RECURSIVE AND TELEOLOGICAL RATIONALITY INVOLVED IN THE MODELING PROCESS OF SELF - ORGANIZING SOCIO - ECONOMIC SYSTEMS

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Abstract

The modeling of socio - economic systems, seen as a cognitive process, involves some forms of procedural reasoning which, in practice, differ from the familiar linear, deductive or substantive, syllogistic formal reasoning processes.
It needs some forms of recursive reasoning, where the operator is transformed by the result of its previous operations. And some forms of teleological reasoning, where the choice of the means to reach an end transforms this end along times, and where this new end suggests frequently some new means, when it becomes explicit : "Searching is the end", says H.A.Simon ("Reason in human affairs",1983).
Since E. Kant ("the Third Critics", 1793), we are accustomed to understand and to interpret those forms of recursive and teleological rationality in terms of "appropriate deliberation", but during a long time, economists as many scientists, have not seen them as "correct methods" for the production of "scientific propositions" in order to work on the modeling and the reasoning processes of socio economic systems.
If we consider to day that a "well founded argumentation" is at least as epistemologically correct as a "formal demonstration" (and perhaps more), we can identify some forms of rhetorical and dialectical reasoning, which help us to design and to interpret, in reflexive and teleological terms, the evolving and self - organizing socio economics systems in which we are acting.

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"…*Each step of implementation created a new situation; and the new situation provided a starting point for fresh activity*"
H. A. Simon [1]

Usually, socio - economic systems are percieved as evolving systems, although their modelers claim their difficulty to design stable, teachable and workable models of such phenomena, particularly when they must admit that they do not know the laws which eventually govern the local or global evolution of those phenomena : How can they design predictive models of the behavior of social systems, when this evolving behavior is affected at each step by the expectations and reactions of the various actors involved in the process ?
"*The theorems of game theory and rational expectations have added a new hazard to be faced by designers of social and economic models aimed at prediction*" conclude H.A. Simon, who add :

[1] H.A.Simon [1]"*The sciences of the artificial*", 1991.p.163

"*More than forty years of intensive research leaves us with the firmly established conclusion that there is no unequivocal definition of rationality under conditions of mutual outguessing*"[2].
The modeling process of a socio economic evolving system needs some preliminary and explicit considerations on the reasoning process involved in such design.
The classical deductive -or substantive - rationality, usually seen by economists as the most scientific mode of reasoning when they have to design and to interpret the models of the future behavior of any socio economic systems (assuming that those systems will not always remain in a stable equilibrium), appears practically inadequate.

Even if the modeler knew the "**ends**" of the behavior of such a system (considering, for instance, that it has first to obey to some hypothetical "*natural laws*", such as "*Survival for the fittest" or* "*Maximize the expected subjective utility*), he would have to recognize that can not identify all the feasible "**means**" which would be considered, by the system step after step in order to reach this final end.
"*There might exist hundred of million of distinct microenvironments niches to which species could separately adapt, and these niches may have been filled gradually as the processes of variation continued to create new kind of organisms*[3]".

And there is no "generally accepted agreement" about the rational definition of the ultimate end of any socio economic system: "*Reason, taken by itself, is instrumental. It can't select our final goals, nor can it mediate for us in pure conflicts over what goals to pursue*[4]"

At this stage, the (percieved) complex system's modelers, and more specifically here, the socio-economists designing some workable models for studying the behavior of a complex socio economic system, have to reconsider the familiar criteria for characterizing the epistemic relevance of the reasoning processes in use in their argumentation.

Complexity: Unpredictability, Inseparability, and Irreversibility.

If we aim to describe such systems behaviors in order to help the actors **to prescribe** their "next step", we probably shall design some **empirical models** rather different that the more **normative models** built in order **to predict** it. And even if those workable symbolic models appears rather similar, we presume that the rational searching processes used to design and to legitimate them will differ, as will differ the reasoning processes of their interpretation leading to practical conclusions.

The experience gained since forty years in studying the behavior of large complex systems gives us to day a more "open - minded" understanding of the effective use of human reason in such affairs. We realize that we have more to reconsider the "**Why question**" : the *epistemological foundations* of the legitimation of the results of our scientific research (results which have to be "teachable here and now"), than to confine ourselves in the "**How question**" : the discussion of the *methodological explanations* of the computation of the conclusions .

If we try to summarize the key lessons of this experience[5] in complexity modeling, we usually find the essential feature of **unpredictability** ("*Complexity: the essential unpredictability*" said P.Valéry) and the related characteristics of **irreversibility** and **inseparability.**

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[2] H.A.Simon "*Prediction and Prescription in System modeling*" , 1990, in "Models of Bounded rationality , Vol.3" , 1997, p.121
[3] H.A.Simon "*Rationality and Teleology*", in "*Reason in Human Affairs*", 1983, p.46.
[4] H.A.Simon «*Rational Processes*", in "*Reason in human affairs*", 1983, p.106.

Those features were considered as dissuading for any intelligible modeling as long as the unique tool for the design of a "*scientific model*" was the analytical deductive reasoning: the so called "*Cartesian Rationality*". During a century, the modelers have preferred to change the problem and to "closed arbitrarily the system under inquiry" than to change their inquiring method, because they believed that this analytical method (often call "scientific method") was more rigorous.
Holding as complicated (*predictable, separable and reversible*) phenomena that are percieved as complex, those analytical modelers are more and more failing in their predictions. They try, often effectively, to improve their analytical method (non -linearity, chaos theory...), but they still do not agree to reconsider the epistemological foundation of their belief on the exclusive virtue of the deductive - or substantive - rationality.

Is the aim of scientific research to give us some rationally **explained predictions** of the future behaviors of (percieved) complex systems? Or is it to help us to give us some **understandable descriptions**, which will help us **to design the prescriptions** of our own next future behaviors?

If we agree to consider this second answer (which is, historically, a very ancient one from Aristotle's "*Rhetoric*" to J.Locke's "*Essays on Human Understanding* " or G.Vico's "*Principj di Scienza nuova*", through the "*The Notebook of Leonardo da Vinci*"), we can to *day «deploy the span of rationality*» in some understandable and reproducible way: The empirical evidence gained by our contemporary experience of socio-economic systems' modeling appears rather convincing.

From "*Cybernetic Modeling*"[6]to "*Systemic modeling*"[7], the **Paradigm of OrganisaCtion**, initially formulated by the Russian economist A.Bogdanov[8] and rather completely synthesized to day by Edgar Morin in the first four volumes of "*la Méthode*"[9], gives us a general framework (or "*Method*") which present the basic inquiring principles guiding the intelligible modeling of complex systems, and particularly of evolving socio economics organizations.

In other words, social organizations that exhibit a behavior percieved
- As inseparable between mutually independent parts
- As **irreversible,** never perfectly restoring some initial or previous state,
- And as **uncertain,** never surely predictable.

Nevertheless, the behavior of those organizations appears usually intelligible for the various actors engaged in their modeling and their managing processes. "*Wonderful, but not incomprehensible*" underline H.A.Simon in the first page of his original presentation of systemic modeling titled "*Understanding the Natural and the Artificial Worlds"*[10].

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[5] See amongst some recent papers R. Delorme "*The Foundational Bearing of complexity* ", in A. Amin et al, ed. "*Beyond Market and Hierarchy*", 1997, p.32-56, and " *Evolution et Complexité: l'apport de la complexité de second ordre à l'économie évolutionnaire"* in *Economie Appliquée*, T. L, 1997, n°3 p.93-118; J.L.Le Moigne "*On theorizing the complexity of economic systems*", in the Journal of Socio-Economics, vol. 24, n°3, fall 95, p.477-500.
[6] G.Klir and I.Vallach: "*Cybernetics modelling*", Iliffe Books, London, 1967.
[7] J.L. Le Moigne, "*La Théorie du Systeme Général, théorie de la Modélisation*" PUF, Paris , 1977- 1994
[8] A.Bogdanov *"Essays in Tektology*" first published in Russian in 1921. In English, Intersystem Publications , Seaside, Cal. 1980
[9] Published in 1977, 1980, 1986, 1990. The first volume "*Method vol.1, The Nature of Nature*" was translated in English in 1992. P.Lang, N.Y.
[10] H.A.Simon: "*The Sciences of the Artificial*", 1969-1996. P.1. The devise is quoted from a vignette of Simon Stevin, illustrating the law of the inclined plane

The human reason does not necessarily destroy the "*enchantment of the world*" when it helps us to design symbolic models guiding some understandable search for meaning.

But here we need a less simple - or naive - understanding of the cognitive processes involved in **symbolic modeling** and in **search reasoning**[11], than the classical, analytical and deductive one (the so call "Cartesian" or "Substantive" Rationality). Those deeper "*alternative conceptions of rationality*[12]" are frequently defined in general terms as "Dialectical", or "Reflexive" (Kant) or "Procedural" (W.James, H.A.Simon) Rationality[13]. Those terms characterize a large span of the multiple forms of human reasoning ("*the process of thinking that underlie judgment and choice"* say H.A.Simon[14]. We may here focus on the facets of this fan, which appear correctly adapted to the modeling of complex and evolving socio- economics organizations.

We have to be able to design models of systems percieved as evolving in uncertain contexts,

- **Inseparably** maintaining, ***and*** relying, ***and*** producing those contexts in which they are active, ***and*** self -maintaining, self-relying, and self-producing themselves,

- And **irreversibly**, transforming themselves in some ***deliberated*** *way*, searching (not always successfully) for some "*appropriate outcome*".

And we consider that those social organizations are able to elaborate along time, step by step, such complex behaviors, using this strange resource of human reason that G.Vico call "**Ingenium**", or "**Mente heroica**"[15]: the primary ability of human mind ***to join***, or to relate, or to associate, instead of first to separate, or *to disjoin:*

"It was long ago noticed and established that man in his activity, practice and cognition, only joins and separates…But further investigation reveals that these two acts, joining and separation do not play an equal part in the activity of man: joining is primary, separation is derivative. In cognition, no «distinction», «opposition» or «differentiation» is possible without a preliminary comparison; that is, without the joining of separated complexes in common field …of «experience»[16] "

This experience of the use of human reason in complex organizations modeling has led the systemic modelers to focus more on two related characteristics of the procedural - or dialectical -

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[11] A.Newell and H.A.Simon: "*Symbol and Search, Computer Science as Empirical Inquiry*", 1975 ACM Turing Lecture.

[12] H.A.Simon, "*Reason in Human Affairs*", 1983, p.37

[13] I shall avoid here the term "**Bounded Rationality**" proposed and discussed by H.A.Simon "*to designate rational choice that takes into account the cognitive limitations of the decision maker, limitations of both knowledge and computational capacity*"(1987. Vol. 3 of "*Models of Bounded Rationality*", 1997, p.291). The physical limitations of cognitive and computational capacities are not the limitations of the mental concept of rationality. Rationality as such has no limit: It appears more or less adaptive or adequate or appropriate, more or less formal or natural. "*Economic Rationality* " says H.Simon is "*Adaptive Artifice*"(Title of chapter 2 of the second and third edition of "*The Sciences of the Artificial*", 1980, 1996. p.24) . Although using limited cognitive capacity, human reason appears able to solve effectively complex adaptive problems through heuristic "*symbol and search processes*". Therefore, if we may designate this type of reasoning, we can speak of "*abundant*" better than "*bounded* " rationality.

[14] See note 11

[15] E.Husserl, in his now famous "*Wien Conference*, 1935, concluded to a call of "*the heroism of human reason*", able "*to elaborate … an historical teleology of rational infinite aims* "(p.382 of the French translation of "*the Crisis of European Science*").

[16] A. Bogdanov: "*Essays in Tektology*", 1921, translated in English by G.Gorelik, 1980, p.63-64.

rationality which appear to be correctly and pragmatically adapted to the organization's modeling criterions of inseparability and of irreversibility.

The first one, **inseparability**, will permit to consider the **recursive relationships** between an organization and its environments: it sees itself as autonomous and dependent, transforming it and transformed by it. E. Morin proposes first to characterize the Paradigm of Organizaction by this recursive relationship: It is an "*Eco - Auto - Re - Organization*", and we can label as "**Recursive Rationality**" this form of reasoning.

The second one, **irreversibility**, will permit to consider the **teleological behavior** of the complex and evolving organization: Seeing itself as evolving through time, the organization will try to intelligently elaborate and re elaborate its own projects or ends; it knows that it can do so through its own ability to model and to understand, at each step, its own behavior. This intelligent behavior is the product of the *Information Processing capabilities* (H.A.Simon) of any complex organization. E.Morin propose to add this second feature to the Paradigm of OrganisaCtion: "*Informational, Computational, Communicational Organization* "; We can label "**Teleological Rationality**" this form of "*Intelligent rationality*[17]".

Recursive Reasoning: If we cannot separate the Organized and the Organizing processes…

"*The organization, the organized thing, the product of this organization and the organizing are unseparable*[18]*".* Any observer acting in a social organization, from the small business to the great society, and trying to describe it in order to rationally prepare his next action, will agree: the process and its result are always interrelated through time.
Each action aiming to modify *'the organized thing'*, or *'the products of the organization'*, or its *'organizing activities*' affects effectively, immediately or not, the others facets or components.

We can, in many practical cases, ignore for some moments those constitutive interdependencies: H.A. Simon suggests to consider the property of "*Near Decomposability of Social Systems*" to establish an "*initial state description*" of the organization (the "*organized thing*"), from which we could through ***"means-end analysis***", discover some "*process descriptions*" (the "*organizing process*") which will lead to some desired state[19]. The progressive discoveries of those processes' descriptions are often guided by the interpretation of the memorized observations of its own previous behaviors by the organization itself.
But this pragmatic suggestion does not tell us in teachable terms how to design the inquiring process involved in the designs of the observations and their interpretations.

We are facing a situation that the classical logicians do not like at all: the case where the operator is transformed by the result of its operation in a way that the observer cannot always correctly predict or compute:

"**At each step, The operand, operated, operates the operator which has operated it "**

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[17] Robin Marris, who "*does not like the 'bounded' terminology …would prefer to describe the type of mental process characterized by the writing of Simon…as «intelligent» rationality*" in H.A.Simon et al, "*Economics, Bounded Rationality and the Cognitive Revolution*", 1992, p.199.
[18] This sentence was written by P.Valéry in his "Cahiers" in 1920 ("*Cahiers 1*", ed. Pleiade, NRF. 1973, p.562). It summarize most of the discussion of the concept of "organization" and "organisaction" of complex systems published since fifty years , from N.Wiener' s "*Cybernetics*" to E.Morin' s "*La Méthode*"
[19] H.A.Simon: "*The sciences of the Artificial*", 1969-1996, p.211.

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So that, in the general case, the modeler, who may know
- At time To, the "value" of an initial *operand*: Or(To),
- The 'state description' of an *Organization* - the actual behaving of the *Organized Thing*-,
- Does not know with certainty what will be exactly at a future step, the behavior of the associated *operator* OP(To), the *Organizing Process* or the 'process description' of this *Organization),*
- Which can be transformed by the *products* of its previous *operation* (the previously operated 'behaving *Organized thing*' now operated, a new, although anticipated *Organized thing*, Or(T1))
- This transformed *operator* -the new *operating process*, OP(T1) -will have a behavior which, in the general case, cannot be predicted by the modeler with certainty and accuracy.

So, although he knows that this Organization will change, and that he can explore the field of its **possible future states (or behaviors**), he must admit that he will not know what will be the exact final result (or state) of the organizational process. He only may have some confident rational expectation of the result of **the immediately next step**, and some plausible anticipation of the possible (or impossible) future states.

"Whenever this computer has computed, the computer has changed. It is the notion of a Turing Machine; it is the notion of ***a non- trivial machine****…"* observe H.von Foerster [20].

Is "*the behavior which is the engine of the evolution*[21]", or the contrary? Nobody knows the final answer to this old "chicken and egg "problem? But, in practice, observing our own cognitive behavior, we can, pragmatically, propose some rational answer to the question: in this context, "***what to do next****?"*[22]

In some cases nevertheless, this situation of "**recursive reasoning**" has a computable issue which has been often explored by the logicians as by many others scientists: the case of the "*fixed point theorem"* or of the "*eigen behavior*" (which is more 'circular ' or 'spiral' than 'recursive'). In such cases, the modeler knows that not only the behavior of the operator will not be modify by its previous operation, but also that the next operand will exclusively be the result of the previous operation:
If we consider a closed set E in R_n and a function f which maps E into E, this operator f has a fixed point x* if it exists at least one point x of E such that f(x*)=x* . That means that in such cases the modeler, knowing that such fixed point exist, can compute using a step by step simulation starting from any feasible initial state description, the final eigen value, or the final state that would reach the evolving system after a finite number of steps
This beautiful case is not often observed in practice, but the classical economists like it very much: it suggest a theory for the determination of the future self equilibrated state of a given market, when one may prefer to over simplify the description of the phenomena in order to compute completely a theoretical prediction, prediction which in practice….

If it is not effectively observed, this type of complex behavior has a great learning value, because it suggest some understandable (and simulable) process of a self organizing phenomena showing **the emergence** of a new stable organization. H. Von Foerster, the pioneer of our contemporary theories of self - organizing systems, has suggested many interesting examples of

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[20] H.von Foerster: "*A Constructivist Epistemology*", 1981, in "*Cahiers de la Fondation Archives Jean Piaget*", Geneva, 1982, n° 2-3, p. 205.
[21] J.Piaget : "*Le Comportement, Moteur de l'Evolution*", ed. Gallimard , Paris , 1976
[22] See note 10, p.121.

such "**Eigen behaviors**", particularly in the case of "cognitive behaviors", when the "*observing system*" cannot be separated from the "*observed system*"[23].

In practice we can usually describe those types of recursive reasoning only through step by step simulations: If we ignore generally all the possible states that the operating system may exhibit, we can identify, with the initial description, most of the constraints which will affect its future states. Therefore, the exploration of the "*field of possible future states* " is a feasible task, particularly when the exploration aims to be "*larger than deeper*". The modeler may identify some possible "*emergent organizations*" which were not explicitly registered in the initial state description, and that the usual linear extrapolation will never show. However, the power of this inquiry depends of the "richness" of the description of the initial state. If it is over simplified, ignoring most of the major conjunctions interweaving the Organizaction[24], one may anticipate that the recursive search for some emergent possible states will be rather disappointing.

Here is perhaps one of the most relevant justification of the use of some forms of "**recursive rationality** "in the understanding of the behaviors and the transformations of self - organizing systems: the strong incitement it gives to the modeler to primary focus on the modeling processes and on the step by step simulation.
More effectively drawn will be the initial picture of the organisaction, more efficient will be the recursive drawing of the field of possible future emerging states ("A richer picture for a deeper understanding"). The cognitive process, or reasoning, involved in complexity modeling is neither more nor less rigorous than the reasoning involved in algorithmic computations[25], but it *does not separate the symbol processing of model building and the heuristic search* of model re - drawing or transformation: The cognitive process of understanding or interpreting[26].
If we want "to develop our **knowledge of organization**, we have, recursively, to understand the **organization of our knowledge**," concludes E.Morin[27]

Teleological Reasoning: "Reason, taken by itself, is instrumental. It can't select our final goals"[28]

If the complex organization's modeler can eventually design some possible future states which would eventually reach this organization, he will be in position to select, amongst those possible states a desired one (or, at least, some prefered ones), say an intermediate desired goal, and therefore he can now identify the adequate way to reach it. The analogy with the behavior of the good chess players has often be used to illustrate this rational strategy.

In practical situations, the modeler knows that the organization will evolve and transform itself: If he does not undertake any teleogically - or 'deliberated'- designed action, the system will self

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[23] H.von Foerster: "*Observing Systems* " Intersystems Publications, CA; 1981 -1984.
[24] Those "*major conjunctions*" are presented and discussed in J.L. Le Moigne: "*The Intelligence of Complexity*" in "*The Science and Praxis of Complexity*", UNU Press, Tokyo, 1996, p.42-44. In French, a more recent presentation in "*La Modélisation des Sytèmes Complexes*", Ed. Dunod, Paris, 1990-99. 76 -81.
[25] H.A.Simon and C.A.Kaplan : "*Foundations of cognitive science*", in M.Posner, ed. "*Foundations of Cognitive Science*", 1989, p.19
[26] A.Newell and H.A.Simon: "*Computer Science as Empirical Inquiry: Symbol and Search*", 1975 ACM Turing Lecture: "*Symbol systems are collection of patterns and processes … The most important properties of patterns is that they can designate objects, processes, or other patterns, and that, when they designate processes, they can be interpreted. Interpretation means carrying out the designated process.*" (Communication of the ACM, Vol.19, n°3, March 1976, p.125.
[27] E. Morin : "*Method , Vol.*1", Peter Lang ,N.Y. 1992, p.358
[28] H.A.Simon: "*Reason in Human Affairs*", 1983, p.106.

evolve toward some "emerging" new order, through "*Chance or Law*"[29]; And in both cases, the modeler cannot predict it with certainty, and he must resign himself to reach a final and non consciously desired "*spontaneous Kosmos order*"[30].
But if the modeler cannot "*non intentionally **predic**t*" the future of an evolving complex system submit to chance or to some (unknown) law, he can, "*intentionally, **prescribe***" it, assuming that the organization may reach one of the next possible future states that he can identify and evaluate using his cognitive modeling resources: "*Modeling is a principal - perhaps the primary - tool for studying the behavior of large complex systems*", observe H.A.Simon[31] who *conclude "that we will do a better job if, before we begin (to design a model), we ask what our goals are - what questions we are trying to answer* "[32]

To the question «**What are our modeling goals**?» it is very probably no rationally computable definitive answer. We can explain a posteriori for which reasons we have selected such or such goals; but we cannot explain why we have not selected, here and now, some other plausible goals that would be prefered by some other peoples. "*Reason* add H.A. Simon, *taken by itself is instrumental. It can't select our final goals, nor can it mediate for us in pure conflicts over what final goals to pursue - We have to settle these issues in some other way.* "[33].
However, here, we have gained some pragmatic experiences. We know not only *that «the ends do not justify the means*», even if they are rationally justified to reach those ends; We know also that the search for means adequate to reach such ends (often seen as "*intermediate goals*"), produce some new "*problems*", that is some different representations of the ends which now appears as (and often are) new ends for the modelers.

This cognitive experience has been discussed by many researchers since J.Locke ("*An Essay concerning Human Understanding*", 1689), G.Vico ("*De nostri temporis studiorum ratione*", 1708) or E.Kant ("*The Critics of teleological Judgment*", 1793). But for our contemporary discussion, we can usefully rely to the works of J.Dewey[34] on the concept of «**Deliberation»,** and of H.A.Simon[35]on the concept of «**Means-Ends Analysis**».
The practical search for some means which will eventually lead to some initial accepted ends, will often suggest, when considering the plausible consequences of the use of such means, to the identification of some plausible and eventually desired new intermediate goals, which, in turn, will recursively and heuristically suggest some new plausible means …

So that, if "*reason cannot select the final goals*" of our actions (and organisaction), it can effectively help us to identify, at each step of a reasoning process, some "*agreed-on intermediate goals*", intermediate goals cognitively designed through the inquiry for adequate means. J.Dewey and H.A.Simon call this cognitive design process the "**Principle of Intelligent Action**": When a complex autonomous system is searching for some adaptive behavior, it can *dialectically* search for new means **and** for new goals.

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[29] L.von Bertalanffy: "*Evolution: Chance or Law* ", title of § III 4 of "*Problems of life*" 1949 -1952 in English. J.Monod knew probably this book and this title (translated in French , 1961)when he published his now well known "*Le Hasard et la Necéssité*", 1970
[30] Many economists like this hopeless theory of the two social orders, Kosmos and Taxis, developed by F.A.Hayek who supposed that Kosmos is more spontaneous than emergent, and that Taxis is more arranged than deliberated.
[31] H.A.Simon: "*Prediction and Prescription in Systems Modeling*", 1990, *in "Models of Bounded Rationality, Vol.3"*, 1997, p.115.
[32] Id., p.127
[33] H.A.Simon: *"Reason in Human Affairs*", 1983, p.106
[34] J.Dewey : "*Logic : The theory of Inquiry*", 1938 , p.161 +
[35] H.A.Simon : "*The Sciences of the Artificial*", 1969- 1996, p.121 +

We have initially see Evolution as "*postulating the ends without specifying the means… We have perhaps (to day) to see Evolution … in a complex world as specifying means that do not lead to any predictable end*", suggest H.A.Simon, who conclude: "*From end without means, we have come full circle to means without ends…. **Searching is the end*** "[36]

H.A.Simon has proposed the interesting parable of oil painting to illustrate this rather familiar use of **teleogical rationality** in any design activity, when "*each step of implementation created a new situation; and the new situation provided a starting point for fresh design activity".*

"*Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. In oil painting, every new spot of pigment laid on the canvas creates some kind of pattern that provides a continuing source of new ideas to the painter. The painting process is a process of cyclical interaction between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggest new goals[37]".*

When we interpret this oil painting parable in order to describe the behavior of a complex organisaction, we may consider and model this evolving self - organizing system not only as usual, as a **«finalized» system,** but mainly as a **«finalizing» system:** A system which finalize itself through its own behavior.
This is the main characteristic of its «*autonomy*»: although opened and interacting with others systems which may constraint its behavior, the autonomous system is able to «*re finalize itself*» at each step, that is to re - elaborate its own rules of behavior. When we describe the behavior of a complex organization as finalized, we must understand that it is also finalizing.

We face here a new type of complexity modeling: How the finalized design of human action (the organizational behavior) designs the finalizing process that will guide its next step (the design of the next actions)? The Principle of Intelligent Action suggests some pragmatic answers[38]that can be summarized by their headings, once defined the operating concept of "*Intelligent System*" or "*Intelligent Organizaction*":

An intelligent system is able to process some "**means-ends interactions** " which characterize it as a Self - Finalizing system ("Problem setting") and as a "Self Action-Designing" system ("Problem solving") requiring the various forms of **Teleological Reasoning**:

* As a **self - finalizing system**, it has

- To intentionally design, using ***symbols systems***[39], representations of its own behaviors in the contexts that it perceives,
- To register, **to communicate** and **to memorize** those informations

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[36] H.A.Simon : "*Reason in Human Affairs*" , 1983, p.70
[37] H.A.Simon : "*The Science of the Artificial* ", , 1983-1996 , p.163
[38] One may find some developments in two of my recent studies published in French: "*L'Economique entre Energétique et Pragmatique: Evolution, Rationalité et Téléologie*" in "*Economy Appliquée*" Tome L, 1997, n° 3, p.53-70. And: "*Représenter et Raisonner les Comportements Economiques*" in C.Roland-Levy & P.Adair, Ed: "*Psychologie Economique, Théories et applications*", ed Economica, Paris 1998, p.319-337.
[39] Symbols systems such as words, pictures, graphs, and not only, nor mainly, numerical figures.

- And **to compute** various relationships between the representations of its expected behaviors and its observed behaviors.
-That means that it is able to settle and to assess its next intermediate goals in terms of its own problems. It is first a "Problem Finder" or a "Problem Setter" system.

* As a **self -designing system** it has also

- Through ***heuristic search computation***, to design and to assess various combinations of feasible means which may eventually "solve" the previously formulated problems;
- This problem solving process is usually oriented toward the identifications of "*satisficing*" solutions, proposing some "convenient or adequate combinations of the next actions" which may adapt the next behavior of the organization to the various intermediate goals that it is now considering.

In order to model and to understand the teleological intelligent behavior of any complex organisaction, we always need to see it as a "symbol processing" system able to design, to memorize, to communicate and to compute through heuristic search those symbols. The recent works on the formation of *organizational routines*, the developments of *organizational learning and knowing processes* as well as the renewal of old studies on *organizational reporting*, promoted by the "*New new" Institutional (and Conventional) Economics* illustrate in practice this types of "symbolic modeling" of complex teleological organizations.

It is rather trivial to say that the use of teleological reasoning is not adapted at all, for epistemological and practical considerations, to any "*predictive modeling*" of the future behaviors of complex systems. However, we can notice now that it is no more directly adapted to their "*prescriptive modeling*": It does not tell "what to prescribe", but it tells "How to prescribe" and this answer is formulated in rather modest terms. It tells us *"**how to describe*** " in order to help the organizational managing system to elaborate more effectively the prescriptions that it will implement or try to implement at the next step.

One of the interesting lessons given by this discussion of the exercise of teleological rationality in self organizing systems is to focus the attention of the socio - economists on their intentional modeling of the past and actual steady -states of the observed organization: They have to model their own "**observing system**", and to identify, at each step, its projects, or its teleological characteristics. "*The meditation of the object by the subject takes always the form of the project*" said Gaston Bachelard in pioneering essay "*The New Scientific Mind*"[40].

The Pragmatic Turn: Recursive and Teleological Reasoning in complex socio economic systems modeling.

We may conclude this brief epistemological discussion of the two forms of rationality that we may also use in the modeling of socio economics systems with a short illustration concerning a contemporary political discussion: The so call "global revenues sharing " policy.

[40] "*Le Nouvel Esprit Scientifique*" was published in French by G.Bachelard in 1934 , one year before the first edition , in German , of the K.Popper's "*The Logic of Scientific Discovery*"

Usually many economists say that they have developed (or are developing) some scientific knowledge which will permit to prescribe the most equitable sharing. The political powers would have only to apply their prescriptions. Fortunately, perhaps for our societies, all the economists and experts do not agreed upon the same prescriptions at the same moment. However, many economists have still some difficulties to admit that they do not have to determine the "best prescription", if they are now admitting that they are not in position to deliver the right answers to the "predictive questions".
Perhaps is it useful here to read again H.A.Simon: "*Generally, modeling serves policy*" (To serve is not to define or to dictate)…"*We construct and run models because we want to understand the consequences of taking one decision or another…*"[41].
So if we start from the question: «How to describe the Revenue Sharing Policy», assuming that we want to understand it in its complexity *(inseparability, irreversibility, unpredictability*) we shall probably observe that the *process use at a given period to share* the global revenue of the economic production (the GNP.), *has a recursive influence on the size* of the global revenue at the next periods (If you are involved in the cooking of the cake, the rule used to share the cake once cooked, between the various people involved, will very probably modify the quality and perhaps the quantity of your contribution to the cooking of the next cake!) .
Even if we do not know what will be those future effective behaviors of each economic agent, we are able to model some of the various possible behaviors and to appraise them pragmatically … if we design some adequate representational systems.
Proposing some richer description of the possible states of the systems, and being aware to test and to complete it at each of the next steps of the implementation of such or such prescribed policy, we may "*serve policy*", proposing it some richer understanding of the underlying evolving process.
If we study, for instance, the consequences of a new rule aiming to reduce in a context of severe unemployment, the legal weekly labor duration, **seeing it as a recursive and teleogical process**, we shall probably establish, pragmatically, a richer description of the problem than if we see it, as usual, as a linear and cumulative process (just as an energetic system which is suppose to automatically increase its outputs when its inputs increase).

Perhaps is it time to invite **the economic sciences to face now a new "Pragmatic Turn"**, where some powerful procedural or dialectic forms of rationality, the recursive and the teleological one, will be generally accepted and often used, mainly in the developments of the modeling or describing processes of complex evolving socio economics systems? Can we longer separate our methodologies from the contexts in which we use them, and from the ends for which we use them?

[41] H.A.Simon "*Models of Bounded Rationality*, vol.3", 1997, p.122.