about the question whether a (presumably cumbersome) bureaucracy could replace market mechanisms and perform the calculations required to establish the levels of supply and demand for all goods and services, through production planning.

This issue provoked heated debate in the neo-classical school. The Austrian branch of the marginalist school - Menger, in particular -, argued that planning was theoretically impossible, and claimed that the Planning Office could never possess all the knowledge and information required to artificially calculate what the market could calculate 'naturally' via price movements. As a member of the opposite school, O. Lange (1937) responded to the impossibility argument with a model of socialist planning based on decentralised decision-making, which seemed to settle the question in favour of the socialist position (Keizer 1994). Some years later, in *Capitalism Socialism and Democracy*, Schumpeter argued that not only was an artificial calculation entirely feasible, but that the introduction of an extensive bureaucracy would render the system more straightforward than was the case in a market economy.

Hayek wrote a critical rejoinder to Schumpeter's position (Hayek, 1980: 90) where he noted that Pareto himself, while suggesting that the problem of calculation was essentially the same in socialist and market economies, had sustained the practical impossibility of socialist calculation, due to the astronomically high number of equations that were to be computed.

It is clear that all the key elements in the debate on socialist planning can be fully transferred to the question of feasibility and efficiency of planning in large business organizations. Here again the question of decentralisation is relevant to understand the working of business organizations.

In *Organizations*, and after a detailed discussion of the comparative advantages of decentralisation over centralisation, March and Simon note that even Hayek was right in asserting that "*given realistic limits on human planning capacity* the decentralised system will work better than the centralised", thus the existence of external economies could reverse the relative advantage of decentralisation. They therefore suggest that, *if we limit our analysis to a definition of planning that is essentially static*, the question of the degree of decentralisation in organizations cannot be settled once and for all from a priori considerations. They claim that only in dynamic conditions (and today we would prefer to say in evolutionary conditions) the question of decentralisation may be clearly set.

The key to moving away from the concept of programming as computation based on static conditions was provided when it was acknowledged that most managerial decisions take place in conditions of highly unstructured form and very incomplete information.

In 1956 Coyest, Simon and Row carried out an empirical analysis of managerial decisions which revealed an evident 'dualism' of behavior: on the one hand, a behavior guided by a coherent choice



among alternatives, typical of structured and repetitive conditions; on the other, behavior characterised by highly uncertain and ill-defined conditions, where the predominant role was played by problem-solving activities.<sup>6</sup>

The core of the decision-making process is therefore the activity of searching and learning that provides participants with the information and knowledge they require to achieve their goals. The conditions for the standard choice theory to be applied are entirely lacking, because the preference orderings are highly incomplete, decisions are simultaneously inconsistent and choices are largely ineffective in relation to the goals to be pursued. The most important part of the process is driven by the ability of the subjects to formulate and solve problems.

Bounded rationality, unprogrammed decisions and learning are the key aspects of human behavior in organizations under ill-defined conditions.

This new vision leads March and Simon to completely redefine the description and analysis of “planning”: planning is no longer a static and mechanic activity based on rational decisions immersed in a world of complete information. Planning is now based on “organizational learning”. *Search* therefore becomes a key activity in organization, as well as being a resource that can be differently improved within different organization, giving rise to *differentiation in organizational performances*. Adaptation is the crucial element that may generate differentiation and sub-optimality.

From *A Behavioral Theory of the Firm*:

“If we assume that search is problem-oriented, we must also assume that search rules change. Most simply, what we require in the models are considerations of the following type: when an organization discovers a solution to a problem by searching in a particular way, it will be more likely to search in that way in future problems of the same type; when an organization fails to find a solution by searching in a particular way, it will be less likely to search in that way in future problems of the same type. *Thus, the order in which various alternative solutions to a problem are considered will change as the organization experiences success or failure with alternatives.*

In a similar fashion, the code (or language) for communicating information about alternatives and their consequences adapt to experience. Any decision-making system develops codes for communicating information about the environment. Such a code partitions all possible states of the world into a relatively small number of classes of states. Learning consists in changes in the partitioning. In general, we assume the gradual development of an efficient code in terms of the decision-making rules currently in use. Thus, if a decision rule is designed to choose between two alternatives, the information code will tend to confine all possible states of the world into two classes. If the decision rules change, we assume a change in the information code, but only after a time lag reflecting the rate of learning. The short-run consequences of incompatibilities between the coding rules and the decision rules form some of the most interesting long-run dynamic features of an organizational decision-making model.” [Cyert and March, 1992, p. 174]

Organizations therefore evolve through problem solving, and problem solving activities lead to modifications in the internal division of work. The idea that the search process involves a change of the information code has been further expanded by the recent results from experimental economics showing that the creation of *mental categories* to represent a problem is the basic driver for the generation of a division of problems and therefore the source of the correlated errors and biases in decision-making (Egidi, 2002).

Hence, a relevant conceptual improvement is that not only do organizations learn, but they make errors during this process, and – as March’s behavioral description shows – since adaptation may

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<sup>6</sup> In this last set of conditions, not only must subjects gather information, they must also be able to select the information and knowledge that is effectively relevant to their purposes and to assimilate it into the system of knowledge that they already possess. To do so, they must have a 'level of competence' adequate to the situation of their choice; they must, that is, implement skills of learning and problem solving.

easily lead to sub-optimal organizational configurations, errors may be systematic and stable in the long run.

In recent years, a large number of results deriving from experimental economics have demonstrated that human decisions display systematic deviations from fully rational ones, and that in many cases ‘errors’ persist even when the rational solution has been explicitly presented to the subjects. This happens both in individual and team decision-making. In the case of teams and organizations, it may happen that systematically erroneous decisions are made by organizations, and that they remain trapped in sub-optimal routinized strategies, which are not changed even when they are highly sub-optimal. Levinthal and March (1993) single out a number of ‘traps’ into which an organization may fall during the process of organizational learning; consider for example the ‘success trap’: here, the tendency of organizations to focus on success may induce them to persist excessively in the use of procedures and actions that have been associated with successes in the past. Consequently, an organization that falls into this trap tends to anchor its activity in processes of organizational exploitation, to the detriment of research and innovation. Moreover, this tendency may prevent organizations to adapt to changed environmental conditions.

Hence, the vision of the modern business firm moves more closely towards a realistic approach based on experience, and to the building of a new robust conceptual frame to understand and explain it.

Far from being the perfect machines depicted by tradition, that optimally decide their strategies using all relevant information, business organizations adapt to evolving reality, trying to build up their strategies under conditions of highly unstructured decisional frames. Despite their uninterrupted process of learning, they can be sometimes locked in persistent sub-optimal conditions.

The traditional notion of “planning” as static computation is therefore overcome by this new theoretical approach, that explicitly takes into account the failures of human rationality. But there remains an important question raised by Hayek in the original debate to be taken in consideration: the role of the incentives in fostering the efficiency of institutions.

### **Incentives, motivations, conflict: the business organizations as social creation.**

Hayek’s dispute against the possibility that a planned system could work as a market economy was not based solely on the complexity of economic calculation; he contended that, since a planned system lacked competition, the incentives that would ensure its efficient functioning were absent.

"To assume that it is possible to create conditions of full competition without making those who are responsible for the decisions pay for their mistakes seems to be pure illusion" (Hayek 1980: 186)

Therefore Hayek viewed the role of competition very differently from Walras, and considered that failing to allocate responsibilities was a crucial reason for the inefficiency of planning, beyond the question of calculation complexity.

In his dispute, Hayek was suggesting that the limits of the planning process were rooted in the impossibility to *allocate responsibilities and incentives*; an issue that has received serious attention in the contemporary economic theories, and mainly during the 1980’s, when Arrow, by proposing the principal-agent theory, explicitly accepted the idea of information asymmetries and focused on the reduction of conflicts among agents. His view is based on the assumption that, given the asymmetries in knowledge and information between individuals within business organizations, the “principal” is prevented from observing directly the abilities and performances of the “agent”.

Therefore he suggested to design a system of incentives to reduce the discrepancies between the principal's and the agent's goals. This approach, developed more than thirty years after *Organizations* and *A Behavioral Theory of the Firm*, while responding in a very ingenious way to an important question raised in these books, namely the *management of conflict*, limits the nature of the problem and does not respond fully to the question of the reasons of the feasibility and efficiency of planned organizations in market economies.

Cyert, March and Simon frame this question in a richer and more open way: whilst in the classical economic approach individuals are supposed to pursue their own interest in an egotistic, and sometimes opportunistic way, March's view presupposes a more varied and richer depiction of human beings: humans in organizations have motivations, they are capable of participating in the organizational life and goals, not uniquely as consequence of an efficient design of incentives, but also for reasons related to the share of organizational values, which sometimes involve altruism. This leads to the idea of organizations as *social creations and as institutions*. (See on this line March and Olsen *Rediscovering Institutions*, 1989).

### **From organization as a mechanical process to integrated institutions**

March and Simon's picture of organizations works at two different levels: on the first level, mainly analysed in "A Behavioral Theory of the Firm", organizations are characterised by bounded rationality, adaptation, unresolved conflicts, and sometimes permanent sub-optimality. Here, decisions may be affected by high uncertainty and ill-defined conditions but rights and responsibilities are supposed to be clearly allocated and incentives reasonably well defined.

What happens then, when rights, rules and responsibilities are also not distributed in a clear pattern? Explorations in this direction characterise some of March's publications in the 1970's and 80's. Among the many, a clear description of organizational disorder can be found in "A garbage can Model of Organizational Choice", written in 1972 jointly with Michael Cohen and Johan Olsen. The model represents the "second level" of March's analysis, in which rights and preferences are also poorly defined. According to his view, instead of considering organizations as mechanical processes, in which decisions take place optimally, we wonder how comes that organizations define and achieve their goals when facing conditions of high uncertainty and unclear allocations of rights, rewards and responsibilities.

The question we have been discussing at the beginning of this section is therefore completely reversed: instead of considering organizations as mechanical processes, where decisions take place optimally, we wonder how comes that organizations define and achieve their goals when facing conditions of high uncertainty and unclear allocations of rights, rewards and responsibilities.

This is, in our view, a core problem in the background of many publications by March since the 1970's. Here the author assumes a new and more radical vision of organizational phenomena. Going beyond the view of large business organizations as coalitions of interests incapable of resolving completely the internal conflicts, when introducing the distinction between aggregative and integrative institutions, March discloses the fragility of economic and political institutions, and the transience of human actions based merely on egotistic interests.

### **Routines**

The counterpart to the analysis of search and creativity within organizations is the development of studies to explain routinized behaviors. As noted earlier, Cyert, Simon and Trow (1956) carried out an empirical analysis on managerial decisions which revealed an evident 'dualism' of behavior:

'Decisions in organizations vary widely with respect to the extent to which the decision-making process is programmed. At one extreme we have repetitive, well-defined problems (e.g., quality control or production lot-size problems) involving tangible considerations, to which the economic models that call for finding the best among a set of pre-established alternatives can be applied rather literally. In contrast

to these highly programmed and usually rather detailed decisions, there are problems of non-repetitive sort, often involving basic long-range questions about the whole strategy of the firm or some part of it, arising initially in a highly unstructured form and requiring a great deal of the kinds of search processes listed above.' (Cyert, Simon and Trow, 1956, p.238)

In *Organizations*, March and Simon deepen this observation, and provide a definition of “routinized behaviors”

"We will regard a set of activities as routinized, [then,] to the degree that choice has been simplified by the development of a fixed response to defined stimuli. If search has been eliminated, but a choice remains in the form of clearly defined and systematic *computing routine*, we will say that the activities are routinized" (March and Simon 1993, page 142).

A part of this definition should be highlighted: routinized behaviors take place when "search has been eliminated", i.e. when the individual learning process stops. This clarifies that March and Simon provide a “macro” definition of routines as *repetitive organizational procedures* and at the same time a “micro” definition of routinized activities as *individual activities automatically triggered on the basis of stable mental models*. Psychology literature suggests that automaticity in behaviors reduces the mental load required to decide during the action, and therefore helps us to understand routinized behaviors as the outcome of the human activity of coping with complexity in large organizations.

The notion of routine has been re-visited thirty years after *Organization* by Nelson and Winter (1982). They consider routines as the basic elements of the organization’s life, and innovation as the engine of routine creation, in an evolutionary approach to organizational life. In *Evolutionary Theory of Economic Change* the authors make an interesting effort to more accurately explore how routinized behaviors reduce the need for 'rational computation', on the basis of the methodological principles enunciated by M. Polanyi in *Personal Knowledge*. They note that some behavioral sequences consist of actions that are often partially inarticulate, i.e. they are not expressed linguistically, and need not to be transmitted in the form of messages. This feature leads Nelson and Winter to the problem of how *tacit knowledge* is formed and transferred.

On the other hand, more along a “micro” view, Cohen and Bacdayan (1991) suggest that routines are stored as *procedural* memory; following Squire's (1987) distinction between procedural and declarative memory they claim that procedural memory appears to be the form that stores the components of individual skilled actions - for both motor and cognitive skills. They use a laboratory experiment to analyse the emergence of procedural behavior by two subjects involved in a game that requires co-ordination and co-operation, and its 'sedimentation' in memory. The general point at issue here is how the acquisition and memorisation of cognitive skills takes place, and how its transfer is possible, i.e. how skills can be re-used.

These findings suggest that the automaticity with which players repeat the same sequences of actions can be explained in terms of automaticity in their mental processes. Studies on the mechanization of thinking - the so-called "*Einstellung effect*" - have a long tradition in psychology (Luchins 1942, 1950). The literature has suggested that routinized behaviors are based on "routinized thinking", i.e. on the automatic use of "chunks" which enable individuals to save on mental effort (Weisberg 1980, Newell and Simon 1972, Laird Newell and Rosebloom 1987, Newell 1990).

Along the lines of this tradition, we suggest that behind routinized behaviors there lie particular features in terms of mental models (Johnson Laird 1983): subjects who behave in a repetitive (routinized) way follow set of rules sedimented in the long term memory which enable them to make their actions with less mental efforts. In a word, routinized behaviors have to be considered as

the outcome of routinized thinking. Under this assumption, "automaticity" is considered important not only at behavioral level but also and mainly at the level of mental models.<sup>7</sup> Interestingly, this property of mental activity - i.e. the need to save on mental efforts, to lighten the load on the short term memory by creating mental building blocks and to store new elements of knowledge in long term memory - is not only widely analysed in the context of experimental psychology, it was also emphasised by Hayek in his *The Sensory Order* (1952).

### **Bounded Rationality, Problem-solving**

Routinization and division of labour within organizations are the empirical cornerstones for the development of the theory of bounded rationality: Simon built this theory upon close observations of the behavior of employees and managers in large organizations. During the 1950s and early 1960s, he took part in numerous collaborations and research projects at the Graduate School of Industrial Administration of Carnegie Mellon, including a study on decision-making under uncertainty conducted jointly with Charles Holt, Franco Modigliani and John F. Muth. Curiously, the conflicting notion of rational expectations (Muth) and that of bounded rationality (Simon) originated in the same context. The milestone in the founding of organizational studies on bounded rationality, i.e. *Organizations*, written with James G. March and published in 1958, is also rooted in the researches and debates at Carnegie.

*Organizations* moved forward from the notion of problem solving as an individual activity to the notion of organizational problem solving, clearly recognising the evolutionary processes of organizational adaptation and organizational learning within business corporations. The identification of these processes proceeded in parallel with the discovery that the division of labour can be considered a problem solving activity, and that the recursive division of problems into sub-problems is a feature of both organizations and computer programs.

Thus the development of a finer theory of problem solving became crucial to explain the organizational routines and procedures within business firms, and their evolution. Developments in one of the sciences of the artificial - the theory of computation - became key to development in the other - the theory of organizational learning. Most probably it was for this reason that Simon's interests moved to computation theories as natural candidates to explain human problem solving and discovery processes.

About the time he was finishing his work on *Organizations*, Simon began his collaboration with Allen Newell, a celebrated founding father of the Artificial Intelligence. This collaboration gave rise to the creation of new mathematical tools to model human problem solving and discovery processes. *Human Problem Solving*, published in 1972 with Allen Newell, is a bridge between computation, artificial intelligence and cognitive psychology. This is a fundamental step toward Cognitivism: Simon went beyond the notion of "computation" as a human activity that relates means to ends, replacing it with the notion of symbolic manipulation.

Simon's first studies on the limits of rationality, in fact, focused on the restricted ability of individuals to construct and explore their strategies for action: celebrated examples of this are the insurmountable obstacles encountered by the players of chess and other complex games when devising winning strategies. While Simon's observations and field researches proceeded, he realised that beyond the limits to the human ability to "compute" a strategy in depth laid further limitations, and that these involved most of the cognitive activities connected with decision-making.

Therefore, when limits to the human capacity for mental calculation were experimentally demonstrated, it became clear to him that this ability was an aspect - an important but not unique one - of the mind's more general capacity to manipulate symbols and to create mental models of reality.

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<sup>7</sup> For a comprehensive debate on this issue, see Cohen et alii (1996)

The awareness that human decision-making can be understood only if mental activities are viewed as symbolic manipulation urged the author on the need to build up a bridge to psychology. Simon's research shifted to a different version of the problem, subjecting the various mental abilities essential to explain human actions - memorisation, categorisation, judgement, problem solving, induction - to increasingly intense experimental scrutiny. In parallel with this experimental work, Simon developed computational models of intelligence designed to explain the process of discovery. Bacon and Dalton's programs (Langley, Simon, Bradshaw and Zytkow, 1987), for example, simulate the process of scientific discovery.

The shift toward cognitive psychology required a break with tradition: Weber's analysis of rationality and bureaucracy, filtered into the economic models of rational decision-making, had a favourable reception for over a century, and was therefore deeply rooted in the economists' tradition. While this approach proved incapable of giving full account of managers' behaviors, that is of the ability to solve problems and innovate in uncertain and evolving environments, an alternative approach was missing, and consequently the economists were describing managers' activities with inappropriate tools.

As a matter of fact, the standard theory of decision-making makes reference to a context of decisions as an exogenous element: individuals are considered as experts that possess all cognitive skills needed to select the relevant information and evaluate all possible consequences of their decisions. The group of Carnegie provides a first alternative picture of managerial activities and a new set of analytical tools to describe it. From their analysis it emerged that the decision is only the final step of a complex process in which individuals frame the conditions to make a choice and learn to represent and approach the emerging problems.

Simon's intuition that decision-making is deeply rooted in learning activity has been largely borne out by psychological research, and it gives us important directions for future inquiries. Since the mid-1970s until their most recent study *Choices, Values and Frames*, Tversky and Kahneman have investigated the psychological principles that govern the creation, perception and evaluation of alternatives in decision-making processes. They find that preferences vary substantially according to the way the choice problem is presented ('framed'). They show that preferences are constructed by individuals in the process itself of their elicitation; a clear demonstration of this process is provided by the well-known experiments in which different representations of the same choice generate a *reversal of preferences*.

This suggests that the crucial aspect of the decision-making process is *the ability to construct new representations of problems*. This point was already present *in nuce* in Simon's empirical analysis of managerial decisions conducted in the 1950s. The research we mentioned earlier, where Cyert, Simon and Trow pointed out an evident dualism in managerial behavior, was beginning to discriminate among two different aspects of decision-making processes: on the one hand the coherent choice among alternatives, on the other the search for the knowledge necessary to define the context where choices are made. The evolution of the analytical tools and the experimental outcomes shifted the focus from the *coherence/incoherence* of choices to the *representation and editing* of problems. How mental models used by individuals and institutions to frame problems are constructed became a crucial issue to be addressed by the decision theory, an issue that will yield a better understanding of human innovative activities within institutions.

## **Concluding Remarks**

Besides re-establishing close connections among economics, psychology and the cognitive sciences, a clear line of thought from Simon to Kahneman and Tversky suggests that the actions of decision-makers in the real economic world should be studied, not merely in terms of rationality but also in the light of the capacity of the human mind to frame problems and represent reality in innovative ways, in an endeavour to reduce uncertainty and ignorance. The cognitive approach to economics is

the new discipline now investigating the classic yet still unresolved question of human creative decisions and learning, and their relationship with the nature and evolution of institutions.

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