



Munich Personal RePEc Archive

Institutional Cognitive Economics: some recent developments

Anna Azzurra Gigante

15. July 2013

Online at <http://mpra.ub.uni-muenchen.de/48278/>

MPRA Paper No. 48278, posted 15. July 2013 15:47 UTC

Institutional Cognitive Economics: some recent developments

Anna Azzurra Gigante

Department of Economics and Statistics “S. Cogneetti de Martiis”, University of Turin

Abstract. By investigating the connection between mind working and institutional processes, Institutional Cognitive Economics turns out to be the most appropriate in order to overcome some limits in New Institutional Economics. This leads us to develop further this approach. This paper integrates F. Hayek’s theory on knowledge production and A. Bandura’s social cognitive theory with the fertile contributions coming from Self-Organization approach and *cognitive path-dependence*, by considering also the recent cognitive acquisitions in D. North’s analysis. Then, it proposes a further development. Learning process is broken into smaller sub-processes, each of them is investigated through new analytical tools coming from cognitive psychology and neurobiology. They are T. Higgins’s extension of social cognitive theory and *semantic priming* concept. These mechanisms clarify well reinforcement and evolution processes of institutional norms, while their genesis finds a convincing explanation in *social representations’* theory, as it was formulated by S. Moscovici, which investigates the imaginative dimension ordering perceived data before they are processed into new knowledge.

Key words: cognitive path-dependence, institutions, knowledge activation/use, semantic priming, social cognitive theory, social representation.

JEL classification: A12, B25

1. Introduction

Traditionally, the objective of NIE is to analyze institutional arrangements meaning, on one side, the set of the social, political and juridical norms regulating production, trade and distribution, and, on the other side, the mechanisms governing relations among economic units (transactions). In this approach, genesis and evolution of the rules are not investigated, as they are considered given components of a static framework.

Starting from North's contribution of 1994¹, which defines an explicit link between institutions and mind mechanisms – maintaining that mental models are the internal representations mind constructs to interpret the environment, while institutions are the corresponding external mechanisms created to structure it – Rizzello and Turvani (2000; 2002) argue that the “feedback relation” between mental processes and institutions has to be investigated by institutional economics focusing on the main findings in cognitive theory.

The Austrian tradition and, particularly, Hayek's theory on the connection between knowledge production – learning processes – and institutional genesis and evolution mechanisms constitute the starting point in this new approach. The idea of this connection answers, in Hayek's theory, the main economic problem - understanding how knowledge is produced and distributed (Hayek, 1945) - and is related to a method of analysis, the subjectivism, according to which “explanation in the social sciences consists in tracing social phenomena back to the perceptions and intentions of the agents those phenomena comprise” (Langlois, 1985, p. 493).

As the Austrian approach defines rules emergence as the unintended result of the development of a successful behavior pattern, originating at the individual level and consolidating at the social one, Rizzello and Turvani considered necessary to integrate cognitive institutional approach with the social cognitive theory of Albert Bandura. By describing learning processes generating from the adoption of social models, this theory provides some useful hints to understand standardization and evolution mechanisms of institutional norms.

This paper proposes a further development of the institutional cognitive approach defined above.

On one hand, it wants to strengthen the proposed level of analysis, by integrating it with some important cognitive developments in economics.

Starting from the analysis of the main limits in NIE (section 2) - the missing level about the connection between mind processes and institutions - it traces out, first, the most significant contributions offered by Hayek's model of the mind and by social cognitive theory of Bandura, and their implications in institutional analysis (sections 3.1 and 3.2). Then, it integrates these contributions with the recent acquisitions of cognitive theory in NIE - by taking into account

¹ North, 1994a.

North's most recent works - and with the main results achieved in economic Self-organization approach and path-dependence analysis (sections 3.3, 3.4 and 3.5).

As we'll see, North analysis about the role of learning processes - mental constructs and beliefs - in institutional change and the categories of *neurognosis* and *exaptation* adopted inside economic Self-organization approach are able to provide a more insightful description of the institutional mechanisms regulating economic change. These mechanisms are typically path-dependent: as they are generated from learning processes, cognitive path-dependence turns out to be the most appropriate instrument in order to explain them.

On the other hand, the paper proposes new analytical tools offered by cognitive psychology and neurobiology (section 4).

These new contributions seem to significantly enrich the cognitive level of institutional analysis.

Higgins theories (2000; 2002) on social cognitive theory, focusing attention on some mechanisms regulating knowledge production during social interaction, and *semantic priming*, born as a technique in experiments on mental automatism, throw light on some of the sub-processes involved in general learning activity and on their role in decision-making mechanisms (sections 4.1 and 4.2).

The imaginative dimension of knowledge production (Boulding, 1956; Castoriadis, 1987; Patalano, Rizzello, 2002; Patalano, 2004), finally, examines the incisive role of mental models construction processes in structuring external environment. It provides new horizons of research in the interaction mechanisms - guided by social representations (Moscovici, 1961; 1984; 1988; 1994) - among institutions and social sub-groups - in problem-solving processes (sections 4.3).

We'll conclude this paper (section 5) by pointing out that it contributes to structure the cognitive institutional analysis on two different levels, one focused on standardization and evolution mechanisms of the norms and the other concerning their genesis.

2. Neo-institutional Economics: some limits

The several contributions provided by Oliver Williamson and Douglass North make it possible to have a comprehensive idea of the New Institutional Economics' analysis, as developed so far. In fact, by covering the micro-dimension, concerning the governance structures (Williamson), and the macro-dimension, concerning the institutional environment (North), they turn out to be some of the most complete and significant works in this literature.

However, an investigation about the link between mind mechanisms and institutional systems is missing - as in Williamson's works - or very limited - as in North's contributions before 1994.

2.1 The contribution of O. Williamson

If we trace out the main theoretical results in Williamson's contributions (Williamson, 1985b; 1986; 1993; 1996a; 1998a; 1999) we obtain a three levels analysis composed by institutions, governance structures and individuals.

Individuals represent the link between institutions and governance structures.

They specialize labor and establish the institutional framework and the governance forms. In this way, they provide a solution to the problem of information availability - which is scarce - and of the cognitive limits of the mind.

On the basis of the available information and the produced knowledge, governance structures - in capitalistic system, hierarchy (internal organization of the firm), market and organizational hybrid forms - guarantee the pursuit of interests, but also a certain form of order answering the problem of adaptation to change. Adaptation, in fact, can take place through the market (autonomous form) or inside the firm (cooperative form).

Particularly, governance systems assure the efficiency of transactions processes against bounded rationality, opportunism and asset specificity, which characterize contractual relations.²

The different forms of governance can effectively work and achieve their goals only if institutional environment - the set of both formal and informal norms - provides the appropriate opportunities. Changes of these norms (as in property rights or laws) entail also some changes in economic organizations and in the costs of governance.

In Williamson's analysis, the connection between transaction cost economics and cognitive analysis - explicitly recognized - is evident in the adoption of some specific behavioral assumptions and, particularly, of bounded rationality (Williamson, 1981; 1985b; 1996a; 1996b; 1998b; 1999).

This analytic and theoretical tool, introduced by Herbert Simon (1947; 1955; 1957; 1969; 1976; 1983), in contrast with the olympic neoclassical rationality - refers to the cognitive limits characterizing individuals in making choices and, then, in processing information and in evaluating the possible alternatives, and which prevent them to make optimal choices in a context of complexity (Rizzello, 1999; Langlois, 1986).

Williamson, particularly, defines it as referring to "...neurophysiological limits on the capacity to receive, store, retrieve and process information without error, and to definitional limits inherent in language" (Williamson, 1986, p. 200).

And, soon, he explains the link between these limits and transaction costs economics: "if these limits make it very costly or impossible to identify future contingencies and to specify, *ex ante*,

² Without these three assumptions, transaction processes would be drastically simplified and governance would not be necessary. Particularly, its efficiency would be guaranteed by only planning (if bounded rationality was missing); or by promises (if opportunism was missing); or, finally, by competition (if asset specificity was missing).

appropriate adaptations thereto, long-term contracts may be supplanted by internal organization. Recourse to the internal organization of transactions permits adaptations to uncertainty to be accomplished by administrative processes as each problem arises. .. Internal organization in this way economizes on the bounded-rationality attributes of decision-makers in circumstances where prices are not ‘sufficient statistics’ and uncertainty is substantial” (Williamson, 1986, p. 200).

Williamson recognizes also Simon’s ideas about “self-interestedness” of human actors, and their capacity to foresight (Williamson, 2007).

Bounded rationality represents a significant cognitive assumption in Williamson’s contributions. It is the reason why individuals need to regulate their economic processes through organizational modes and institutional norms.

However, two important limits emerge from this analysis.

First of all, bounded rationality - though defining the cognitive limits in decision-making process - is still characterized by some important features of substantive rationality - constrains (alternatives) and objectives (profit and utility function) - such that it’s still possible to adopt a maximizing behavior, within those limits. Only the concept of procedural rationality - here not adopted - is able to overcome this structural limit, by focusing attention on the process regulating the elaboration of information and the decision-making mechanisms (Rizzello, 1999, pp. 74-120; Langlois, 1986, pp. 461- 471).

The second limit is represented by the fact that only the first level of analysis (individuals) is investigated through the help of cognitive approach (though very limited), while the other two levels – institutions and organizations – are presented as mere instruments in order to solve cognitive and adaptation problems.

The three levels are, so, connected in a functional sense, but not in a cognitive sense as no investigation takes place about the connection between the mechanisms of the mind and those ones which regulate institutional and organizational processes.

2.2 The contribution of D. North before 1994

In his masterpiece of 1990, North defines institutions (formal and informal) as tools individuals use in order to make it possible the spread of a higher quantity of information and, in doing so, the decreasing of transaction costs. He maintains that “institutions have been devised by human beings to create order and reduce uncertainty in exchange” (North, 1991, p. 97).

On the other hand, North (1990; 1991) recognizes a connection between institutions and individuals involving mind’s mechanisms activated in the processing of information.

This constitutes an important step forward with respect to Williamson’s contributions.

Institutions are explained as the result of the way mind elaborates information through cultural framework.

“The way by which the mind processes information not only is the basis for the existence of institutions, but is a key to understanding the way informal constraints play an important role in the makeup of the choice set both in the short-run and in the long-run evolution of societies. In the short-run, culture defines the way individuals process and utilize information and hence may affect the way informal constraints get specified” (North, 1990, p. 42). And “the long-run implication of the cultural processing of information that underlies informal constraints is that it plays an important role in the incremental way by which institutions evolve and hence is a source of path dependence” (North, 1990, p.44).

The role of culture, considered as the set of past experiences, ideas and ideologies becomes, therefore, fundamental in his analysis. “Ideas and ideologies shape the subjective mental constructs that individuals use to interpret the world around them and make choices.” (North, 1990, p. 111).

Investigation about the cognitive link between individuals and institutions is, however, not further deepened. As we’ll see later, only since 1994, North’s works start to acquire some of important cognitive contributions, starting from Hayek’s work of 1952. This makes North’s analysis one of the principal starting points for the building of a new level of institutional analysis.

3. Cognitive theory and institutional analysis

“Institutions, .., are orderly and more or less persistent behavior patterns. At a more abstract level, they are the rules or sets of rules that constrain or govern organized patterns of behavior. In either case, institutions are structures. And explaining them requires attention both to their origins and to their maintenance.”(Langlois, 1986, p. 483).

In this section, we’ll expound the most significant aspects of Hayek’s theory, starting from his book of 1952; Bandura’s contributions (1986; 1989) on vicarious learning and North’s more recent positions in institutional analysis. Then, we’ll integrate such contributions considering the main results coming from Self-organization economic approach and path-dependence analysis.

3.1 Hayek: a model of the mind

In “The Sensory Order” (1952), Hayek builds up a model of the mind - what he names our “milieu intérieur” - whose working mechanisms are explained through the classification process, the sensory order that makes it possible to perceive and interpret external objects and events.

When a physical object or event exerts a set of stimuli, our nervous system translates these stimuli in a series of impulses which are transmitted through networks of connections. So, classification of

stimuli takes place through the classification of impulses, by means of an association mechanism. The same class of stimuli can be directed to a unique class of impulses (simple classification) or to different classes (multiple classification).

Every time new stimuli are transmitted, their association with classes of impulses (which can be considered as classes of responses) will be conditioned by past connections between similar stimuli and impulses, according to a typical path-dependent process. This means that we do not perceive external objects in all their properties, but we perceive only those aspects related to our internal rules of classification. In other words, we classify stimuli, by adjusting them to the existing classes of impulses, created from past experience.

Adjustments mechanism entails continuous reclassification processes. Our mind creates new classes (reclassification) by modifying or destroying the old ones every time the expectations deriving from a certain classification are disappointed by new experiences.

“The continuous process of reclassification is forced on us because we find that the classification of objects and events which our senses effect is only a rough and imperfect approximation to a reproduction of the differences between the physical objects which would enable us correctly to predict their behavior – an approximation determined by the accident of evolution, the physiological capacities and the pragmatic needs of the individual and the species” (Hayek, 1952, pp. 145-146).

Connections networks can be imagined, consequently, as “imperfect” partial maps expressing the relationship between impulses and external events and changing continuously.

Connections and classifications processes do not take place at a conscious level: we follow some “rules”, even though we don’t know them and we can’t explain them, but - most of all – we don’t need to.³ “We shall find that perceptions of this sort, which the radical behaviorists wish to disregard because the corresponding stimuli cannot be defined in ‘physical terms’, are among the chief data on which our explanations of the relations between men must be built.” (Hayek, 1998a, p. 54).

Hayek names this phenomenon as “perception of the rules”.

Such rules are the same which give rise to informal norms and, so, to institutions (Hayek, 1998b). They are, in a sense, “regularities”, characterized by the fact that even though tied to human action, they are not deliberate. This is perfectly consistent with the aim Hayek - in line with K. Popper -

³ Hayek, 1998a. Hayek describes three modes to perceive external reality: we can perceive some *external* models (as the geometric figures) that we not only understand intuitively, but we can also explain in words; we can explain a certain model, but we can’t imagine it intuitively (like some models concerning multidimensional spaces); finally we can perceive some models, by recognizing them, but we can’t explain them (one example is language).

recognizes to social sciences: the explanation of the unintended results of human actions.⁴

The importance of “regularities” in Hayek’s theory derives from his conception of economic process, defined not as mere logic of means and ends (Pure Logic of Choice) - according to neoclassical deductive principles - but as a process of subjective knowledge production and consequent behavior adjustment, both regulated by social interaction.

Social interaction (Rizzello, 1999; Langlois, 1985; 1896) promotes the emergence only of those behaviors (which will become “regular”) favoring social utility and making it possible the fulfillment of a spontaneous order (*catallaxis*). This does not entail maximizing results as individuals do not share the same knowledge and act according to a not perfect rationality which in Hayek’s theory consists “in the ability to learn from experience” (Langlois, 1985, p. 466).

The merit of Hayek’s analysis is, therefore, twofold. He not only grasps the fundamental mechanisms our mind activates in order to process information and produce knowledge, but he explicitly recognizes these mechanisms as the same determining the genesis of institutional norms. Institutions make it possible knowledge distribution and, in this way, they provide the solution to what Hayek has defined the principal problem in the explanation of economic processes: how knowledge, which is fragmentary distributed, is communicated and used (Hayek, 1945).

3.2 A. Bandura: the vicarious learning

Vicarious or observational learning in Bandura’s *social cognitive theory* (Bandura, 1986; 1989; Rizzello, 2002) overcomes the limits of learning derived only from personal experience. In this case, learning would be “retarded”, “tedious” and also costly considering trials and errors processes. Vicarious learning, on the contrary, makes it possible to generate – through the observation of the others’ experiences – “new behavior patterns, judgmental standards, cognitive competencies, and generative rules for creating new forms of behavior.” (Bandura, 1989, p. 23).

Observational learning includes four kind of sub-processes: attentional process; retention or representational process; behavioral production; motivational process.

Attentional process entails a mechanism of selection of what we decide to observe. We take only that information we need for our problem solving.

Through retention function we process this information in a symbolic form. “The full content of most modeled activities is too copious and contains too many irrelevancies to be retained exactly as portrayed. Learners must, therefore, transform what they observe into succinct symbols to capture the essential features and structures of the modeled activities.” (Bandura, 1986, p. 56).

⁴ Langlois (1986, pp. 471-483).

Behavioral production entails behavior adjustment to the constructed symbolic models. This is a dynamic process through which choices and actions are continuously compared, and also modified if some mismatches with mental models arise, and if feedback received from environment is negative. This is a form of self-regulation mechanism.

Finally, motivational process explains the importance of incentive. Successful experiences of the others become “vicarious incentives” to make the same choices, as the outcomes expectations are positive. This reduces resignation or frustration that may derive from personal failures.

The description of the four sub-processes makes it clear that vicarious learning is far from being only a mere imitation process.

“.. innovation can emerge through the modeling process. Modeling can directly facilitate the emergence of new genres by providing ingredients for innovative syntheses and by cultivating unconventionality. ... observers combine various aspects of different models into new amalgams that differ from the individual sources.”(Bandura, 1986, p. 104).

This is possible through our “reflective self-consciousness”: the faculty of self-evaluating our thoughts and actions, as it emerged, particularly, in the behavioral production process. External behavioral patterns are interpreted through the cognitive mechanisms of each individual depending on biological characteristics, experiences, feedback from external environment and also fortuitous events.

Self-evaluation, therefore, makes it possible the genesis of new patterns of behavior. This process is, however, strictly conditioned by social mental constructs which limit the set of the possible interpretations.

The implications in institutional analysis are evident: rules emerge at an individual level also through the indirect learning, as individuals are inserted in a social dimension. On one side, vicarious learning assures continuity and solidity to institutions, as it contributes to the standardization of rules; on the other, self-evaluation - whose working mechanisms are, consequently, the same described in Hayek’s theory - makes it possible their changing in time (Rizzello, 2002).

Moreover, if vicarious learning entails a continuous adjustment of behavior to mental models and environmental feedback, and if fortuitous events, genetic characteristics and past experiences play an important role in it, then we can find in Bandura’s analysis the cornerstones of cognitive path-dependency concept.

3.3 North's new positions in NIE

Since 1994, institutional analysis significantly acquires cognitive theory in North's contributions.

Considering the most significant areas of research in NIE, he explicitly recognizes a third line (next to the theories of the firm and of the state) which concerns "cognition, beliefs and institutions". Cognitive science is considered a fundamental tool in order to understand decision-making processes and economic relations (North, 1994a; North, 1996; North, 2003; Mantzavinos, North, Shariq, 2004, p. 75; North, 2005; North, Wallis, Weingast, 2006, p. 8).

Learning process (Denzau, North, 1993; North, 1994a; North, 1996; North, 2003; Mantzavinos, North, Shariq, 2004; North, Wallis, Weingast, 2006) is the key element in this analysis. It "entails developing a structure by which to interpret the varied signals received by the senses. The initial architecture of the structure is genetic, but the subsequent scaffolding is a result of the experiences of the individual. ... The structures consist of categories – classifications that gradually evolve from earliest childhood to organize our perceptions and keep track of our memory of analytic results and experiences. Building on these classifications, we form mental models to explain and interpret the environment... . Both the categories and the mental models will evolve, reflecting the feedback derived from the new experiences: feedback that sometimes strengthens our initial categories and models or may lead to modifications – in short, learning." (North, 1994a, pp. 362-363).

The influence of Hayek - explicitly considered by North as the precursor in the analysis of learning processes, through his work of 1952⁵ - is evident both in the description of classification process, and in the role of feedback and past-experiences.

Learning makes it possible the conversion of mental models in beliefs. They generate from the necessity to deal with the uncertainty conditions of environment.

A mental model is the representation of external events or objects, before receiving feedback from environment. According to this last one, we can confirm, modify or completely reject our model. This process of adjustment takes place through learning.

If external environment confirms several times our mental model, it is stored as a "belief": it guides our choices and actions.

North analyzes also collective learning. It arises from the interaction among individuals, which makes it possible the sharing of mental models. Collective learning first takes place in basic organizations (families, schools, neighborhoods..). Then, it is transmitted in time and across generations, by means of symbols. Collective learning is an indirect learning process which homogenizes mental models and facilitates its transfer among generations.

It is the starting point to understand social interaction and consequently institutional and

⁵ North, 2005.

organizational dynamics in economic analysis (Denzau, North, 1993; North, 1994a; North, 1996; Mantzavinos, North, Shariq, 2004; North, 2005; North, Wallis, Weingast, 2006). Institutions are “nothing more than shared mental models or shared solutions to recurrent problems of social interaction” (Mantzavinos, North, Shariq, 2004, p. 77). They are built up on social belief systems. Particularly, North explains how informal norms derive from a process of “spontaneous emergence”, through imitation and innovation mechanisms activated by collective learning. Social interaction favors the genesis of behavioral regularities: habits in interaction mechanisms form behavioral modes perceived as binding by individuals and this leads to the emergence of informal and formal rules. Once they are formed, institutions - favoring communication and distribution of knowledge - coordinate economic actions, making the connection between knowledge and exchange an intimate one. “During the socialization process, individuals have learned the conventions, moral rules, and social norms of their society. When they start their business, entrepreneurs have learned which legal rules they have to respect and the point to which property rights are protected or violated by the state...” (Mantzavinos, North, Shariq, 2004, p. 11).

Mental beliefs are considered a crucial factor in institutional change. They constitute the principal element of the tension which rises between institutions and organizations and which determines social change. Every time new chances of development arise, organizations exert a diverting force directed to changing institutional framework. The new chances of development are perceived by organizations as positive or not on the basis of knowledge they produce in order to face competition. So, they evaluate opportunities of development according to their mental beliefs (knowledge) and this will determine their choices.

As it emerges, on one side, institutional norms determine those competencies, abilities and knowledge organizations should invest on in order to develop. But, in the same time, institutional norms – being changed by organizations’ pressure force and, so, conditioned by mental beliefs which guide their perceptions about opportunities changes – are themselves products of those mental constructions.

3.4 Self-organization approach and cognitive economics

In the explanation of dynamic processes, self-organizational approach - affirmed in the second postwar through Prigogine’s theory⁶ - refers to non equilibrium dissipative systems constrained in boundary conditions. These systems reach a certain level of self-organization or *autopoiesis*, meaning a dynamic process according to which they import energy and export entropy. Entropy law

⁶ In contrast with Newton/Boltzmann mechanical approach and to thermodynamic theory of maximum disorder’s equilibrium.

(the second law of thermodynamics) - which constitutes the analytical foundation of this process - entails time-irreversibility and, therefore, these systems can change only by evolving (Foster, 1993; 1997). “Although all processes can be reversed if sufficient free energy is used, the rise in energy cost necessary to arrest entropy growth is highly nonlinear and the resultant entropy barrier is such that irreversibility must prevail.” (Foster, 1997, p. 439). Self-organizational systems are, so, those evolutionary structures characterized by continuous exchanges with external environment, which take place by means of energy flows (Witt, 1997).

Self-organization approach turns out to be the most appropriate in order to explain economic change.⁷ The entropic and cybernetic character of economic systems is explained by their informational nature. They generate, combine and destroy information, which constitutes a clear form of energy. Informational flows let them self-regulate and evolve (Rizzello, 2003).

As individual represents the unit of analysis in economic systems - therefore, in organizations and institutions - knowledge production process becomes relevant in self-organization approach. Brain itself can be considered, in fact, as a cybernetic structure, able to self-regulate and to change by evolving. It imports external information, uses some of them - producing knowledge through interpretation process - and wastes some others (Rizzello, 2003).

These considerations make it necessary to integrate self-organization analysis with cognitive economics. Particularly, *neurognosis* and *exaptation* categories - coming from biology and anthropology and explaining evolution process of human brain and animal organisms (both cybernetic and entropic systems) - explain well knowledge production processes (Rizzello, 2003).

Neurognosis' concept comes from biogenetics and refers to some neural structures originated in the cerebral cortex in the prenatal and perinatal age, and genetically determined. Particularly, interaction among cells originates neural networks, which can be considered as models⁸ of the self and of the external environment. Neural models constitute the “cognized environment”, which differs from the “operational environment” as this last one is the real one. Cognized environment

⁷ This approach (Foster, 1997; 1993; Witt, 1997) overcomes the intrinsic limits in the use of biological analogy. Evolutionary biology, tied to Neo-Darwinian tradition reduces change in competition among genes: genetic competition makes it possible the final mutation, through the process of natural selection. Neoclassical economics which is based on this approach explains how “at each instant, competition ensures utility maximization, cost minimization and equilibrium” (Foster, 1997, p. 431). Neo-classical economics and Neo-Darwinian biology describe Newtonian systems, which are timeless and ahistorical, so time-reversible. They are closed systems answering the first law of thermodynamic (the principle of conservation) and their dynamics are affected by their initial conditions.

Lamarckian tradition considers changes in behavioral characteristics derived from experiences in specific environment. In economic domain, this entails the use of routines, which are in fact the procedures used in a specific context or situation. But, still, Lamarckian traditions is based only on competition among genes and it is timeless and ahistorical. Also nonlinear “punctuated equilibria” theory - which consider natural selection in a context of changes of environmental conditions, considering in this way historic contingencies - seems not to be too much different from the previous ones. In this theory, “there is not departure from timelessness, only enhanced story-telling possibilities” (Foster, 1997, p. 434).

⁸ Laughlin stresses that the term “model” does not entail a mental representation, but an organization of tissues.

works according to adaptation rules in order to investigate external environment: the external is adapted to the neural models. “Neurognosis literally means knowledge inherent in the initial organization of the neural networks mediating the perception, cognition, feeling, intuition, etc. I mean all learning is mediated by neurognosis!” (Laughlin, 1996, p. 6).

In evolutionary biology, the term *exaptation* has been introduced to indicate a certain kind of adaptation process. Adaptation, in fact, can be referred to a characteristic born in natural selection process for the present role or, instead, to a characteristic born in natural selection not for the present role, but turning out to be fit for. *Exaptation* indicates this last feature.

Particularly, it can be built by selection for a certain function and, at the present, it can be coopted for another one; or it can be not the direct result of natural selection (nonadaptation) but it can be coopted for the current role (Gould, Vrba, 1982). For instance, feathers were created not to make it possible flight but they were “an adaptation for thermoregulation and, later, an exaptation for catching insects. The development of large contour feathers and their arrangement on the arm arise as adaptations for insect catching and become exaptation for flight” (Gould, Vrba, 1982, p. 8).

While neurognosis, guiding interpretation process through static and quasi-rigid neural structures, act as resistance-force to change, exaptation entails innovation in evolution’s processes. “Apparently exaptation is irreconcilable with neurognosis. The latter, in fact, stresses the relevance of innate structures in explaining evolution. The former does not consider innateness explicitly and it does not clearly underline the role of path-dependence” (Rizzello, 1993, p. 7).

However, if we take into account Hayek’s theory of the mind, these two concepts can easily be considered as complementary and applied in order to explain cognitive processes.

Human mind interprets external data by connecting classes of stimuli to the already existing classes of responses, these last ones depending on genetic traits and past experiences. This takes place according to a process of adjustment of the new to the old mode of interpretation. In this process, we find clearly neurognosis mechanism.

In the same time, when it is not possible to interpret data with the preexisting classes of responses - as feedback from environment is negative or when new problems arise to be solved - our mind modify partly previous nervous circuits (which are not completely rigid) or build up new ones. This is exactly what we mean by exaptation. “In other words, previous neural structures built and developed to solve problems of the interpretations of the external world effectively, reveal their capacity to co-op new configurations and functions when the individual faces new problems. After this process, these new modified neuronal configurations, in turn, are ready to co-op new unfamiliar external data, and so on.” (Rizzello, 1993, p. 9).

3.5 Cognitive path-dependence⁹ and institutional change

As it emerged from the contributions considered so far (Hayek's model of the mind, as well Bandura's explanation of vicarious learning), cognitive processes involved in knowledge production are strongly path-dependent. They are conditioned by individual's genetic characteristics, past experience, fortuitous events and feedback from environment.

a) *genetic characteristics*

Classes of responses and their connections with classes of stimuli are affected by genetic code, responsible for the cytoarchitecture of each individual, meaning the order among cells in cerebral cortex (Rizzello, 2004). Sub-processes of vicarious learning, in Bandura's theory, stress this aspect: the way we select information, in the attentional process; the way we translate them in a symbolic code, in the retention one; as well the role of incentive in motivational sub-function and the behavior production are strictly conditioned by genetic features.

b) *past experience*

By means of connection mechanisms, we associate stimuli exerted by new external data to specific classes of impulses (classes of responses) that we already used in the processing of similar data, according to our past experiences. This means a continuous adjustment process of new classes of stimuli to our already existing classes of impulses, formed on the basis of the past events faced and which differ among individuals.

c) *fortuitous events*

As Bandura maintains, fortuitous events - though not predictable - can exert a strong influence on learning process and divert its initial course.

d) *feedback*

If significant and unsolvable mismatches arise between our classification process and feedback we

⁹ Economic path-dependence describes a typical non-ergodic process. Initial conditions and historic events which may take place during a development process - even little and apparently insignificant - play a decisive role. They interplay with bounded rationality and structural behavior of individuals, conditioning generation processes of externalities, knowledge spillovers and learning. Consequently, process is not a linear one, but it develops in different successive steps. Interaction among irreversibility, individuals' creativity, local externalities and knowledge spillovers, as well feedbacks determine the direction of the process at each step. They exert opposite pressures: while the former is past-dependent and so a deterministic force, the others - that are typically non-ergodic forces - can direct the process into a different way, by diverting it. Each step, therefore, follows a specific direction, according to perturbations during the path and to the interaction with initial conditions, which generates a certain level of irreversibility. This leads to the generation of "trapping states" which condition all the dynamics. In the presence of such conditions, the final state of the process cannot be predicted. Most of all, efficiency is not guaranteed. Path-dependence and its "trapping states" make it possible also the continuity of inefficient and unproductive processes (Antonelli, 1995; 2006).

Path-dependence was applied in economics for the first time through P. David (1985) and B. Arthur (1989) contributions. Industrial and innovation economics, as well economic geography are traditional fields of application of this concept which has led to the achieving of important results. For instance, recent applications in innovation economics (Antonelli, 1997; Antonelli, 2006; Antonelli, Crespi, Scellato, 2012) showed the endogenous nature of technological change and the path-dependent character of innovation persistence.

receive from external environment, classes of responses and relative connections modify according to a continuous reclassification process which stops once we receive a positive external response. Incompatibilities and mismatches are, therefore, at the center of a continuous problem-solving process, where environment's answers to our plans and actions are determinant in their successful enactment.

These four elements are the source of cognitive path-dependence.

If mind's processes are the same regulating institutional mechanisms, cognitive path-dependence becomes a useful analytic tool that can be used in order to explain the path-dependent process of institutional change (Denzau, North, 1993; North, 1994a; North, 2003; Mantzavinos, North, Shariq, 2004; North, 2005).

Mantzavinos, North and Shariq (2004), for instance, provide an integrated approach to path-dependence "starting at the cognitive level, going through the institutional level, and culminating at the economic level" (Mantzavinos, North and Shariq, 2004, p.15).

As to the cognitive level, they describe how mental models guide and condition our interpretation of external environment and, consequently, our decision-making processes. Once individuals intervene on environment through actions, they receive also a feedback from, which starts a new process of mental models construction. In fact, feedback can be positive, confirming in this case the previous mental models, or negative, leading to modify or completely replace individuals' beliefs.

In this mechanism, cognitive path-dependence finds explanation. "In case when the content of the shared learning is the same or similar over a number of periods, the mental models become relatively inflexible and shared belief systems are shaped. These are in turn the source of *cognitive path dependence*, since the more inflexible the mental models are, the more difficult their modification and revision become" (Mantzavinos, North and Shariq, 2004, p. 14).

Exaptation and *neurognosis* concepts (described in 3.4 section) explain well the path-dependent character of mental models construction processes (Rizzello, 1999; 2004).

When processing new stimuli, individual's interpretation mechanisms (*exaptation*) make the new knowledge production process and the derived choices locked-in in some "trapping states". They are determined by past experiences, small events and genetic characteristics of the individual. These trapping states represent mental models of North's analysis. Their construction is started by external stimuli, but - in the same time - it is strongly affected by individual features and history.

On the other hand, when our resistance to change prevails, neurognostic processes reinforce those trapping states, through "self-reinforcing mechanisms". This is the inflexibility condition described in Mantzavinos', North' and Shariq's work.

In interpretation mechanisms, therefore, “every ‘successful’ perception reinforces the perception mechanisms in its direction, by creating neurobiological paths towards which similar external data will be conveyed, and the individual will change such paths only when a problematic novel situation arises”¹⁰.

As mental models are the basis of individuals’ decision-making processes, cognitive path-dependence shifts to the institutional level, concerning both formal and informal norms.

In this regard, Rizzello (1999, pp. 200-202) points out how path-dependence, in the genesis of informal norm - a certain pattern of behavior recognized as “fair” and “successful” and considered binding - is more related to individual processes of knowledge production and less to the history of the society. On the contrary, in the formalization of that pattern of behavior (formal norm) path-dependent process seems to be more connected to the history and the traditions of society.

Formal and informal norms provide the framework of rights and opportunities regulating economic aspects. This constitutes the link among cognitive, institutional and economic levels of path-dependence. Institutional structure - the interconnected system of institutional rules and economic organizations can be described as a continuous dynamic process. The interplay between individual choices - based on their initial mental beliefs - and small events generates a continuous adjustment process of institutional structure to the new mental constructs, which are the initial ones modified by small events and feedback from environment. Depending on these multiple forces, development process can be diverted at each step. The result is that society can get “stuck” in an inefficient and not productive institutional system, characterized by law returns and errors.¹¹

4. New cognitive contributions for institutional analysis

Cognitive classification processes in Hayek’s theory, well-described by *neurognosis* and *exaptation* concepts - if integrated with Bandura’s *vicarious learning* and *self-evaluation* mechanisms, and explained in terms of path-dependence’s dynamics - constitute the starting tools for the cognitive level of institutional analysis. They represent, in a sense, the conceptual coordinates of a new interpretative grid for institutional processes. Now, this grid has to be filled up with new elements which have to cover the empty spaces existing among the coordinates of this map.

Which are the mechanisms regulating the use of stored knowledge when we interact with other

¹⁰ Rizzello (2004), p. 261.

¹¹ (North 1990; North, 1991; North, 1994a). By showing the path-dependent character of institutional change, North (1991) explains why some inefficient economic systems still exist. North considers the most evident differences in institutional frameworks between Western Europe and other contexts like North Africa or Middle East, that is between more complex and still primitive social organizations. The latter have an inefficient system of economic change, characterized by “high measurement costs”, “continuous effort at clientization” and “intensive bargaining at every margin”: there is not a such institutional framework that makes it possible an economic system more profitable, by reducing transaction costs and making more secure the exchange system (like happened in Western Europe).

individuals? And those regulating the activation of Hayekian classes of responses? Is the link between perception of stimuli and production of knowledge direct or is it filtered by anything else? And, finally, how all these new aspects contribute to explain institutional dynamics?

In other words, it's necessary to deepen the knowledge of cognitive mechanisms and social cognitive theory, already described, with new elements able to offer a more insightful analysis.

Some contributions developed in cognitive psychology and neurobiology seem to answer the questions we asked. They provide some analytical tools which seem particularly fit to be applied in economic field and, especially, in the explanation of the link between individuals' cognitive processes and institutional genesis' and evolution's mechanisms.

We'll indicate the principal theoretical baselines, characterizing these contributions and some first implications for institutional analysis.

4.1 The social cognitive theory of Tory Higgins

T. Higgins (2000; 2012) extends social cognitive theory, providing two levels of analysis.

The first level of social cognitive theory concerns the cognition of social psychology.

Principles explaining cognition of social psychology answer the question: what does it happen to individual's mind when he or she gets in contact with other individuals? They are: *organization; explanation; knowledge activation; knowledge use*.

Particularly interesting are *knowledge activation* and *knowledge use* concepts.

The former explains the crucial role that activation of the knowledge previously produced has in the categorization process. Knowledge activation depends on its level of *availability* and *accessibility*.

The former is the fundamental condition of the latter. Most of all, higher the accessibility, easier knowledge activation. Recent or frequent interpretations of specific classes of stimuli increase the accessibility to the connection among them and classes of answers.

Activated knowledge is not always used in the interpretation of stimuli. For this reason, Higgins distinguishes between *knowledge activation* and *knowledge use*, and he explains how this last one depends on some factors like: *automaticity, judged usability* and *expectancies*.

According to the former, activated knowledge is more likely to be used when this process is automatic and not controlled by the individual. *Automaticity* develops when individuals are repeatedly exposed to similar events or experiences, which activate specific cognitive patterns. This makes activation process regular and regularities cause automaticity.¹²

When, instead, interpretation of stimuli is conscious and, therefore, controlled (*controlled automaticity*), the use of activated knowledge will be depending on some evaluations on relevance

¹² See also Camerer (2005).

and appropriateness (for instance, social norms).

Finally, also expectations on future events strongly condition *knowledge use*.

Knowledge activation/use and the concepts of *availability*, *accessibility* and *automaticity* - if integrated with Bandura's *vicarious learning* and *self-valuation* – can explain well standardization, reinforcement and change processes of institutional norms.

When well-defined norms – which formalize a certain pattern of behavior spontaneously arisen and turned out to be effective – are perceived and recognized as fair, they are transmitted among individuals through *vicarious learning*. Whenever these norms have to be applied, *knowledge activation* and *use* mechanisms intervene and they are strictly dependent on *availability*, *accessibility* and *automaticity* levels. As long as a rule is recognized and perceived as binding, *accessibility* level of the relative knowledge will be very high. *Knowledge use* – which follows knowledge activation – will be a typical automated process.

However, according to Bandura's *self-valuation* concept, the adoption of certain patterns of behavior is never completely imitative, but subordinated to individual's interpretation which favors change and evolution in time. When a significantly different pattern of behavior is considered more efficacious than the previous one and gradually recognized as fair, the use of the knowledge connected to the previous rule will be inhibited. In fact, *accessibility* level will considerably decrease and knowledge activation will not lead also to its use. Progressively, activation itself will be inhibited.

The second level of social cognitive theory concerns the social psychology of cognition.

Principles explaining social psychology of cognition answer the question: how individual's mind is influenced by social context? These principles are: *shared reality*; *role enactment*; *social position and identities*; *internal audiences*.

They explain well how institutions affect individuals' cognitive processes.

Through *shared reality* concept, Higgins explains the influence external context has on the interpretation of stimuli. Knowledge is produced or transformed also on the basis of the interaction with the others and of the rules regulating this interaction.

Role enactment and *social positions and identities* principles explain well the importance of socially recognized roles in terms of expectations towards the self and the others. Finally, *internal audiences* concern judgements and expectations group has on each individual belonging to, and which affect *self-regulation* mechanisms.

Social psychology of cognition confirms the one-to-one relationship between individual and

environment. Not only individual structures external environment through norms, but – after receiving feedback from environment – he can modify his evaluations and, consequently, current norms.

4.2 The *semantic priming*

Knowledge activation and use mechanisms assure the application of those norms which are considered efficacious. But how do these mechanisms take place? The explanation of the adjustment process of new classes of stimuli to the old classes of responses is not sufficient.

Semantic priming seems to explain well how the activation of the old classes of answers works. This analytical tool comes from cognitive psychology (particularly, from social cognition's field) and it turned out to be extremely useful in the explanation of mental automatism's processes. (Arcuri, Castelli, 2005; Higgins, 2012; Moscovici, 1994).

It is based on the principle according to which knowledge is organized in complex grids, made up of associative links among several concepts. The activation of a single component of this structure starts automatically the activation of the other components tied to it in a semantic sense.

It follows that the different components of the grid work as a reference map which rapidly makes it possible the interpretation of data and which addresses to the most appropriate behavior in a certain situation.

After all, mapping is an organization principle we find also at cerebral level, with cortical maps. (O'Shea, 2012; Gazzaniga, 1992, 2005). They are groups of neurons at cortical level which answer to those stimuli acting on our body's surface. Hence, different cortical portions stand for different parts of our body. Each map works as a distributed circuit. We can think - for instance - to optical sense: sensory information distribute on a population of neurons, whose almost simultaneous activation is necessary to the generation of the optical sense.

Our mind follows the same principles: it builds up semantic circuits which activate in order to interpret external data and to produce knowledge.

Priming can be activated also in an inhibitory sense. We have to distinguish between lateral and hierarchic inhibition.

The former consists in a sort of competition among representations activated simultaneously and relative to the same conceptual level. It's an automatic inhibition, which selects information entering individual's awareness system and guides cognitive processes.

Hierarchic inhibition, instead, is a mechanism through which general instances (like social or moral norms) regulate lower-level processes (for instance, daily behavior or the formation of impressions).

Priming mechanism has a clear *path-dependent* nature. The generation of semantic circuits which activate through this mechanism is determined by genetics and experiences of each individual. This can be explained both on a phylogenetic and ontogenetic level.

Some semantic connections take place automatically and unconsciously (think about lateral inhibition) and depend on the presence of certain specific neural connections, which are the results of mankind evolutions in millions of years.

In the same time, these connections change during different phases of human life. Those connections which are less automatic seem to be strongly determined by the interaction of the individual with external environment, therefore by his or her experiences.

Priming mechanism can be considered the analytical foundation of reinforcement and change institutional mechanisms. When a norm is recognized as binding, activation and use mechanisms of the knowledge tied to this norm follow the already existing semantic circuits, which reinforce the knowledge map sustaining the norm.

However, associative circuits are not completely rigid: this is consistent with institutional change. When the individual interprets data not consistent (or not completely) to preexisting circuits, these last ones can be partly modified.

After all, also at a neurobiological level modifications of cortical maps can take place, through a changing in neural structure, leading consequently to a change of the knowledge tied to the norm.

4.3 Imaginative dimension and institutions: Boulding's and Castoriadis' contributions

The connection between perception of external data and knowledge production is not direct. It is filtered by a third dimension: the imaginative one.

The first significant contribution about is provided by Kenneth Boulding (1956) who focuses his analysis on *image* concept (Boulding, 1956; Patalano, Rizzello, 2002; Patalano, 2004). Knowledge construction mechanism is conditioned by mental images (representations) each individual forms about himself or herself, about external environment or about the network of relationships which link himself or herself to this environment. These images have a *path-dependent* character, as they are strictly tied to the genetic and experiences' dimension of the individual.

On one side, images constitute the knowledge-base of each individual and, on the other, they produce knowledge, working as interpretative grids for elaboration of data.

Boulding does not analyze *image* only at the individual level. The development of similar images among individuals determines the sharing of analogous values systems. In this perspective, he considers the sharing of images as an important social cohesion factor and points out the neuralgic

role mass media play in the diffusion of certain images inside society. Shared image is, therefore, the origin of standardized behaviors and, consequently of those norms which regulate them. Institutions arise, then, from shared images.

Though not completely rigid, shared images are refractory to change. When the mind perceives external stimuli which contrast with the previous mental image, the first reaction is to reject them. If the reception of these stimuli go on, a change is possible: the image will be modified gradually and, if necessary, it will be supplanted by a completely new one.

A particularly illuminating contribution about the link between images and institutions is provided by Cornelius Castoriadis (1987). He introduces the concept of “*radical imaginary*”, which indicates the representational activity of individuals, that is the creation of semantic connections among perceived data. Imaginative capacity is autonomous in each individual, but - at the same time - affected by social context he or she is living in.

Images give significance to what is perceived. If shared, these significances determine the emergence of institutions, defined by Castoriadis as the representation of these significances at a formal level.

On the basis of Castoriadis’ contribution, the link between mental images and institutions is organized in two phases (Patalano, 2007).

The first is the sharing of similar mental models. In this phase, perception process of external stimuli is followed by a process of significances’ assignment. *Sense making and affective investment* is the process through which individual’s mind completely filters external environment.

During imaginative activity, the individual can attribute significances and affective values to data previously not perceived or modify those ones relative to already perceived data.

The sharing of mental images takes place through the use of symbols. Symbols are the tool through which society’s imagine materializes, as they refer to real objects.

The second phase consists in sanctioning such symbols through the formalization of institutional norms. Patalano, in fact, defines institutions as “systems of symbolic relationships that are socially recognized and sanctioned” (Patalano, 2007, p. 235).

Therefore, symbols are the link between individual’s mind and external environment. They own, in fact, a mental component as they arise from individual’s imaginative capability; and a real component, as they are always tied to real objects.

Institutional change will be possible when new mental images replace the old ones. For this reason, it has a strictly endogenous nature.

4.3.1 Moscovici's social representations: a possible integration

It seems necessary to integrate previous contributions with that of Serge Moscovici's theory of social representations (1961; 1984; 1988; 1994).

Social representations are produced collectively, through processes of exchange and interaction and on the basis of shared mental models.

Social representations are the mental reconstruction of external environment. For this reason, they can be considered as knowledge systems guiding individual behavior.

Particularly, they are the tool through which the unknown is made familiar and usual.

Literature developed very much in this sense, introducing two instrumental categories which explain the process of integration of the unknown to the familiar. They are *anchorage* and *objectification* mechanisms. They can be considered as the generative processes of social representations (Galli, 2006; Grande, 2005; Arcuri, 1995).

Anchorage is the transfer of the unknown inside our cognitive systems (this is the mechanisms of association and adaptation already described). Through this process, new produced knowledge can be used by social groups in order to legitimate and safeguard their interests and pursue their goals.

Objectification, instead, is the transformation of the anchorage's product – of an abstract kind – in a concrete element, through the use of symbols. This process can be divided in three steps: *selective construction*, according to which some information is selected and some other is rejected; *structuring schematization*, through which a new and robust figurative nucleus is formed, linking the concept to a certain visual dimension; finally, *naturalization*, through which the elements of figurative nucleus are associated to a specific physical element.

Particularly interesting is the distinction Moscovici makes among classes of representations.

Closed social representations are characterized by elements distributed uniformly and with the same meaning among all individuals of a society; *critic representations* are composed by elements having different meanings depending on the different values through which they are filtered (values can be even opposite); *open social representations* are characterized by elements distributed in a non uniformly way among different social categories and such that they have to be combined together in order to be consistent.

Besides, Moscovici distinguishes among *hegemonic*, *emancipated* and *polemic* representations.

The first ones are shared by all the members of a strongly structured group (as political classes). And they are binding for all the collectivity. The second ones belong to social subgroups, characterized by different concepts of reality, which are tied for instance to the different social functions. They are reciprocally complementary. The third ones are on the basis of social conflicts and are not shared by all people. For this reason, they contradict each other.

5. Concluding remarks

By shifting the analysis on the cognitive level, cognitive institutional approach completely changes traditional units of investigation in NIE, that is to say the single economic transaction for the micro level (the unit of analysis in transaction costs economics defined by Williamson) and the social, political and juridical rules regulating production and exchange, for the macro level.

Now, the investigation starts from decision-making process, considered both at the individual and social level: the unit of institutional economics becomes learning process.

The Austrian approach with Hayek's theory on knowledge production and Bandura's social cognitive theory - proposed by Rizzello and Turvani - proved to be the most appropriate to investigate the link between learning and institutions.

Starting from these theories, the paper has tried to develop further this level of analysis. On one hand, it has integrated them with the learning processes regulating 'mental models' construction in North's analysis, some important findings in Self-organization approach and the main results in cognitive path-dependence analysis; on the other hand, it has proposed new cognitive contributions to be used in institutional analysis.

The paper has moved the cognitive analysis of institutional processes on two levels of investigation. The first level concerns reinforcement and change mechanisms of institutional norms.

The cybernetic and entropic nature of economic systems, which somehow seems to characterize brain processes of self-regulation and evolution, makes it possible to adopt cognitive theory in the examination of these systems and apply some analytical categories coming from biology - neurognosis and exaptation - which perfectly can be tracked down in Hayek's mechanisms of adjustment and reclassification processes (North's reinforcing and modification of mental models). These mechanisms take place also at social level: vicarious learning, through self-evaluation moment, explains both conforming and creative mechanisms in the adoption of social behavior patterns

These considerations can be integrated with *knowledge activation / use* and *accessibility / automaticity* mechanisms of Higgins' theory and with the analytical tool of *semantic priming*. They explain processes regulating the way individuals use or inhibit produced knowledge, according to evaluations about appropriateness and relevance of social behaviors.

When a pattern of behavior benefits the group and, therefore, turns out to be successful and binding, neurognostic mechanisms prevail and it spreads among individuals according to conforming vicarious learning and self-evaluation mechanisms. In this stage, different learning sub-processes activate according to specific modes: the stimulation and the use of the knowledge defining the

norm (behavior pattern) are highly automatic. Every time individuals deal with a problem requiring the application of the rule, semantic priming connects inputs deriving from the problem to decision making process consistent with the behavior prescribed by rule. This makes possible its reinforcement at social level.

On the contrary, when a certain pattern of behavior is perceived as no more working, it is replaced by another one more appropriate. This entails the activation of exaptation mechanisms which, at the social level, correspond to the creative self-evaluation process in observational learning. The working of learning sub-processes is obviously different, in this case. Activation and use of the knowledge relative to the previous norm are gradually inhibited, as the availability and automaticity levels decrease significantly. Semantic priming works in an inhibitory sense, interrupting the connection between inputs deriving from the problem and the old rule.

These mechanisms are strongly path-dependent: reinforcement or change of the rule take place strictly depending on the preceding paths covered by learning processes. This makes it possible to use cognitive path-dependence also in the explaining of institutional and economic development, as realized in North's analysis.

The second level of cognitive institutional analysis makes a backward step: it refers to the genesis of institutional norms. This means dealing with the imaginative dimension, filter between data perception and knowledge production. Exaptation and creative self-evaluation strictly depend on this dimension. For this reason, it is considered the basis of institutional genesis.

The way institutions behave has to be explained, therefore, beginning from their mental/imaginative foundation through a work of recovery and reconstruction of mental representations which are on the basis.

For this reason, Boulding' and Castoriadis' contributions about the role of *images* and their connection with institutions - implying resistance to change mechanisms, *sense making/affective investment* and symbolic production - become necessary in order to explain adequately imaginative dimension. Moreover, it seems necessary to integrate these contributions with Moscovici's social representations theory. Theoretical tools of anchorage and objectification and distinction among different classes of social representations seem to be useful to explain the institutional modus operandi in a *problem solving* perspective. Moscovici's analysis can be applied to examine the way institutions act and interact at a social level. The classification of social representations, particularly, seems to be extremely useful to interpret institutional behavior in social contexts of strong criticalities.

Here are described the most intuitive and direct implications of using the new analytical tools presented, in institutional analysis. However, we think that a successive development has to follow,

aimed to investigate more deeply the main results they make it possible to achieve in cognitive theory and, then, to apply these results in institutional analysis.

References

ANTONELLI, Cristiano (1995) “Dynamic structuralism and path-dependence: industrial economics in Italy”, *Revue d'économie industrielle*, vol. 73, pp. 65-89.

ANTONELLI, Cristiano (2006) “Path Dependence, Localized Technological Change and the Quest for Dynamic Efficiency” in *New frontiers in the Economics of Innovation and New Technology: Essays in Honour of Paul A. David* (2006), Cheltenham, Uk: Edward Elgar.

ANTONELLI, Cristiano (1997) “The economics of path-dependence in industrial organization”, *International Journal of Industrial Organization*, n. 15, pp. 643-675.

ANTONELLI, Cristiano; CRESPI, Francesco; SCCELLATO, Giuseppe (2012) “Internal and External Factors in Innovation Persistence”, Working Paper, n. 11/2012, Department of Economics “S. Cagnetti de Martiis”, University of Turin.

ARCURI, Luciano (1995) cura, *Manuale di psicologia sociale*, Bologna: Il Mulino.

ARCURI, Luciano; CASTELLI, Luigi (2000) *La cognizione sociale. Strutture e processi di rappresentazione*, Torino: Laterza, 2005.

ARTHUR, Brian W. (1989) “Competing Technologies, Increasing Returns, and Lock-In by Historical Events”, *The Economic Journal*, Vol. 99, n. 394, pp. 116-131.

BANDURA, Albert (1986) *Social foundations of thought and action. A social cognitive theory*, Prentice-Hall: Englewood Cliffs, New Jersey

BANDURA, Albert (1989) “Social cognitive theory”, in R. Vasta (Ed.), *Annals of child development*, vol. 6, pp. 1-60.

BOULDING Kenneth (1956) *The image. Knowledge in life and society*, Ann Arbor Paperbacks, The University of Michigan Press.

CAMERER, Colin.; LOEWENSTEIN, George; PRELEC, Drazen (2005) “Neuroeconomics: How Neurosciences can Inform Economics” *Journal of Economic Literature*, vol. XLIII, pp. 9-64.

CARCARINO, Marcello; MARTE Barbara A. M.; RICCARDI Pasquale (1998) *Manuale di psicologia sociale*, Napoli: Edizioni Simone.

CASTORIADIS, Cornelius (1987) *The Imaginary Institution of Society*, Cambridge, MA: MIT Press.

- DAVID, Paul A. (1985) “CLIO and the Economics of QWERTY”, *American Economic Review*, vol. 75, n. 2, pp. 332-337.
- DENZAU, Arthur T.; DOUGLASS C. North, (1993) “Shared Mental Models: Ideologies and Institutions”, *Economic History*, pp. 1-15.
- DOSI, Giovanni; NELSON, Richard R. (1994) “An introduction to evolutionary theories in economics”, *Journal of Evolutionary Economics*, n. 4, pp. 153-172.
- FOSTER, John (1993) “Economics and Self-Organization Approach: Alfred Marshall revisited?”, *The Economic Journal*, vol. 103, n. 419, pp. 975-991.
- FOSTER, John (1997) “The analytical foundations of evolutionary economics: from biological analogy to economic self-organization”, *Structural Change and Economic Dynamics*, n. 8, pp. 427-451.
- GALLI, Ida (2006) *La teoria delle rappresentazioni sociali*, Bologna: Il Mulino.
- GAZZANIGA, Michael S. (1992) *Nature's mind*, New York: Basic Books.
- GAZZANIGA Michael S.; IVRY Richard B.; MANGUN George R. (2002) *Cognitive Neuroscience*, New York: Norton and Company.
- GOULD, Stephen J.; VRBA, Elizabeth (1982) “Exaptation – a missing term in the science of form”, *Paleobiology*, n. 8, pp. 4-15.
- GRANDE, Teresa (2005) *Che cosa sono le rappresentazioni sociali*, Roma: Carocci.
- HAYEK, Friedrich A. (1945) “The use of knowledge in society”, *American Economic Review*, vol. XXXV, n. 4, pp. 519-530.
- HAYEK, Friedrich A. (1952) *The Sensory Order. An inquiry into the foundations of theoretical psychology*, London: Routledge and Kegan Paul.
- HAYEK, Friedrich A. (1998a) “Rules, Perception and Intellegibility”, (first published in Proceedings of the British Academy, 1962) in Hayek, Fredrick A. (1967) *Studies in Philosophy, Politics and Economics*, Chicago: University of Chicago Press, 1967.
- HAYEK, Friedrich A. (1998b) “The Results of Human Action, but not of Human Design” in Hayek, Fredrick A. (1967) *Studies in Philosophy, Politics and Economics*, Chicago: University of Chicago Press, 1967.
- HIGGINS, Tory E. (2000) “Social cognition. Learning about what matters in the social world”, *European Journal of Social Psychology*, vol. 30, pp. 3-39.

HIGGINS, Tory E. (2012) “Accessibility theory”, in VAN LANGE, Paul; KRUGLANSKI, Arie W; HIGGINS, Tory E. (2012) *Handbook of Theories of Social Psychology*, London: SAGE publications.

LANGLOIS, Richard N. (1985) “Knowledge and Rationality in the Austrian School: An Analytical Survey”, *Eastern Economic Journal*, vol. 11(4), pp. 309-330, published in EGIDI, Massimo and RIZZELLO, Salvatore (2004) *Cognitive Economics*, two volumes, Cheltenham: Edward Elgar, pp. 492-510.

LANGLOIS, Richard N. (1986) “Rationality, Institutions and Explanation”, pp. 461-491 in EGIDI, Massimo and RIZZELLO, Salvatore (2004) *Cognitive Economics*, two volumes, Cheltenham: Edward Elgar.

LANGLOIS, Richard N. (1998) “Rule-following, Expertise and Rationality: A New Behavioral Economics?”, pp. 511-534 in EGIDI, Massimo and RIZZELLO, Salvatore (2004) *Cognitive Economics*, two volumes, Cheltenham: Edward Elgar.

LAUGHLIN, Charles D. (1996) “The Properties of Neurognosis”, *Journal of Social and Evolutionary Systems*, n. 19, pp. 1-14.

MANTZVINOS, C.; NORTH, D. C.; SHARIQ S. (2004) “Learning, Institutions and Economic Performance”, *Perspectives on Politics*, vol-2, n. 1, pp. 75-84.

MARRAFFA, Massimo and PATERNOSTER, Alfredo (2012) *Persone, menti, cervelli. Storia, metodi e modelli delle scienze della mente*, Milano: Bruno Mondadori.

MOSCOVICI, Serge (1961) *La psychanalyse, son image et son public*, Paris: PUF.

MOSCOVICI, Serge (1984) “The phenomenon of social representations”, in FARR, Robert M. ; MOSCOVICI, Serge (1984) eds., *Social Representations*, Cambridge: Cambridge University Press.

MOSCOVICI, Serge (1988) “Notes toward a description of social representations” *European Journal of Social Psychology*, n. 18, pp. 211-250.

MOSCOVICI, Serge (1994) éd., *Psychologie sociale des relations à autrui*, Paris: Éditions Nathan.

NAPOLEONI, C.; RANCHETTI, F. (1990) *Il pensiero economico del Novecento*, Torino: Einaudi.

NORTH, Douglass C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge: C. University Press.

NORTH, Douglass C. (1991) “Institutions”, *The Journal of Economic Perspectives*, vol. 5, n. 1, pp. 97-112.

NORTH, Douglass C. (1994a) “Economic Performance Through Time”, *The American Economic*

Review, n. 84, pp. 359-368.

NORTH, Douglass C. (1994b) "Transaction Costs Through Time", *Economic History*.

NORTH, Douglass C. (1996) "Economics and Cognitive Science", Washington University, *Economic History*.

NORTH, Douglass C. (2003) "The role of institutions in economics development", Discussion Paper series no. 2003.2, for United Nations Economic Commission for Europe.

NORTH, Douglass C. (2005) *Understanding the Process of Economic Change*, Princeton: Princeton University Press.

NORTH, Douglass C.; WALLIS, John J.; WEINGAST, Barry R. (2006) "A conceptual framework for interpreting recorded human history" (Working paper 12795), *National Bureau of Economic Research*, Cambridge.

O'SHEA, Michael (2005) *The Brain. A Very Short Introduction*, New York: Oxford University Press.

PATALANO, ROBERTA (2004) "L'agente che rappresenta sè stesso: economia, matematica ed eterogeneità" *CESMEP Working Papers*, 200305, University of Turin.

PATALANO, ROBERTA (2007) "Imagination and society. The affective side of institutions" *Constitutional Political Economy*, vol. 18, pp. 223-241.

PATALANO, ROBERTA (2007) "Mind-dependence. The past in the grip of the present" *Journal of Bioeconomics*, vol. 9, pp. 85-107.

PATALANO, ROBERTA (2007) "Resistance to change. Exploring the convergence of institutions, organizations and the mid toward a common phenomenon" *MPRA Paper, University Library of Munich, Germany*, n. 3342.

PATALANO, Roberta; RIZZELLO, Salvatore (2002) "Il concetto di image nel pensiero di Kenneth Boulding e le implicazioni per la teoria economica contemporanea" *Storia del pensiero economico*, n. 45.

RIZZELLO, Salvatore (1995) "La path-dependency nella teoria economica e il contributo di Franco Momigliano", *Storia del Pensiero Economico* n. 30, pp. 23-52.

RIZZELLO, Salvatore (1997) *The Economics of the Mind*, Northampton: Edward Elgar, 1999.

RIZZELLO, Salvatore (2003) ed., *Cognitive Development in Economics*, London: Routledge.

- RIZZELLO, Salvatore (2004) "Knowledge as a Path-Dependent Process", *Journal of Bioeconomics*, vol. 6, pp. 255-274.
- RIZZELLO, Salvatore; TURVANI, Margherita (2000) "Institutions Meets Mind: the Way out of an Impasse" *Constitutional Political Economy*, vol. 11, pp. 165-180.
- RIZZELLO, Salvatore; TURVANI, Margherita (2002) "Subjective Diversity and Social Learning: A Cognitive Perspective for Understanding Institutional Behavior" *Constitutional Political Economy*, vol. 13, pp. 197-210.
- SIMON, Herbert A. (1947) *Administrative Behavior*, New York: McMillan.
- SIMON, Herbert A. (1955) "A Behavioral Model of Rational Choice", *Quarterly Journal of Economics*, n. 69, pp. 99-118.
- SIMON, Herbert A. (1957) *Models of Man*, New York: Wiley.
- SIMON, Herbert A. (1969) *The Science of the Artificial*, Cambridge, MA.: MIT Press.
- SIMON, Herbert A. (1976) "From Substantive to Procedural Rationality", published in Latsis, ed., *Method and Appraisal in Economics*, Cambridge, MA: Cambridge University Press.
- SIMON, Herbert A. (1983) *Reason in Human Affairs*, Stanford: Stanford University Press.
- TOPOL, Richard; WALLISER, Bernard (2007) ed., *Cognitive Economics. New Trends*, Elsevier.
- WILLIAMSON, Oliver (1981) "The Modern Corporation: origins, Evolutions, Attributes", *Journal of Economic Literature*, n. 19, pp. 1537-68.
- WILLIAMSON, Oliver (1985a) "Reflections on the New Institutional Economics", *Journal of Institutional and Theoretical Economics*, n. 141, pp. 187-195.
- WILLIAMSON, Oliver (1985b) *The Economic Institutions of Capitalism*, New York: The Free Press.
- WILLIAMSON, Oliver (1986) *Economic Organization. Firms, Markets and Policy Control*, Brighton: Wheatsheaf Books LTD.
- WILLIAMSON, Oliver (1993) "The Evolving Science of Organization" *Journal of Institutional and Theoretical Economics*, vol. 149, n. 1, pp. 36-63.
- WILLIAMSON, Oliver (1996a) *The mechanisms of Governance*, New York: Oxford University Press.

- WILLIAMSON, Oliver (1996b) "Transaction Cost Economics and the Carnegie Connection", *Journal of Economic Behavior and Organization*, n. 31, pp. 145-156.
- WILLIAMSON, Oliver (1998a) "The Institutions of Governance", *American Economic Review*, vol. 88, n. 2, pp. 75-79.
- WILLIAMSON, Oliver (1998b) "Transaction Cost Economics: how it works; where it is headed", *De Economist*, n. 146, pp. 23-58.
- WILLIAMSON, Oliver (1999) "Human actors and Economic Organization", *Quaderni del Dipartimento di Economia Politica*, Siena.
- WILLIAMSON, Oliver (2000) "The New Institutional Economics: Taking Stock, Looking ahead", *Journal of Economic Literature*, n. 38, pp. 595-613
- WILLIAMSON, Oliver (2009) "Pragmatic Methodology: A Sketch, with Applications to Transaction Cost Economics", *The Journal of Economics Methodology*, n. 16, pp. 145-157.
- WITT, Ulrich (1997) "Self-organization and economics – what is new?", *Structural Change and Economics Dynamics*, n. 8, pp. 489-507.