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Theories as Agents of Progress –

Can we see a Bridge between Constructionism, Chaos Theory and Organization Research?[1]

by

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Abstract:

”Constructionism shares constructivism's connotation of learning as ”building knowledge structures” irrespective of the circumstances of the learning. It then adds that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sandcastle on the beach or a theory of the universe... If one eschews pipeline models of transmitting knowledge in talking among ourselves as well as in theorizing about class rooms, then one must expect that I will not be able to tell you about my idea of constructionism. Doing so is bound to trivialize it. Instead, I must confine myself to engage you in experiences (including verbal ones) liable to encourage your own personal construction of something in some sense like it. Only in this way will there be something rich enough in your mind to be worth talking about.” (Papert, 1991)

This essay is intented as a contribution to the philosophical discussion of the development of science, i.e. the process of adopting, keeping and rejecting scientific theories. The aim of this short investigation is to make a contribution to the understanding of constructionism and other scientific theories like chaos theory and self-organization, which influences organization theories. The present essay constitutes rather an elaboration of views than a solution to given problems but perhaps the views gives another piece to the puzzle of understanding the development of scientific theories.

Keywords: **chaos theory, constructionism, organization theory, self-organization, self-fullfilling prophecy**

If people define situations as real,
they will be real in their consequences.
W.I. Thoma

Chapter 1: Constructionism - An introduction:

Constructionism is usually thought as an educational theory, rather than a theory with broader sociological implications, but ”Social Constructionism” is today a very fast developing research area. We believe that borrowing this view from educational sciences can offer fresh and insightful perspectives because borrowing ideas from one field to another can be an important avenue for breaking new ground for old problems.

Constructionism asserts that knowledge is not simply transmitted from teacher to students, but is actively constructed by the mind of the learner. This view suggests that learners are particularly devoted to create new ideas when they are actively engaged in making external artifacts that they can reflect upon and share with others.

That means that one of the main ideas of constructionism is that the learner actively construct/reconstruct knowledge from their experiences. That places special emphasis on knowledge construction, which takes place when learners are engaged in building objects in reality. Constructionism differs therefore from other learning theories along several dimensions, which often describe knowledge acquisition purely cognitive and/or as behaviorism. This is even opposed to an educational philosophy, labelled instructionism (learning is seen as a process in which students passively receive information from teachers, for example presenting structured series of lessons by computers). The constructionist philosophy underlies developments of LOGO, Smalltalk and related programming environments for learning (Quast-87). These environments provide computational media that makes a variety of computational objects available to novice programmers and encourages experimentation and/or improvisation: programmers can build systems simply by copying, dragging, and combining parts via direct manipulation. Constructionism in these areas has sometimes been overinterpreted to mean that computational environment should initially be completely blank to be populated by creations of the user, but this is not the ”Grand Theory” about constructical ideas.

It argues that learners become intellectually engaged when they are working on personally important activities/projects. When a constructionist discuss learning she/he means forming new relationships with knowledge is important but also to form new representations of knowledge. Constructionism also emphasizes *diversity*: it “sees” that learners can make connections with knowledge in many different ways. Constructionist learning environments encourage therefore multiple learning styles and multiple representations of knowledge.

Social constructionism is an approach, which in recent years has become influential in social sciences. ***Central is the idea that social phenomena do not exist as natural events/real objects in the world they are brought into existence by human social activity***. This has important implications for how they should be studied. It has argued that rather than taking the existence and/or even the character of social phenomena as given, one should document processses through which phenomenas are constituated as they are. From this point of view it is not important to identify causal relationships amongst social phenomena.

Constructionism is a controversial approach, because almost all of mathematics and natural science education is based on traditional philosophical perspectives (often implicit but powerful) *that what we know is what we can justifiably demonstrate to be true*. But we argue (Quast-03) that first order cybernatical views build on mechanical ideas ”loaned” from natural philosophy has great difficulties to ”explain” important questions in organization theory

- the startpoint (why starts organizations?) in the rational organization theory a´la Abrahamsson (Abrahamsson-86, 89, Andersen-Abrahamsson, 00)
- the development of organizations, in our view a evolutionary one.

We have to shift the view from a ”technical (first order cybernetical) sociological” point of view to new research tools like complexity theory, which means the study of chaos and self-organization.

The simplest idea in constructivism, and perhaps the grounding stone of all the other shades of constructivism is what Glasersfeld (Glasenfeld-90) calls *trivial constructivism* (also known as *personal constructivism*). The principle can original been credited to Jean Piaget (a pioneer of constructivist thought). We collect some of the ideas in the following statement:

Knowledge is actively constructed by the learner, not passively received from the environment (including very genenerally ideas about ”teachers”).

This statement must be seen as a reaction against other epistemologies promoting simplistic models of communication as simple transmission of meanings from one person to another (Quast-95). The prior learners knowledge (bias) is to be able to actively construct new knowledge. But this raises some questions: What is the environment? What is knowledge? What is the relation between knowledge and the environment? And questions like: Are there environments, which are better for learning? Trivial constructivism says nothing about these issues, and these shortcomings other faces of constructivism tries to address. *Radical constructivism* adds therefore a new principle to trivial constructivism, which can expressed as: *Coming to know is a process of dynamic adaptation towards viable interpretations of experience. The knower does not necessarily construct knowledge of a "real" world* (Glasersfeld- 90)

In extreme situations could this expression mean that we all are living in our own dreams (that means i our own worlds), more or less unable to communicate with other people. *But even radical constructivism does not deny an objective reality, but states that we have no way of knowing what that reality might be.* Mental constructs, created from past experience, help to impose an order through the flow of continuing experience. However, when they fail to work (external or internal constraints) a new situation is grounded: The constructs have to change and we try to accommodate new experience. *Within the constraints that limit our construction is therefore room for alternatives* (in the complexity theory we discuss this phenomena as bifurcation, specially in theoretical models in decision theories (Quast-92).

So how can people with different world views communicate? From a radical constructivist perspective communication need not involve identically shared meanings between participants. It is sufficient for their meanings to be *compatible* (Hardy/Taylor-97). If neither of the parts does anything completely unexpected to the other, then ideas of identically shared meaning are maintained (Glasersfeld-90). But neither trivial nor radical constructivism look closely at the extent to which human environment affects learning: it is part of the total environment. These issues are focussed in more detail by social and critical constructivism: Beyond the social environment of learning situations are a wider context of cultural influences, including custom, religion, tools and language. *"[What we need] is a new conception of the mind, not as an individual information processor, but as a biological, developing system that exists equally well within an individual brain and in the tools, artefacts, and symbolic systems used to facilitate social and cultural in teraction*." (Vosniadou-96). *The tools we use affect the way we think* (Salomon and Perkins-98). *Critical constructivism* looks therefore at constructivism within a social and cultural environment, but adds a critical dimension aimed at reforming these environments in order to improve the success of constructivism. Taylor (Taylor-96) describes *critical constructivism as a social epistemology that addresses the socio-cultural context of knowledge construction*. It confirms the relativism of radical constructivism.

Critical constructivism adds a greater emphasis on the actions for change of a learning teacher, which include a primary concern for maintaining empathetic, caring and trusting relationships and last not least a commitment to dialogue that aims to achieve reciprocal understanding of goals and interests. *Constructionism* asserts that constructivism occurs especially well when the learner is engaged in constructing something for others to see: Constructionism shares constructivism's conotation of learning as "building knowledge structures" irrespective of the circumstances of the learning.

These thoughts lead to some conclusions:

- Constructivism is a way of thinking about knowing, a referent for building models of teaching, learning and curriculum (Tobin and Tippin-93). ***In this sense it is a philosophy***.
- Constructivism also can be used to ***indicate a theory of communication***. When we send a message (providing information), we have no knowledge of the receiver, no idea how the message was received, and we cannot unambiguously interpret the response (typical situations for modern WEB-based information systems). Viewed in this way teaching becomes the establishment and maintenance of languages and a means of communication between the teacher and students.

Constructivism state:

Hypothesis 1: Scientific beliefs and our philosophy of science significantly affect cultural values and beliefs (Kuhn-70).

Hypothesis 2: Cultural beliefs about man's relation to nature significantly affect the amount and kind of impacts that will result from human activity. Specifically, societies with strong cultural beliefs that man is an integral part of nature tend to have less overall impact, and vice-versa, i.e."The Gaia Theory" in ecological sciences which states that it is impossible even for humans to separate ourselves from the system of study, as reflected in the concept of "participatory science".

But Constructivist epistemology is obviously difficult to label, depending on different interpretations, specially about how constructivist epistemology should affect educational practice and ideas about learning theory. The importance of constructivism can be understood by comparing it with the opposite, more traditional approach in epistemology - cognitive science, which sees knowledge as passive reflection of external, objective realities. This implies a process of "instruction": to get such an image of reality, the subject must somehow receive the information from the environment, i.e. it must be "instructed". This view means that our senses work like a camera that projects images of how the world "really" is to our brain, and use that image encoding the objective structure "out there". Such a view runs quickly in conceptual problems, mainly because it ignores the complexity of the world. Moreover, detailed observation reveals that in many cases, cognition does not work a camera. It seems us that the subject is actively generating plenty of models, and that the role of the outside world is limited to reinforcing some of these models while eliminating others (selection). From en evolutionary point construction can naturally have selfish purposes: subject wants to get control over what it perceives, to eliminate deviations/perturbations from its own preferred goal state, typically in cybernetical theories. Control requires models of the thing to be controlled, but that model will only include those aspects relevant to the subject's goals and actions (self-fullfilling prophecy).

Constructivism has roots in Kant's synthesis of rationalism where it is noted that the subject has no direct access to external reality, and can only develop knowledge by using fundamental in-built cognitive principles (categories) to organize experience. One of the first psychologists to develop constructivism was Piaget through a theory (genetic epistemology) of the different cognitive stages, which a child passes while building up a model of the world. In cybernetics, constructivism has been elaborated by von Foerster, who noted that nervous systems can not absolutely distinguish between perceptions and hallucinations, since both are merely patterns of neural excitation. This neurophysiological view were further developed by Maturana/Varela seeing knowledge as necessary components of autopoiesis (self-production) characterizing all living organisms. The difference between a Lamarckian and Darwinian evolutionary theory is from this point of view that Lamarck assumed that the environment somehow instructs an organism how to be adapted. Darwin's view emphasized that an organism has to find this out for itself, by trial and error. Constructivist mechanisms are not limited to higher level learning or discovery of models, they pervade all evolutionary processes.

A similar conceptual transition from instruction to construction took place in the theories of immunity: organisms are not instructed how to produce the antibodies to stop ”invaders”, they need to generate possible combinations by trial-and-error until it finds a antibody that works. Once such an antibody is ”discovered”, knowledge about how to fight particular infection remains (in organization theories this is the ***organizational memory*** (Quast-03)).

Since constructivism rejects any direct verification of knowledge by comparing the constructed model with the outside world, an important issue is how the subject can choose between different constructions to select the “right one”. Without such a selection criterion, constructivism would work like the absolute relativism: the assumption that any model is as adequate as any other (popular saying: *Anything Goes*). Often used criteria are ***coherence,*** *agreement between different cognitive patterns* within an individual's brain, and ***consensus****, agreement between different cognitive patterns* of different individuals. The latter position leads to “social constructivism”, which sees knowledge solely as products of social processes of communication and negotiation. *We note that adequacy of knowledge depends on different criteria none has an absolute priority over the others. Constructivism and constructionism are radical ideas. Constructivism forces us to acknowledge that learning is a creative process and that knowledge is constructed rather than received. Constructionism suggests that this process takes place not only inside the heads of individuals, but involves interaction with the material and social worlds. Both imply a great deal of freedom and the possibility of alternative epistemologies.*

2) Complexity Theory - Linear Versus Non-linear Behavior:

Classical physics is a science based on our belief in a deterministic, time-reversible description of Nature, which not include any distinction between past and future. The Universe is ruled by deterministic laws, yet the macroscopic world is not reversible. This is known as Epicurus clinamen, the dilemma of being and becoming, the idea that some element of chance is needed to account for the deviation of material motion from rigid predetermined evolution. Probability-based interpretations make therefore for us the macroscopic character of our observations responsbile for the irreversibility we observe. Under these circumstances for uninitiated, chaos theory must be seen as a valued mathematical theory only to a small group of theorists. But studies of chaos led us to understandings of both nonlinearites in the world and functional aspects of instability in adapting new situations. Chaos is one possible result of the dynamics of non-linear systems. Nonlinearity refers to behavior in which relationships between variables in systems are dynamic and disproportionate. In non-linear systems small changes/errors can have big effects and outcomes are subject to high levels of uncertainty and unpredictability. In nonlinear systems behavior is erratic and filled with surprises.

Disaster and emergency situations epitomize nonlinearities of human events. These are events in which relationships between relevant variables are churning. Even in our desire to create order and control situations, events often seem to churn one step ahead of our best efforts. Pagels (Pagels-88) noted that, "life is…nonlinear. And so is everything else of interest". New thinking about recognition of non-linearity in human and organizational systems has focused on functionality of disorder and instability. Nonaka (Nonaka-88) offers a view of disorder and instability in organizations *"Chaos widens the spectrum of options and forces the organization to seek new points of view. For an organization to renew itself, it must keep itself in a non-equilibrium state at all times"*. Most importantly, during times of high instability such as disasters when emergency services reach peak levels of activity, it is essential to recognize that stability can only be regained by developing strategies that are themselves unstable. We must match the instability of these environments with management practices/organizational strategies that are dynamic and fluid. The best way to understand that disaster/emergency events are non-linear systems is to compare the behavior of such systems with that of linear systems. In linear systems relationships between relevant variables are stable and relationship between cause and effect is proportionate. If disaster processes were linear we could predict the amount of resources required to bring order to chaos and how long reconstitution to he previous environment would take. But when we look at real disasters we can´t see such prediction and linearity!

To fully understand nonlinear dynamics we need to examine types of behavior that nonlinear systems generate. For our purposes, behavior refers to how change occurs in organizations and how organizational data evolve over time. Nonlinear systems exhibit three distinct types of behavior over time, labeled as

- convergence to stability or equilibrium
- stable oscillation
- chaotic.

Each behavior can appear as term behavior of a nonlinear system. We can examine the different kinds of time series nonlinear dynamical systems generate by using a simple nonlinear equation: The logistic equation is an often used algorithm for generating nonlinear time series. The logistic map takes the form $x(t+1) = wx(t) * (1-x(t))$. The variable w represents a control parameter in the range $0 < w < 4$. The variable x(t) is the value of x at the current time and x(t+1) represents the next time point following x(t).

The most simple type of time-based behavior generated by nonlinear systems is convergence to stability/equilibrium. This occurs when we start from an initial point that quickly reaches and maintains a mathematically stable point and represents the ultimate equilibrium, where change does not occur over an extended period. As one can see, once the mathematical point of stability is reached, the system remains stationary, even if time series is extended indefinitely.

A second type of nonlinear time series that can occur in the real world of organizational data is rhythmic/oscillatory behavior. This type of behavior is generally labeled as *stable oscillation* because output/responses shift fluidly in a patterned fashion. This type of smooth change is incremental change that moves up and down in a predictable manner.

A third type of nonlinear time series data that can be expected in the world of management is chaotic behavior. Priesmeyer (Priesmeyer-92) has shown how chaos appears in organizationnal systems ranging from financial management data to data from production processes. Chaos does, however, occur within definable parameters (mathematical boundaries). It is not random behavior that can result in any outcome. ***Chaos looks like random behavior but is unstable behavior over time that stays within clear boundaries.***

Although chaotic time paths may look random they are generated by deterministic mathematics. It appears that such deterministic chaos can be created by organizational systems and processses: Researchers have discovered both such deterministic chaos in organizational data (Priesmeyer-92) and the potential for this chaos in organizations (Mosekilde-91).

First, this means that systems or processes with few parts and simple interactions can generate very complex data, that look erratic and chaotic over time. A word of caution is necessary: To verify the existence of real mathematical chaos in organizational data requires use of sophisticated statistical methods. Analysts need to be careful not to call all "messy" looking time series data as chaotic. *Time series data may be nonlinear but not chaotic*. So we must be sure, are we discussing real verifiable chaos or chaos as a metaphor.

Second, Sensitivity to "Initial Conditions Systems" functioning in chaotic regimes show a tendency to be highly sensitive to their initial conditions. This means that small changes or errors can have ***amplified effects***. This point is reinforced if we consider the concept of the "butterfly effect". To examine "order within chaos" in organizational data we can examine the "attractor" of time series data. An attractor is a graphical method, chaos researchers use to determine how much change is occurring in a set of data over time. The attractor presents an image of all of the change in the data that i.e. work process data or employee performance data generate. By viewing this attractor we can begin to see the unusual and unique forms of order that the data in organizations create. To look at time-based data managers usually examine line graphs. An attractor is a different way of viewing time series data. An attractor is a mapping of data that allows us to see how all the data, relate to each other. These figures are called attractors because the data seem to be "attracted" to certain regions on the graph. While line graphs show us how each element of data changes relative to the data point behind it and in front of it, an attractor mapping shows us how all of the data we are examining change relative to each other. The attractor can show managers how much variation and change is occurring in organizational data over time.

Conventional systems thinking has focused to an extreme extent on actions necessary to stabilize systems. While instability is recognized, previous systems thinkers saw a return to stability as the only real alternative. This focus on stability thus minimized efforts to examine the positive aspects of periods of instability or even chaos.

One method for controlling chaos is to alter the parameters of the system. This means limiting degrees of freedom or the extent of the behavior available to a system. The hope is to alter behavior and/or create greater stability and predictability. In a disaster situation these degrees of freedom are often beyond the control of human actors. As an earthquake travels up the logarithmic Richter scale, the degrees of freedom in potential damage expand making control an increasingly difficult endeavor.

A second method for controlling chaos uses "perturbations" during chaotic episodes to change behavior back to more predictable. This refers to the sensitivity of chaos to small changes. The intent with such interventions is to use small change that creates non-linear effects. Scholars are increasingly critical of the types of models used for planning. For example, Forrester (Forrester-87): *"There has been a reluctance to give up the linear mathematical procedures, with the result that models have been biased to fit the linear procedures at the expense of faithfulness in representing the real world"* (even Hallén, Quast-88). These linear models, moreover, have led traditional policy modelers to seek and identify variables and system behavior that lead to some clear image of the future. As Rugina (Rugina-89) notes, such modeling efforts are based on mathematics that avoid the uncertainty inherent in real social systems. Therefore many social scientists believe that once the model produces a "stable" outcome to a problem then such a stability must represent the desired solution. ***This is obviously problematic since we know that social phenomena are inherently nonlinear and unstable.*** Traditional modelling thus seeks to generate stable solutions in an unstable world and therefore "often goes wrong".

Chaos theory opens opportunities in science and sweeps across physics, physiology, genetics and sociology with little regard to discipline boundaries. Oriented to infinite variety of starting points, infinite and fractal connectedness at all scales of observation, Chaos theory offers an ontological envelope not only to the natural sciences but also to human sciences like sociology (in our research organizational theory). Out of these new findings about the structure of reality and the dynamics of complex systems, a new methodology is possible which serve the human interest in both certainty and dependability on the one side as well as change and renewal on the other. ***These attributes, taken together, falsify falsifiability as a maker and breaker of theory***. In modern science, if the data do not confirm the axioms and propositions of the theory, the theory must be reconstructed. If data do not conform to the predictions and patterns of given chaos findings, then one assumes that bifurcations have occurred to change the dynamics without falsifying the previous findings. Falsifiability is dethroned by chaos theory.

Popper (Popper-65) made falsifiability the ultimate test of formal theory. *Social systems with the ontological features of chaotic systems cannot be falsified*. It is an ordinary feature of such systems that causal connections are unstable for chaotic systems. The model of theory building currently in vogue in American sociology takes the form of an endless circle in which theory sets at the top from which hypotheses are generated. Hypotheses are operationalized and data collected by direct observation in the field to which the theory speaks. From the data, empirical generalizations are made which, by induction build and rebuild the theory.

With such a theory, one can deduce lower order statements from higher order statements. The lower order statements have epistemic correlates in the real world which, when examined, verify *the truth value of the connection between explanadum and explanans*. In chaotic systems, however it would not reveal stable connections between explanadum and explanans - yet statements about the observation would not be false even if one were never to find the same connections again. *A second, fourth or tenth replication of the study would produce other results and the research scientist, operating within the logics of linear dynamics would declare previous studies invalid and her/his own findings the true state of the system*. (*Replicability*). In the same moment that falsifiability is removed as the ultimate test of the soundness of a theory, the importance of replicability is seen to be misplaced. One can never replicate a given study; one can only trace, in panel analysis, the ever-changing dynamics of a system. There is a limited place for replication and falsification. If modern sociology and its claims of objectivity are insupportable, the task of some sociologists is to frame a sociology that is value-full. By value-full, it is simply meant that the researcher acknowledges the value agenda from which concepts are selected and research is done.

The findings of chaos theory inform us that the task of the social scientist is not, cannot be, the discovery of the immutable laws of society; it is not, cannot be to build grand theory by means of value-free research designed to approach objective reality through the method of successive approximations, it is not and cannot be the identification of ideal and/or essential structures of social organization; if the role of the social scientist is not and cannot be to be the impartial arbiter of that which is natural and normal, of that which is deviant and - then what is it to be?

The central assumptions which ground the mission of modern science are

- objectivity as a methodological instance
- general theory as goal of social science.

The scientific task will be twofold: ***first*** to ***identify the key parameters*** which pushes social systems from near stability into a very deep chaos and, in that deep chaotic regime ***secondly*** to ***identify parameters that generates order from disorder***. The next part is to find which of the many parameters in a field push any given system from semi-stable to very unstable dynamics. Chaos theory instructs us that there are, regions of order in every chaotic regime and some uncertainty in every stable regime. Even perfectly ordered regime suddenly and unpredictably transform into nonlinear dynamics. Indeed, Chaos theory is best understood as the study of the changing mix of order and disorder in both structure and process, which is a typical situation for most natural and social dynamic processes.

3) Self-Organization (”verum ipsum factum ”)

The basic idea of self-organization is coming from natural systems, where the term itself has various interpretations. One interpretation of self-organization is based on the idea about *locally behaving units organizing interactive networks capable of global behaviors*. The ultimate aim of using self-organization is to reduce the amount of design, i.e. the system should itself make an organization capable of wanted behaviors. A self-organizing network propels its own operation recursively, that is, by restructuring its organizational basis in the present on the basis of its interactions, which means that the architecture at each moment contains expectations of its future operation. This uncertainty is contained in the distribution of nodes and links over the network. The expected information content of a subsequent message reporting change in the network system is equal to the sum/total or aggregate of all the mutual informations of the network with communicating agencies. The remaining uncertainty, that is, the structure of interactions, recurs on the previous state of the network since it was not affected by the interactions with actors. This uncertainty, however, cannot be fully perceived by any of the participating actors. They are embedded, the network structure remains (at least partially) latent for them and the operation of the network consequently remains virtually.

Structure at the network level is communicated with actors through their respective windows of mutual information. Being only partially informed, actors run their own programs on the basis of their perceptions. The distribution over the network is expected to be disturbed by local actions, and particularly by aggregates of action. The expected information content of the network is thus changed, and this is again available for partial observation. The systems of communication and action propel each other in a “structural coupling”.

Social network systems are multi-layered: at each moment, there is both a network of events and a network of perceptions of these events. These two layers are expected to interact over time. This model is so dynamic and interactive that the emerging system is no longer expected to stabilize completely: it is transient and thus it “self-organizes”. *The system can therefore not be defined in terms of observables, but only in terms of operations*. In other words, at each next stage an evolving network has two incoming arrows: one from its previous state and one from the various interactions. Hence, there is always an interactive term and a recursive term. An interaction is mutually informative: the interactive event can be attributed as action to the actor or as communication to the network system. The systems update one another through their mutual information.

While engaged in their interactions, reflexive actors may have reasons to select actively their individual self-organization in relation to options provided by their environments. The expected information content of the social network is processed in this distributed mode, that is, as uncertainty. If the reflected (meaningful) information can be communicated, the network is provided with an additional layer, allowing for a similar process of constituting a distri- buted "meaning", but now as a consequence. The idea of what is information and what meaning remains uncertain at each receiving end. While a biological signal (for example, a spike at a neuron) can have a function in addition to containing information, one is additionally able to distinguish in human communication between the function and the meaning of a message.

Social systems are in principle non-computable: relations between function and meaning are a priori asymmetrical and asynchronous: for example, the situational meaning of an interaction may change without regard to the intentions of the participants.

Luhmann defined communication explicitly as the unity of information, message, and understanding and noise is to be filtered away by the reflexive operation which provides us with "meaningful information". As Luhmann (Luhmann-84,-95) emphasized: *"By information we mean an event that selects system states."* Using this definition of information, the uncertainty can no longer be informative to sociology. The meaningful information is not specified as an operation on the Shannon-type information or uncertainty .In other words, options provided by the network or events not perceived by human carriers ("observers") cannot be provided with social meaning under these definitions. These events remain operationally external to the social system. Indeed, Luhmann shared with Parsons an interest in cybernetics and control. Self-organization theory can from this point of view be considered as a theory about the limits of control given the wealth of possible combinations at the reflexive level. The metaphor of "self-organization" enabled Luhmann to relate his theory to the new biological theorizing about autopoiesis (Maturana-78,-88; Maturana/Varela-84). Whenever a disturbance of this otherwise "plastic" medium is recursive, a structure emerges.

4) Self-Fullfilling Prophecy – Cause and effect:

Self-fulfilling prophecies are predictions about a future event, which in turn increases the probability of the occurrence of that event. Self-fulfilling prophecies can occur in almost any type of environment. The main elements for a self-fulfilling prophecy is a perception about someone/something and behavior consistent toward someone/something that in turn, causes the prophecy to come true. It appears that self-fulfilling prophecies are motivated by the environment, behaviors and expetations.

There are two types of self-fulfilling prophecies. ***One type is the Pygmalion effect***. This type of self-fulfilling prophecy occurs when one person has a perception and expectations of another and treats that person in a manner consistent with those expectations. The prophet, or the person with the perception, changes his behavior, and that in turn changes someone else's behavior, thus the occurrence of the self-fulfilling prophecy. For example, teachers may have certain expectations from their students. The teacher may treat the student in a manner consistent with those expectations, expectations that the teacher has is transferred to the student. If the teacher has a positive expectation or perception of the student, the teacher conveys that message both verbally and nonverbally to the student. This positive expectation changes the student's perception and expectation and creates a self-fulfilling prophecy.

The other type of self-fulfilling prophecy occurs when a perception or prophecy is made and people autonomously change their behavior to agree with the prophecy. An example of this is bank failure. There may be a false perception that a bank is in trouble. Depositors withdraw their money and the bank goes bankrupt. There is no person or prophet behaving in a manner to make these people withdraw their money. They withdraw their money because of their own perceptions.

Research has shown that self-fulfilling prophecies exist regardless of whether the prophecies are true or false. The perception of a bank being in trouble may be true or false, but the outcome is the same if many people have the same perception. The perception that a student will do well in school will be true if expectations are transferred from the teacher to the student. Self-fulfilling prophecies are interesting phenomena first studied by Merton in 1948.

The assumption of consistency is primal in formal theory building; the possibility that inconsistent axioms or propositions could be true would be considered outrageous to a formal logician. The theory should contain sufficient coverage of causes to account for all the variations in a dependent variable. The causal variables themselves should be independent; they stand as first cause in formal theory.

The postulate of necessity means that there can be no slippage between cause and effect in the theory. One must, necessarily, follow the first: if A, then B. B cannot arise if A is not present; A cannot be present without contributing to the probability that B ensues. A could exist without B if there are other independent variables which must appear before B can appear. The dynamics of chaos systems do not sustain the requirements of formal theory. The consequences of chaotic systems are not consistent with classical dynamics; qualitative changes occur which are far different from the dynamics of the initial conditions and cannot be predicted from a complete knowledge of those prior conditions. In revolutions, consistency fails. Some may be orderly and some may become chaotic; there is no consistent connection between initial conditions and following sequences. The postulate of independence falls in social dynamics. Instead of independence and causal priority of one variable in relation to other variables, chaotic systems (and social systems) are characterized by feedback loops, which determine the behavior and integrity of the system. For human beings in social matrices, any number of feedback loops, displace the model of causality which mark formal theory construction in sociology; the self fulfilling prophecy concept encompasses the wisdom of this view. In human affairs, anticipation of behavior B may invoke behavior A, which in turn, only affects indeterminate probabilities of B. There are human-made deviation amplifying and deviation damping feedback loops in all social encoun ters which make it necessary to treat the system as an interconnected whole rather than as a system with external and independent causal patterns. The chaos perspective provides an ap- propriate framework for such analysis. The ability of social systems to displace consequences of their dynamics changes the rigid pattern of causality set by linear models of causality. The impressions human beings form of one another often shape others' reactions to us and effect others' self-perceptions as well. As a result, an impression sometimes becomes a self-fulfilling prophecy when a person's expectations actually help cause those expectations to become a reality. Through the process of categorizing (labelling) incoming information, we tend to sim- plify our experiences into categories that help us to generalize, to understand, and to predict. We have all experienced self-fulfilling prophecies, we expect something to happen and we act in ways that increase the likelihood that the expectation will be meet orders. This shows the basic components of a self-fulfilling prophecy. It is a reinforcing cycle; an expectation of success will often lead to success, which in turn provides evidence that the original expectation was correct in the first place. On the other hand, an expectation of failure will often result in an unsuccessful outcome, which in turn validates the negative expectation. In both cases, the outcome created by the expectation supports the authenticity of the original expectation.

The self-fulfilling prophecy in the beginning is typically a false definition of the situation. But it evokes behavior, which makes the originally false conception come true. What is the key to the self-fulfilling prophecy? ***Expectations***. Confidently anticipating that something will be true sometimes helps to make it true. More importantly, it is because we act on the basis of our expectations.

5) Conclusion (Everything is said by an observer):

This essay began with a discussion of knowledge-intensive areas. In these domains researchers solve ill-defined problems and learn as they work. The thinking development was presented as an evolutionary and most important participatory process. The idea of constructing knowledge is based on a constructionist framework that focuses on the role of artifacts in learning and communicating. This essay presents constructionism as an epistemological framework concerned with building things, both in the sense of building understanding and building artifacts. And this is the reason we can look to the constructionism as one tool among others, when we ask the important question in organization theory: ”Why organizations?” The constructivist assumption is that knowledge is an interpretation of experience. This assumption implies that what an individual can know is both enabled and constrained by prior experiences and interpretations (bias). Again: constructionism can be one tool to help us to understand the other important question in organizational theory: ”What is the logic of organizations?”Constructivism in education is based on Piaget's doctrine that knowledge cannot be “transmitted” or “conveyed ready made” to another person. This perspective on human understanding is individualistic, implying that we each live in a world of our own making and we have to work with the theory of self-organizing and self-fulling prophecy as scientific working tools to understand the dynamic of organizational development..

In the constructionist paradigm (which encompasses both cognitive and philosophical ideas of constructionism), our understanding of the world is fundamentally tacit. Normally, we are not conscious of these understandings. To become aware of understandings by thinking about understandings is to make them explicit. This seems us are important viewpoints if we will understand some of the phenomenas we have seen in our research in organization theory like ”information assymetry”, ”the skilled helper”, professional self-organization” and ”deterministic rationality”.

Papert's notion of constructionism builds upon this constructionist framework, but he has a special concern with the role of physical artifacts (objects) in thinking. Papert writes that *"con- struction that takes place in the head often happens especially felitiously when it is supported by construction of a more public sort "in the world" . . . Part of what I mean by "in the world" is that the product can be shown, discussed, examined, probed, and admired. It is out there"* (Papert-93). Papert argues that we learn through interacting with artifacts - that we create an understanding of the world by creating artifacts, experimenting with them to see how they work, and modifying them to work better. Since artifacts are in the world and can provide an anchor for understanding among a group of people, they can also address a prob- lem that faces the constructivist cognitive scientists - namely, if we construct knowledge as an individual act-, how can understandings be shared? Even this is an important question in organizatorial research: How can the executive share the founders idea-world? Experiential artifacts allow us to interact with the world. They provide information that enables us to interpret a situation through our perceptions. *The danger of experiential artifacts is that they don't in themselves provide us with knowledge* - instead they provide us with information that is tacitly interpreted: Representations, like analogies capture certain features and ignore others. A representation is never a complete duplication of one's understanding: this is a source of its strength as well as its weakness. The shared understanding representations are *not fixed relationships between a representation and the things represented, but are commitments to carry out a dia log within the horizons of both speaker and hearer in a way that permits new distinctions to emerge and provide the foundation for new understandings*.

With this point of view we understand that chaotic activity may be unpredictable but it follows rules (is orderly) unlike randomness. It hallmark is the butterfly effect, that means that a tiny change in the initial conditions of a chaotic system (and all systems with more than three degrees of freedom are substantially chaotic systems) will have dramatic impacts of the outcome. Therefore it is not only fashionable but necessary to apply chaos theory to events in the society and economy.

With these ideas in the background we are sceptical about quantitative predictions for complex systems such as social or economic ones – we must be aware of their great limitations. One way out this problem could be to steer a system softly continous by setting the conditions so that the system smoothly can self-organize in a more optimal state.

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