

Learning, Change and Economic Performance

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The greatest challenge for the social sciences is to explain change, or more specifically social, political, economic, and organizational change. The starting point must be an account of human learning, which is a fundamental prerequisite for explaining such change. The ability to learn is the main reason for the observed plasticity of human behavior and the interaction of learning individuals gives rise to change in society, polity, economy and organizations. Because learning is the main object of inquiry of cognitive science, only a dogmatic attitude would prevent social scientists interested in phenomena related to change from paying appropriate attention to its findings. The revolution of the last few decades in cognitive science has produced valuable insights regarding the processes of individual learning across different types of environments. This is the main reason why cognitive science is not merely of peripheral importance for the social scientists, but must be the very starting point of any serious discussion of the processes of change at the societal level.

Section I explores the nature of individual learning; section II examines shared learning; section III ties learning to overall economic performance; section IV examines path dependence.

Individual Learning

Research in cognitive science during the last decades has advanced understanding of the relationships between mind, behavior, and brain. Work in the approaches known as “cognitive neuroscience” has advanced our understanding of how brain structures are linked to mental phenomena and observable behavior (Damasio, 1999). Because the cognitive architecture of *Homo sapiens* is the product of a long evolutionary process, a major issue that confronts us is the interplay between the genetic structure that has evolved in response to the evolving human environment and the cultural conditioning that is a consequence of the institutional framework deliberately created by humans to order their environment.

Because cognitive science is a very young discipline, it is not surprising that there are a number of competing explanations to account for perception, learning, memory, attention, and even more controversy when it comes to overall explanations of the nature of the cognitive processes and the interplay between mind and brain. In order usefully to apply cognitive science to economics and other social sciences, it is important to keep in mind the analytical focus of the explanatory enterprise. For our explanatory purpose, we want to use theory that is sufficiently analytic to help us come to grips with the issue of change. Specifically the theory should provide:

1. An empirically testable account of individual learning.
2. A satisfactory account of choice processes.
3. A foundation to account at a second stage for the processes of social learning, since the ultimate phenomena of interest are societal change and economic outcomes.

The approach that we suggest views the mind as a complex structure of neural networks which actively interprets and at the same time classifies the varied signals received by the

senses. The mind classifies the experiences from the physical environment as well as those from the socio-cultural linguistic environment (Hayek, 1952). Rules gradually evolve during the individual cognitive development to organize our perceptions and keep track of our memory of our experiences. Clusters of such cognitive rules build **mental models** to explain and interpret the environment. Mental models are flexible knowledge structures that are typically formed by an organism with regard to a problem situation (Holland, Holyoak, Nisbett and Thagard, 1986). In other words, the formation of mental models as well as all our cognitive activity takes place in a pragmatic context: human beings perceive and learn only with regard to a problem.

Mental models can best be understood as the final prediction or expectation that the mind makes regarding the environment before getting feedback from it. According to whether the expectation formed is validated by the environmental feedback, the mental model can be revised, refined, or rejected altogether. Learning is the complex modification of the mental models according to the feedback received from the environment. It is important to stress that the learning process of human beings is distinct from that of other animals and it also diverges from the computer analogy which is dominant in studies of artificial intelligence. The unique feature of human learning is that the modification of the mental models goes hand in hand with a process of “representational redescription” (Clark and Karmiloff-Smith, 1993). Convincing experimental evidence shows that knowledge stored as solution to special problems of the environment is subsequently reordered by the representational redescription process to serve for the solution of a much wider variety of problems.

The formation of mental models and the testing of a problem solution in the environment do not necessarily lead to success, however. Learning is an evolutionary process of trial-and-error (Popper, 1972/1992), and a failure to solve a problem leads to the trial of a new problem solution. Mental models being in general flexible cognitive structures that help humans solve

their problems, it is interesting to consider further the relationship between environmental feedback and the stabilization or modification of mental models.

In the case that the environmental feedback reinforces the same mental model many times, it becomes stabilized in a way. This relatively crystallized mental model, we call a “belief.” The interconnection of more mental models of this kind, that is of beliefs (which can be either consistent or inconsistent) we call a “belief system.” The primary characteristic of a belief system is the following: because it has enabled the individual to survive in his environment in the past, it has somehow become connected with the motivational system. To put it another way, the belief system is progressively shaped by the involvement of a parallel emotional adaptation. Therefore the belief system takes on the character of a general filter for all new stimulus processing, and one may safely hypothesize that it is relatively resistant to abrupt changes.

When the solution produced on the basis of a certain mental model has not been successful the first kind of response of the individual is to employ inferential strategies, especially analogies in a quasi-automatic way (Nisbett and Ross, 1980). If these analogies do not lead to success either, that is if they do not solve the problem, then the individual is forced to become creative, that is to form new mental models and to try new problem solutions in the environment. This is the case of choice which can be best conceptualized as the mental probing of alternatives in order to solve a new problem (Mantzavinos, 2001)¹.

The environmental feedback plays a primary role in determining the success and the subsequent incremental stabilization or the failure and the subsequent modification of the

¹ As the cognitive neuroscientist Elkhonon Goldberg puts it (2001, p. 44): “The brains of higher animals, including humans, are endowed with a powerful capacity of learning. Unlike instinctive behavior, learning, by definition, is change. The organism encounters a situation for which it has no ready-made effective response. With repeated exposures to similar situations over time, appropriate response strategies emerge. The length of time, or the number of exposures required for the emergence of effective solutions, is vastly variable. The process is sometimes condensed in a single exposure (the so-called Aha! Reaction). But invariably, the transition is from an absence of effective behavior to the emergence of effective behavior. This process is called “learning” and the emergent (or taught) behavior is called “learned behavior”. At an early stage of every learning process the organism is faced with “novelty”, and the end stage of the learning process can be thought of as

underlying mental models. In sum, whether creative choice or learning will take place depends crucially on the environmental feedback that the individual mind receives while trying to solve its problems. Obviously, nothing guarantees that the reception of environmental feedback will occur accurately or flawlessly. Because the mind is an active interpreter of all sensory input, it is often the case that the message regarding the success or failure of the problem solution attempted will be misinterpreted.² Indeed the persistence throughout history of dogmas, myths, superstitions and ideologies based on such flawed belief systems requires that we pay as much attention to learning that produces such beliefs as we do to learning that appears to interpret correctly the problems confronting humans.

Obviously the theory that we suggest here needs further elaboration. But it provides, we think, a useful starting point for building our analytical framework because it meets all three criteria previously proposed. It gives a more or less satisfactory account of both individual learning and choice processes, while at the same time providing a sufficient basis in order to explain at a second stage the processes of social learning, to which we turn now.

II

Shared Learning and Change

Learning at the societal level can best be conceptualized as a process of shared learning. When we attempt to explain the emergence of social or cultural knowledge, we must distinguish two aspects of shared learning: the static and the evolutionary. Starting with the static dimension, it is obvious that individuals who find themselves in a given sociocultural environment constantly communicate with other individuals while trying to solve their problems. The direct result of this communication is the formation of shared mental models

“routinization” or “familiarity”. The transition from novelty to routinization is the universal cycle of our inner world. It is the rhythm of our mental processes unfolding on various time scales.

² This is the case of the “anomalies” frequently discussed in the literature.

(Denzau and North, 1994). These shared mental models provide the framework of a common interpretation of the reality and give rise to shared solutions to the problems arising in the environment. The importance of this communication process is obvious because a common interpretation of reality is the foundation of any further social interaction.

What about the evolution of the shared mental models in a social group over time?

The evolution of shared mental models, that is shared learning, will depend on the group size and will be different within organizations and in the society overall. The modern theory of organizational learning, for example, views organizations as systems of distributed knowledge in which capabilities are shared through knowledge exchange (March, 1999) At the level of a society, the process of cultural evolution concerns the growth and transmission of knowledge in time. Donald (1991) stresses the importance of what he calls “External Symbolic Storage” for the transmission and accumulation of knowledge across generations. The critical innovation that has massively supported the evolution of “theoretic” culture was the simple habit of recording ideas, that is “of **externalizing the process** of oral commentary and events.” (p. 342) and occurred in Ancient Greece from around 700 B. C. The new element then was that “for the first time in history complex ideas were placed in the public arena, in an external medium, where they could undergo refinement over the longer term, that is, well beyond the life-span of single individuals.” (p. 344). These External Symbolic Storage Networks have decisively driven forward theoretical knowledge--that is, knowledge which is communicable by means of symbols (natural and artificial)--because they provide the possibility of a constant interaction between the corpus of theoretical-scientific knowledge and the theoretical problems of the individuals in a society.

However, the stock of knowledge that is transmitted from generation to generation is not limited to theoretical knowledge. The other category of knowledge, practical knowledge or “knowing how” (Ryle, 1949) is not expressible in linguistic terms and the mechanism of its transmission is the direct imitation of the performance of others. Practical knowledge refers to

all skills acquired by solving practical problems--swimming, cooking, riding a bicycle, driving a car, typing a paper--and is equally important for the everyday life of all individuals in a society.

As shared or collective learning at the societal level takes place, the problem solving capacity of the society, encompassing both theoretical-scientific and practical knowledge, grows and is transmitted over time. There is, however, a sub-category of practical knowledge, the knowledge concerning the solution of social problems of human interaction, which cannot be plausibly understood as having grown and been transmitted through time. At this point, we must go beyond Hayek, who equated the growth of civilization with the growth of knowledge including “our habits and skills, our emotional attitudes, our tools and our institutions – all adaptations to past experience which have grown up by selective elimination of less suitable contact.” (1960, p. 26). We must develop a more analytical understanding of the institutions of the society and examine in some depth how they evolve through time.

Institutions are the rules of the game in a society or, more formally, the humanly devised constraints that structure human interaction. They are made up of formal rules (constitutions, statute and common law, regulations), informal rules (conventions, moral rules and social norms), and the enforcement characteristics of each. Because they make up the incentive structure of a society, they define the way the game is played through time. When theorizing about institutions, it is useful to distinguish between two aspects: the external and the internal.

From the external point of view of the scientific observer, institutions are shared behavioral regularities or shared routines within a population. From an internal point of view, institutions are nothing more than shared mental models or shared solutions to recurrent problems of social interaction anchored in the minds of the people. Only because they are anchored there, do they ever become behaviorally relevant. The elucidation of the internal aspect is the crucial step in adequately explaining the emergence, evolution, and effects of

institutions. It is this which makes for the qualitative difference of a cognitive approach to institutions in comparison to other approaches.

Institutions as the rules of the game have diverse effects. One is the provision of incentives to create organizations. Before going on, it is useful to distinguish institutions from organizations. Institutions are the rules of the game; organizations are the players. The latter are made up of groups of individuals bound together by some common objective. For example, firms are economic organizations, political parties or legislatures are political organizations, universities are educational organizations. As an evolution of shared mental models takes place within organizations, shared learning then takes place with respect to their goals. An important area of research examines the specific characteristics of this process of learning (Powell and DiMaggio, 1991).

The emergence of informal and formal institutions is driven by distinct mechanisms. The informal institutions of a society emerge and change in an evolutionary process of spontaneous interaction and are the outcome of a process which is “indeed the result of human action, but not the execution of any human design” (Ferguson, 1767/1968, p. 188). The spontaneous emergence of informal institutions is a process of innovation and imitation which take place in a social group which is learning collectively.

Informal institutions are produced **internally**, that is they are endogenous to the community. By comparison, formal institutions are imposed **externally** to the community as the exogenous product of the political process (Lipford and Yandle, 1997). We lack a fully workable theory of how political markets work, though the recent developments in political science have produced valuable predictions of political outcomes in the short run. Nevertheless, successful explanations have been produced mainly for the United States and other developed polities which operate in a network of fundamental constitutional and other political rules that remain the “unstable constants” in the short run (Riker, 1980). A more general theory of politics must explore the transaction-cost characteristics of political markets

and the role of ideology in shaping political outcomes (North, 1990b). The theory of ideology with empirical content which has yet to be developed could have as a starting point the evolution of the shared mental models of the political actors that give rise to and legitimize new political rules which in turn structure human interaction.

The relationship between formal and informal institutions is very important for policy reasons.³ Since policies consist of changes in the formal institutions, but outcomes are a result of changes in both formal and informal rules (and enforcement characteristics) learning more about the interaction between formal and informal rules is a necessary condition for improving economic performance.

III

Economic Performance

Once the rules are established, the next analytical step is to see how economic markets evolve within the institutional framework. Depending on the kind of institutions that prevail and their enforcement characteristics, the creation, diffusion, and division of knowledge will occur with either high or low transaction costs. Appropriate institutions through the stabilization of expectations lead to greater security in transacting. This goes then hand in hand with low transaction costs, better captured gains of trade, and in the end higher economic performance (North, 1990a).

This general argument can be best illustrated if one distinguishes between exchange and competition and if one examines how they are related to knowledge division, knowledge creation, and transaction costs. Neoclassical economic theory seldom addresses this issue and economists often use the concepts of “market” and “competition” synonymously. We define markets as exchange processes and competition as the rivalry that can take place not only in

³ Nee (1998) and Nee and Ingram (1998) are first attempts to tackle this issue.

markets, but also in politics and organizations and whenever more than two individuals strive to reach the same end. We will first examine how institutions, market exchange, and the dissemination of knowledge are interrelated. Then we will deal with the issue of how the institutional framework affects the market competition and leads to the growth and the accumulation of knowledge.

The exchange processes give rise to a division of labor which is concomitant with a division of knowledge between the market participants (Loasby, 1999). The fact that different individuals possess different bits of knowledge because each specializes in a specific trade or employment poses two difficult theoretical problems: the issue of the coordination of knowledge, and the issue of its effective use. We have stressed before that institutions are anchored in the minds of the people as shared solutions to social problems. The main effect of the existence of shared mental models or shared knowledge regarding the human landscape at the cognitive level is a coordination of individual activities at the behavioral level. The members of a society build the same cognitive structures and adopt the respective behavioral regularities during a long evolutionary socialization process. Thus, an individual who starts exchanging in the market is already a socialized individual who shares social rules with the other participants. He is not an a-historical being equipped solely with preferences that maximize utility under the constraints of, for example, given prices and available income.

During the socialization process, individuals have learned the conventions, the moral rules, and the social norms of the society they are living in. When they start their business, the entrepreneurs have learned which legal rules they have to respect, the point to which the property rights are protected or violated by the state, and they are already the “legal persons” of legal theory. The entrepreneurs and the other market participants share the formal and informal institutions and thus the rules of the game, by sharing the same learning history which makes them the specific agents of the specific economic game.

Hence, institutions are responsible for the coordination of the knowledge of the market participants at a first and most important level. Obviously, depending on the specific characteristics of the shared learning process in specific societies, this coordination of knowledge will take place at a differential level of transaction costs (North, 1990a). The institutional framework of a Moroccan *suq*, for example, coordinates the knowledge of the market participants at higher transaction costs than the elaborate institutional framework of more differentiated markets.

At a second level, the coordination of knowledge in markets takes place with the aid of market prices. This is the old Hayekian argument, which retains its full validity in the sense that the existence of prices in market settings greatly facilitates the further coordination of knowledge of the market participants in comparison with settings in which market prices do not exist (for example in socialistic economic systems). The coordination of knowledge in markets is, thus, due to both the institutional framework and the prices that prevail in the specific market game.

Coming now to the second issue—the role of the market in the accumulation of knowledge-- one must consider what happens during the exchange process, provided that all market participants share the knowledge of the rules of the game. The exchange between the demand and the supply side of the market is also a communication process, during which shared mental models between consumers and entrepreneurs are formed. Thus, entrepreneurs and consumers do not automatically share “common knowledge” (Langlois and Cosgel, 1998, p. 112). Neither is there a fictitious auctioneer who cares that both sides of the market become aware of each other. The very rise of the common structure of communication is the prerequisite of any exchange act. Since neither will entrepreneurs always provide correct hypotheses concerning the consumers’ problems, nor can consumers possibly know all available alternatives in the markets, exchange acts are always ‘imperfect.’”

To prevent a possible misunderstanding here, it is important to stress that the shared mental models arising in the exchange process are different from the shared mental models which constitute the internal forms of social institutions, although they are of the same cognitive material. The distinguishing feature of the internalized rules of the game is that they are shared by **all** market participants. The mental models that become shared in the exchange processes are, conversely, of a more temporary character; and most importantly they are shared only between **some** consumers and **some** entrepreneurs. The existence of prices facilitates the formation of this kind of shared mental models during the exchange process.

At a general level, it is true that the more shared mental models are formed in the market with low transaction costs, the more effective the use of knowledge in the economy will be. This argument needs further elaboration. Martens (1999) discusses the dilemma that specialized agents with limited cognitive capacities face in the division of knowledge-setting of the market. Agents can either devote more of that scarce capacity to acquiring common knowledge and forming shared mental models with other agents or build up their own specialization. Transaction costs affect whether agents will try to form share mental models with other agents or deepen their own knowledge. A high frequency of exchange acts and a deepening of the division of knowledge lead to a greater realization of the gains of trade and in the end to a higher economic performance.

Having examined how institutions, market exchange, and the dissemination of knowledge are interrelated, we proceed to see how the institutional framework affects the market competition. What kind of competition prevails during the process of exchange depends crucially on the institutions that prevail at the time. Institutions determine not only the kind of competitive game, but also the tempo of the entire game. This means that the tempo of learning of the players depends on the intensity of the competition, which is in turn determined by the institutional framework (Mantzavinos, 1994). Because of competition, the

agents suffering from pecuniary external effects are motivated to learn more to ensure their survival in the economic struggle.

During the competitive process technologies are generated as a spontaneous outcome. Why spontaneous? Because the organizations which participate in the economic game, that is the firms, are primarily concerned with the increase of their profits. In the process of solving their primary problem, which is how to attain profits, they employ a very wide range of “competitive parameters.” Technology is just one of them. Scientific knowledge is used (and also partly produced) by firms only to the degree that entrepreneurs expect economic profits from its use. Thus, the generation of technologies is mediated by the market test, that is by profitability considerations. This is the reason why there is no simple causality link between institutions, organizational activity, and the generation of technologies (Rosenberg, 1994).

The economic competitive process that generates technologies and thus new knowledge is, of course, linked to the market exchange. In order for the technologies to be effective at all, there must be an appropriate **absorptive capacity** on the demand side of the market (Cohen and Levinthal, 1990). In other words, the results of the competitive process on the supply side of the market in the form of new technologies can be wealth-enhancing only if the demand side can use them. This fact has profound implications for the important policy issue of the transmission of new technologies, especially in the less developed parts of the world. The transfer of technologies can be accomplished only if the appropriate learning processes have taken place on the part of the receivers and users of them (Wright, 1997). Thus, communication and the formation of respective shared mental models is a prerequisite of any effective use of technologies; and here lies a crucial difference between our theory and the contentions of the endogenous growth theory.

In summary, economic performance is the outcome of a complex process of playing the economic game according to formal and informal rules that provide the incentive structures and channel the innovative activities into a certain direction. There is no guarantee

that the processes of shared learning and the institutions of a society that evolve through time will produce economic growth (North, 1994). In history the stories of failure are more frequent than the stories of success. And it is important to understand that even if we did have it right for one economy, it would not automatically be right for another economy and even if we have it right today, it would not necessarily be right tomorrow. Only if we understand the principal factors that produce path dependence can we hope to be able to alter economic performance in a particular direction. To this issue we turn our attention now.

IV

Path Dependence: Cognitive, Institutional and Economic

The process of societal change that we presented can be summarized as “reality”>beliefs >institutions>specific policies>outcomes and in consequence altered “reality”. The feedback mechanism from outcomes to reality runs through the human mind; and because the mind interprets reality actively, we have a very limited knowledge of how outcomes will be perceived and interpreted by the agents. This is the main reason why mechanistic, deterministic models of economic change cannot work; ideas are the autonomous factors of socioeconomic evolution and if we want to learn more about this process, we need to know more about the way our minds construct reality.

Nevertheless, we can formulate a hypothesis about how the “scaffolding” that humans erect is related to outcomes at the same time that it continues to evolve through time. After a period t_1 —that is, learning through institutions, markets, and outcomes has been completed-- the mind interprets in the period t_2 reality—that is the outcomes-- on the basis of the mental models already existing in t_1 . Obviously, this is true for each individual in the society and thus the shared learning in t_2 must be based on what has already been there in t_1 . In other words, the shared mental models in t_2 are formed on the basis of the shared mental models of

t1. In cases 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 become, the more difficult their modification and revision become.

Because of this cognitive path dependence, the scaffolding of the human landscape, that is the formation of institutions, also takes place in a path-dependent way. Once all of the players have formed the same mental models, the institutional mix may start solving a variety of social problems in a particular way. One can speak of the “increasing returns of an institutional framework” in the sense that once the problem solutions are learned by the agents, they are unconsciously applied each time the similar problems arise. This **institutional path dependence** may structure the economic game in a standardized way through time and lead societies to play a game that results in undesirable consequences (North, 2000).

As long as the institutional framework remains constant and the incentive structure remains unaltered, the market interaction will be channeled into a certain direction and the generation of certain types of technologies will be encouraged. Thus, cognitive and institutional path dependence will ultimately lead to **economic path dependence**. The intuitively formulated proposition that “history matters” designates the importance of the phenomenon of path dependence, starting at the cognitive level going through the institutional level and resulting in the economic level (Mantzavinos, 2001).

Concluding, the analytical framework presented here provides a first approximation of the role that learning plays in the formation of institutions and the economic games unfolded within them. Further research is needed in order to develop theories of the way political markets function, of the emergence and effects of ideology and of the relations between formal and informal institutions. It is obvious that for all the indicated research areas the issue of learning is of crucial importance. This is the reason why we will have to keep track of the

developments in the cognitive science and to utilize its findings for our own explanatory purposes, as we are moving towards a more refined theory operational enough to be employed for policy issues.

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