Learning in economics: the Austrian insights[1]

by

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November 2001

ABSTRACT

In this contribution I first present a selective review of the literature on learning theories in economics. I then show that those theories are often assimilating knowledge to information or considering knowledge as a structure of information. Finally I discuss the possibility for those theories to be defined as Austrian and I conclude with a presentation of a research agenda.

I. Introduction.

Learning is an important topic in economics even it is not a really new topic: indeed Arrow (1962) introduced the idea that individuals were *learning by doing*, before Rosenberg (1982) said that the process of *learning by using* was much more relevant. Thereafter *learning by interacting*, *institutional learning*, and *organizational learning* and *learning by learning* (Stiglitz) were introduced in order to explain how, in an evolutionary perspective, technologies and organizations were changing. However learning, in economics has recently become an important topic *per se*. In other words, learning is no more a mean to explain how innovations or some other economic phenomena are taking place and are evolving but is much more a way to explain how individuals modify their behavior. Indeed, the possibility to conceive individuals as perfectly rational is becoming problematic[2] and it seems that one of the reasons why economists are dealing with learning is due to the fact that they consider that it is necessary to justify why individuals are becoming rational[3] or why they are not.

Recently, learning was then introduced in microeconomics[4] and particularly in game theory[5]. In fact, the idea is either to try explain how individuals' strategies converge to a Nash equilibrium solution, or to look at the way individuals modify their behavior due to the way the others behave even if they are not converging to an optimal or unique solution.

It is difficult not to link those last attempts to one of the main "Austrian" assumption:

Individuals are not perfectly rational and are progressively learning how it is interesting for them to behave in order to improve their economic wealth.

Two questions emerge from this reality:

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[2] In fact such a debate is an old one. Cf. for example the famous controversy concerning the assumption of perfect rational behavior of the producer and the natural selection argument used by Alchian and Friedman.

[3] According to Börgers (1996, p.1), literature concerning learning and evolution "is concerned with dynamic processes which describe how economic agents adjust their behaviour over time, and how, after agents have gained experience, their behaviour may become rational in the economists' sense of the word.

[4] "The question of learning, which has received wide attention in other disciplines, notably psychology, has only recently occupied a serious place in the economics and game theoretic literatures." (Kirman, Salmon, 1995, p.1).

[5] See Fudenberg, Levine (1998), Walliser (1998), Young (1998).

- First why Austrians did not until now build up A theory of learning? Indeed there are many references to learning processes in Austrians writings, but there is nothing looking like an unified theory of learning. It seems very strange especially because of the main assumption recalled above.

- Second what are the possible relations between learning models in economics and particularly in game theory, and the Austrian tradition? In other words is it possible to show that the developments of learning theories in economics are integrating some essential elements of the Austrian tradition, and if it is the case to what extend? This question is important because depending on the answer given, it may be possible or not for the Austrian tradition to borrow some of the theoretical results from the "economics of learning".

In fact it may be possible to assume that if individuals are learning, they have, before learning, non-perfectly rational behavior, even if it is also possible to assume

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II. Learning in economics: a selective review.

Learning is introduced in economics in very different ways. It is however possible to typify the models of learning depending on 1) the kind of conception of rationality they assume, 2) how individuals are learning and 3) what individuals learn.

Learning and rationality

In fact some contributions tell us that individuals are learning but because of the fact that they are unable to say why and how they modify and possibly improve the results of their behavior, it is not sure that individuals are really learning. Indeed many scholars dealing with learning in evolutionary economics are assuming that individuals as well as groups are learning but they are not making explicit the way individuals are doing so.

At the opposite in the *eductive* process (Binmore, 1987) individuals have perfect knowledge of the structure of the game they are playing. Because of the fact that they have perfect instrumental as well as cognitive rationality (Walliser, 1998), individuals are not really learning, they are only modifying their behavior due to the information they gather. This zero learning level (Bateson) is then paradoxically close to the one assumed by evolutionary game theory, even if some recent works introduce the idea of learning in stochastic games (Young, 1993). In fact individual is often considered as a kind of automata responding to stimuli coming from his environment. In between those two extreme conceptions – lack of rationality and perfect rationality – there is, in fact, a continuum of conceptions of "bounded rationality".

When Walliser (1998) analyzes the ways rationality and learning were introduced and are developed in game theory, he shows that between the two extreme conceptions listed above (lack of rationality and perfect eductive one) it is possible to appraise the conceptions game theory hold in terms of the way they deal with the instrumental and cognitive rationality as well. According to him, *cognitive rationality* "deals with consistency between available information and constructed belief, in order to form expectations about the relevant environment" whereas *instrumental rationality* "deals with consistency between given opportunities and fixed preferences, in order to derive intended strategies from previous expectations."

(Walliser, 1998, p. 68). Those two fixed points are interesting because of the fact that they are not too far from the usual distinction made in psychology between behavioral versus cognitive approaches of learning (see below).

Perfect rationality and learning

Indeed it is important to take into account the fact that some economists try to assure that rationality is compatible with learning. In this perspective, the problem is to describe how individuals are becoming rational. Indeed the *fictitious play learning* process can be considered as a possibility to justify that after a kind of "pre-play process" individuals are adjusting their behavior and then progressively playing their best response to the others strategies. It is then possible to justify the existence of a process toward a Nash equilibrium.

However, perfect rationality is not easy to define. In fact rationality can be substantively defined and then "behavior is substantively rational when it is appropriate to the achievement of given goals within the limits imposed by given, conditions and constraints." (Simon, 1980, p. 130). Substantive rationality is opposed to procedural rationality that characterized a behavior that is "the outcome of appropriate deliberation. Its procedural rationality depends on the process that generated it." (Simon, 1980, p. 131).

Learning in economics can be linked with the fact that individuals are perfectly rational in the sense that they optimally change their behavior because information coming from outside justify such a change. They can then be automata that react mechanically to their environment. If however, individuals are bounded in terms of rationality, it is possible to assume that they try to modify or improve their behavior. In other words they can learn.

Learning and bounded rationality

Bounded rationality is an old notion due to Simon, event if the idea that individuals are limited in their cognitive capabilities was introduced before. However this notion is now recognized as an essential one in economics (Conlisk, 1996, Rubinstein, 1998). The problem is that there is no unique and definitive notion of bounded rationality and that there is not a unique model of bounded rationality (Rubinstein, 1998). Indeed, "economists have traditionally avoided explaining

behavior as less than rational for fear of developing many fragmented theories of mistakes. Part of the attraction of highly rational models is the idea that there may be many ways to be less than rational, but only one way (or in light of the equilibrium refinement literature perhaps only a few ways) of being highly rational." (Erev, Roth, 1998, p. 848).

If different conceptions of bounded rationality exist, different ways to link them to learning process also take place. In fact, even if it is difficult to organized the ways economists deal with bounded or soft rationality, I think that two main ways of analyzing the relations between rationality and learning can be considered.

The first one, exemplified by Langlois (1997), and Rubinstein (1998), is to start from the main assumptions of the "neoclassical notion of rationality" or the notion of "rational man" and to explain how it is possible to amend them in order to propose a more useful notion of rationality. The second one is to define the different manners it is possible to define the notion of rationality and to look at the ways they can be modified (Walliser, 1998)[6].

Those two main ways of dealing with bounded rationality implies different conceptions of learning. In the first case the models of learning are characterized by the type of assumptions one relaxes. As an example, according to Langlois (1997), the neoclassical model of rationality "combines the following four elements:

- Self-interest
- Omniscience ("complete information")
- Conscious deliberation (or an "as if" equivalent)
- The representative agent" (Langlois, 1997,p. 3)

Depending on the element(s) (supposing accepted the hypothesis that those elements are independent) you relax, you are going to put to the fore a determined kind of rationality and then implicitly of learning process. If individual are not consciously deliberating, they are going to behave as rule followers and then the learning process is going to explain how individuals (or somebody or something else) modify the rules they follow. The idea that individuals are rule-followers (because it is rational for them to be so) and are learning by trial and error is based on the fact that individuals are sometimes deliberating and sometimes not doing so

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[6] In fact Langlois (1997) is using those two methods even if he is much more interested in the first one.

(Hayek, 1988; Heiner, 1983; Vanberg, 1994). In the same way it is possible to demonstrate (Langlois, 1986) that it is rational for individuals to follow rules both when the environment is uncertain and when it is not at all and they learn according to the context where they are located. In the same Austrian way Koppl and Langlois (1994) analyze actions as some kind of social games.

All those conceptions of bounded rationality are closely related to a conception of learning process, because of the fact that they are based on some abandon of one or more hypothesis of perfect rationality.

In the second case, individuals learn depending one the degrees they are assumed to have instrumental or perfect cognitive rationality. In a case of perfect instrumental rationality, individuals are able to link without ambiguity the information coming from their environment and the action that allows them to get the best outcome, while perfect cognitive rationality permits them to expect exactly the others' behavior in order to define their strategies. If they have not a perfect instrumental rationality they are learning by modifying their behavior, taking into account their past outcomes. It is a kind of *behavioral learning* (Walliser, 1998). If they are updating their beliefs concerning the ways the others are behaving it is a example of *epistemic learning*. Indeed, Hayek (1937) is only interested with epistemic rationality while Hayek (1988) is also considering behavioral learning.

In both case however individuals are learning because of the fact that they are not fully rational and the scope of this learning process can be appraise by the distance between the perfect (instrumental or cognitive) rationality and the hypothesis one makes concerning actual individuals' rationality.

How do individuals learn?

In a recent paper on learning in economics, Young (1998) distinguishes four types of models of learning : the first one is based on the natural selection process, the second on imitation, the third is assuming that individuals are learning by reinforcement, the fourth is asserting that best reply is at the basis of the way individuals learn.

Those models are based on different assumptions concerning, not only the rationality individuals have at the beginning of the process of learning, but much more how those individuals are learning.

- The first kind of models are considering that individuals are allowed not to be rational at all. In fact the selection is going on in the same way if we are looking at animals or at human beings as well. Indeed individuals are surviving if they are using strategies that allows them to get the best outcome when they are confronted to invaders. This kind of learning process is very close, in terms of reasoning, to the "as…if" idea developed by Friedman concerning the entrepreneur's behavior. At the first glance, this kind of model seems not far from the Hayek's idea that rules of conduct are the result of a selective unintended process.

- The second type of models are considering that individuals because they are not able to know what fundamentally is determining the best behavior, imitate the other. The cornerstone is here to define the way individuals are imitating the other and why they are doing so. This kind of learning process is very close to the one Menger implicitly introduces when he says that "there is no better way in which men become enlightened about their economic interests than by observation of the economic success of those who employ the correct means to achieving their ends." (Menger, 1976, p.261).

- The third type of model is exemplified by Roth and Erev (1998). Indeed they are dealing with the fact that individuals change their behavior on the basis of the following hypothesis:

- Respect the *law of effect*, that is to say that "choices that led to good outcomes in the past are more likely to be repeated in the future" (Erev, Roth, 1998, p. 859).

- The *power law of practice* that assumes that learning curve is 'normal'.

- *Experimentation* (or *Generalization*). The law of effect is completed by the assumption that successful choices are generalized that is to say that "similar choices will be employed more often as well, and players will not (quickly) become locked in to one choice in exclusion to the others." (Erev, Roth, 1998, p. 963).

- *Recency* which means that recent experiences play a more important role than past ones

- *Reference point*, that is to say something like a reservation or a minimum value (which can be adjusted).

Erev and Roth (1998) show that this model allow them to explain the way people really play games.

- The fourth kind of model is rooted in the process of "fictitious play" that assumes that individuals are behaving as if they think they are confronted to stationary and unknown distribution of others' strategies. On this basis, Young (1993, 1996) introduces the idea that, i) individuals are able to make mistakes that is to say that, with a given probability, they are not choosing their best response strategy, ii) they have a limited memory, iii) they are looking only at a part of the available set of information.

All those models are based on assumptions concerning the way individuals learn. The first one is dealing with individuals learning without knowing that they do. The second one is considering that individuals are learning on the basis of a comparison between what they obtain and what the others do obtain. The last two ones are much more sophisticated because they introduce the idea that individuals learn both by comparing their action with their past experience but also by taking into account the ways their opponents behave. The problem is however to look at what individuals do learn.

What do individuals learn?

In economics of learning it is often assumed that what is important to analyze is the way individuals are modifying their behavior without looking at the cognitive processes that explain those modifications. In others words it is much more behavioral than cognitive learning which is analyzed. However it seems important to look at the process by which individuals build up and modify their "representations" in order to give significance to a complex as well as uncertain reality (Dosi, Marengo, Fagiolo, 1996) The Austrian subjectivism is very close to this kind of conception.

Such a way of dealing with (behavioral) learning is link with the fact that learning is fundamentally conceived as an informational problem. Indeed economists are rarely try to analyze learning as a problem of knowledge acquisition (that is a cognitive problem). On this basis, information is defined as a flow and knowledge as a stock. In other words, information is a kind of input that is entering a "black box" that produces an output, that is to say new information. The way knowledge is modified or not by those entering information is not taking into account. However Boulding (1955) perfectly shows that it is not sufficient to consider information as

something which modifies knowledge because this last notion is considered as passively reacting. In fact it seems much more appealing to consider knowledge as a structure. Then, "in order for a message to 'stick' to the structure-or, more importantly, for a message to modify the structure in a useful way-that message must be meaningful to the receiving system. The message must somehow 'fit'". (Langlois and Garrouste, 1997, p. 288).

It seems the reason why Rubinstein (1998) defines knowledge as a structure of information that allows to define a sub-set of the states of the world that individuals believe that they are the case.

III. Learning in economics and the Austrian tradition

Indeed those kinds of model are not solving all the problems that learning implies when it is introduced in economics.

Some similarities

Without any doubt learning models are improving the economic analysis of individuals behavior, and some of the main assumptions of those models are close to "Austrian" ones.

First those models are *generally* assuming that individuals are not perfectly rational. Even if it is not always the case, the learning models are assuming that individuals are boundedly rational. Such an assumption is not far from the Austrian idea that ignorance (O'Driscoll and Rizzo, 1996) is much more the case that perfect rationality is. Indeed, ignorance is stronger than bounded rationality in this sense that bounded rationality is a "positive" notion, that is to say that the possibility for bounded rationality to converge to perfect rationality can be assumed (Simon, 1976). At the opposite ignorance is a much more a "negative" concept. It is impossible to eliminate ignorance because it is a very essential reality. Individuals are *necessarily* ignorant.

Second in some learning models (Erev and Roth, 1998, Young, 1996) individuals can learn because of the fact that they are interacting with each others. In fact the idea is to say that it is necessary to take into account the fact that the problem of learning cannot be reduced to a pure logic of choice but needs to be analyzed as a problem of coordination. In other words, people, when behaving take into account

the ways the others do. In fact, even if it is a basic assumption of game theory and then one of the proximity between Austrian economics and game theory, it is an important aspect of learning models.

Third the idea that individuals can learn without knowing that they do is a important topic. In an Hayekian perspective, individuals learn abstract rules of conduct but they do not know that they learn them. Much more importantly economic agents can learn something without knowing what they learn. This kind of conception is not far from the evolutionary game theory conception of learning. In fact, even if Hayek is distinguishing his own conception of evolution and selection and the natural one, such a way of conceiving learning is close to his idea that individuals are using rules of conduct unconsciously.

Fourth imitation as a learning process is common to some learning models as well as to some Austrian way of analyzing the evolution of individual behavior and the emergence of institutions. Indeed when he explains how the money as an organic institution emerges, Menger (1976) introduces the idea that some individuals are much more able than the others to perform in exchanging economic goods on the market in order to satisfy their own needs: they exchange the goods they have against more marketable goods. Looking at their success the other individuals imitate them. Progressively by means of a reinforcement process a institution is constituted. In a similar way of thinking, Hayek writes that language, moral and such like are "the products of selective evolution transmitted by imitative learning." (Hayek, 1990, p.24).

Fifth, the "updating of propensities" (Erev, Roth, 1998) that assumes that individuals are modifying their propensity to play a strategy by means of a comparison between the payoff of that strategy and the smallest possible payoff is a king of trial and error learning process. Yet this kind of learning process is perfectly identified by Hayek when he explain how individuals adjust their plans of action on the market. He refers to "what, since the physical sciences begun to concern themselves with spontaneous orders, or 'self-organizing process', we have learnt to call 'negative feed-back'". (Hayek, 1878, p. 184).

Important differences.

Even if some similarities exist between the hypothesis of learning models in economics and some of the Austrian assumptions, it difficult not to find some important differences between them. It can be interesting to specify rapidly what are the main Austrian assumptions. They seems to be the following:

- *Subjectivism* . Indeed knowledge -inasmuch as it is dispersed-, and its growth, seems to be one of the basic elements that an Austrian conception of economics. Such an phenomenon defines, both with the Austrian specific conception of time, the subjectivism of the Austrian tradition. This vision makes then the analysis of the coordination of individual plans of action the real object of our discipline. Austrians use to explain the spontaneous coordination process that permits the emergence of institutions (organic ones), rules of action, conventions, traditions and so on. In this way, « cognitive commonalties, that is, socially shared tacit knowledge including knowledge about social models of behavior, may emerge spontaneously from intense communication as an unintended collective outcome and may, as such, be difficult to influence. » (Witt, 1998, p. 166). This idea is not Austrian specific and is now developed by the cognitivist approaches.

- *Entrepreneurship*. In fact « Sometimes, however, the institutional set-up of the interactions assigns certain individuals a position in which they get a chance to shape the communication processes and thus to exert an influence on the collective outcome. The firm organization is a case in point. » (Witt, 1998, p. 166). More generally, the Kirznerian idea of "alertness" is one the main characteristic of an entrepreneur.

- *Market process*. The individuals' plans of action are adjusted by means of a spontaneous coordination process. As shown above, a self-organized process progressivelly makes the different plans of action coherent.

The assumption that seems the more important to deal with in order to compare learning models and Austrian tradition is the first one. Indeed, subjectivism (dynamic one) implies first that knowledge is an essential economic variable, second that time is conceived as a real (as opposed to newtonian) and third that individuals are essentially different.

On this basis it is possible to put to the fore the following dissimilarities between learning models and Austrian tradition:

First learning models are essentially behavioral. In other words they do not look at the individuals' cognitive processes that determine the way those individuals' behavior are defined and modified. Even if some learning models are assuming that it can be of some interest to look at the individuals' mental models, or that people can be characterized by some cognitive dissonance (Rabin, 1994), usually, learning models are not concerned with cognitive aspect of learning. As we saw above, this lack of interest is due to the fact that they are information-based and not knowledge-based processes. This lack of interest is however difficult to assume when some experimental results show that there is an individuals' tendency to maintain a strategy even if the state of the world does not justify this maintenance (Egidi, 2000).

Second, even if individuals are not considered as identical, they are often so due to some parameters. In Young's models, the probability not to play the best-response strategy, the memory of players, and the size of the space of information are exogeneous and are given for all players. It is the same thing in the Erev and Roth's models. The problem it is not sure that those parameters are the same for all individuals and it seems that they need to be endogeneous and it is not sure that they are. Even if the learning models are abandoning the notion of "representative agents", they are obliged to maintain some common characteristics that makes their models not really Austrian.

Third, time is a newtonian one (O'Driscoll and Rizzo, 1996). Indeed, by construction, duration is exclude from those models and individuals are supposed to be confronted to the same time. This last difference seems not possible to be avoided inasmuch as those models are formal ones are not set up in order to take into account such a complex reality.

Conclusion : toward an agenda

Two conclusions are in fact possible. The first is taking into account the fact that learning models, even if the incorporate some important elements of Austrian tradition (bounded rationality, coordination, some elements of subjectivism) is not able to integer some important assumptions that characterized Austrian economics. The second one is to take the proximity between learning models and Austrian tradition positively and to define some directions that can be used. As an example some recent works (Egidi,2000; Garrouste, 2000) try to develop cognitive learning

models based on the idea that individuals' minds are characterized by a cognitive inertia and that learning needs to take into account this important characteristics.

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