An Explanation of System Dynamics Recognition Experience According to an Interpretation of Biology of Cognition Theory: The Nature of Feedback Loop Structure

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Abstract

This paper presents the partial research insights about an explanation of the System Dynamics Recognition Phenomenon[1] (Parra, 2002), according to an interpretation of Biology of Cognition Theory proposed by Humberto Maturana (Maturana, 1985, 1992, 2002). This article presents a conceptual model of Biology of Cognition Theory. This model is used to distinguish and configurate elements and relations to permit the construction of the recognition notion according to Biology of Cognition Theory. Next, we consider the principal System Dynamics foundation: the Feedback Cycle under the point of view of the Biology of Cognition Recognition. To accomplish this, we interpret a Jay Forrester´s classic paper. With this intepretation, we propose two ways for the System Dynamics Recognition according to Biology of Cognition. The insights about this research may be pertinent to study the implications of the most important System Dynamics process: the organizational learning and educational applications.

Key Words: System Dynamics Recognition, Biology of Cognition, Feedback Cicle Structure.

Introduction: the System Dynamics Recognition Phenomenon

What do we mean when we denote the System Dynamics Recognition Phenomenon? To answer this question, we present three situations: First situation: An interdisciplinary group is considering a complex situation through System Dynamics digital simulation models. They can integrate fragmented knowledge by constructing the unity of perspectives about the problem and the complex situation. (Acevedo, 1997) (Senge, 1990) Second situation: a System Dynamics model is a component of the organizational learning framework, while this last one increases the organizational reflection capability. (Vennix, 1996) Third situation: a team of teachers can change the learning process to a student-focused learning process. Their students are making knowledge with system dynamics simulation technologies (Richmond, 2000) (Parra, 1998, 1999, 2000).

In the previous situations, we propose that it is possible to distinguish a System Dynamics Recognition Phenomenon. In the context of this phenomenon, people live an experience that can be explained on the following terms: a System Dynamics Phenomenon occures in these situations, while it is created and maintained into the mind of each member of the group, according to its individual perspective.

For understanding this phenomenon, we propose the following unit: in this situation a System Dynamics Recognition Process of the Experience Explanation is conserved. To replicate this phenomenon and consider the possibility and impossibility of the proposed unit, we present a Maturana´s Biology of Cognition conceptual model. Later, we propose a recognition conceptual model according to Biology of Cognition. Then, according to the point of view of this conceptual model, we make an interpretation of the principal System Dynamics foundation, from a Forrester´s article according to Biology of Cognition Theory.

Finally, the document offers some notes about the preliminary implications of this reflection. This research will make a contribution to the process of understanding the fundamental system dynamics phenomenon: the recognition in the organizational and scholar learning contexts.

Biology of Cognition: making explanations from the recognition of the observer biological limitations

The Biology of Cognition Theory is a derivation of the Autopoiesis Theory. The latter theory proposes an explanation of the living organization, that defines this organization`s processes on terms of autogeneration. The fundamental process in the living beings is the conservation of their autogeneration. From these reflections the Biology of Cognition Theory is developed.

In Figure 1, Maturana (who created it) summarizes two possible explanations about how an observer constructs explanations of his experiences. In the first possibility, the observer does not consider his biological limitations in his perception process. He makes explanations on terms of transcendental objects that exist in the reality, while this reality exists independently of the observer. In other words, he assumes that the objects exist independently of what the observer does. In the second possibility, the observer recognizes that objects and reality do not exist independently of what he does. He understands that he does not access any object in the reality, because all the distinctions of the objects are made in the language domain. In his experience, he does not distinguish between perception and illusion. The observer can only speak about reality in the language, because he never has access to any "real" object. Reality is not beyond the language domain. The observer can only explain his experience: this is his experience explanation. The observer can guarantee the existence of his experience and his explanation, but never the existence of the external reality, because all references to external objects require both the sensorial biologycal process and the nervous system. The observer does not have privileged access to reality. The existence of the observer depends on his biology. This explanation defines the constitutive ontologies domain. In this domain it is not possible to talk about the existence of a reality or universe; in this domain one can only guarantee the existence of the multiversa. The human beings live in the operational coherence domain, that all of them construct from the consensual agreement that is reached when they communicate their experience explanations. In this way, the operational coherence domains will be established from the consensual agreement found in the experience explanations in the language domain. So, the operational coherence domains will be constructed by the experience lived in the resonances and agreements of those explanations in the language. These domains will be the multiversa. In these domains it is possible to operate with objects and rules that are in coherence with such domains. Also, the experience explanation acceptance depends on the experience explanation acceptance criteria. These criteria and emotions constitute the matter of the operational coherence domains.
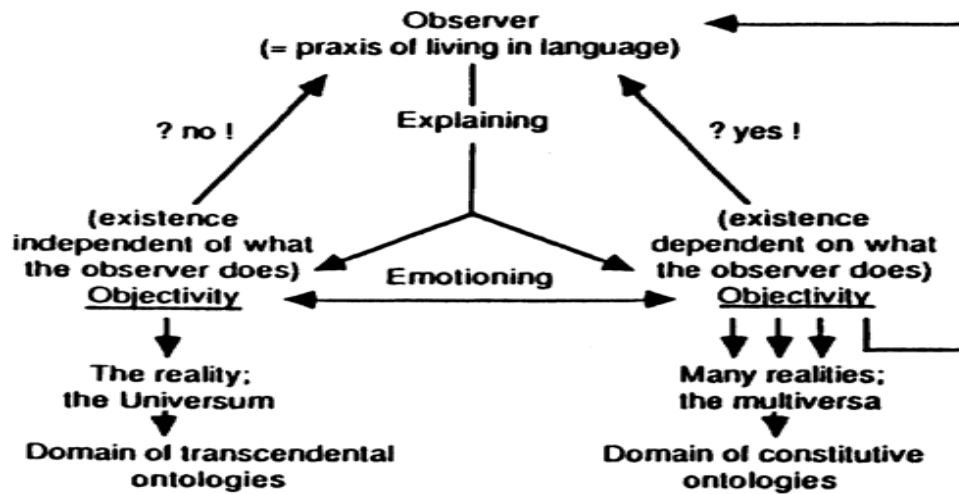
Observer
(= praxis of living in language)

? no !   Explaining   ? yes !

(existence
independent of what
the observer does)   Emotioning   (existence
dependent on what
the observer does)
Objectivity   Objectivity

The reality;
the Universum   Many realities;
                                 the multiversa

Domain of transcendental   Domain of constitutive
ontologies   ontologies

Figure 1. Observer Ontology Diagram. From original paper: "Reality: the search for objectivity or the quest for a compelling argument" by Humberto Maturana. Irish Journal of Psychology. 1998, 1, 25 – 82

Recognition Notion under Biology of Cognition

What is recognition according to Biology of Cognition Theory? Recognition will be an operation that is performed in the language domain. In this domain it is possible to relive the others´ experience by means of the others´ explanations. This reliving is a reliving in the language. This situation does not mean that this recognition implies the acceptance of the others´ experience explanations. In this way, this situation implies playing with objects, rules and coherences that are supporting the others´ experience explanations in order to get situated in the operational coherence domains related with these explanations, so that we could recognize them.

According to the observer ontologies that the Biology of Cognition Theory proposes, there are two ways by which we could recognize the others´ experience explanations. The first way is the recognition from transcendental ontologies, which implies the configuration of a common ground, in which the existence of objects in the external reality is accepted as a true fact. This recognition will depend on the ability to play with transcendental objects. In the second way, recognition is coherent with constitutive ontologies. The common ground will be constructed by means of the experience explanations articulation, in the language domain. This articulation can be understood on terms of the experience explanations recognition dance, as the only possible way of recognition. So, the task of recognizing the others´ explanations begins with the recognition of the own experience explanations. The possibilities to recognize will be conditioned by the possibilities to make distinctions in the language.
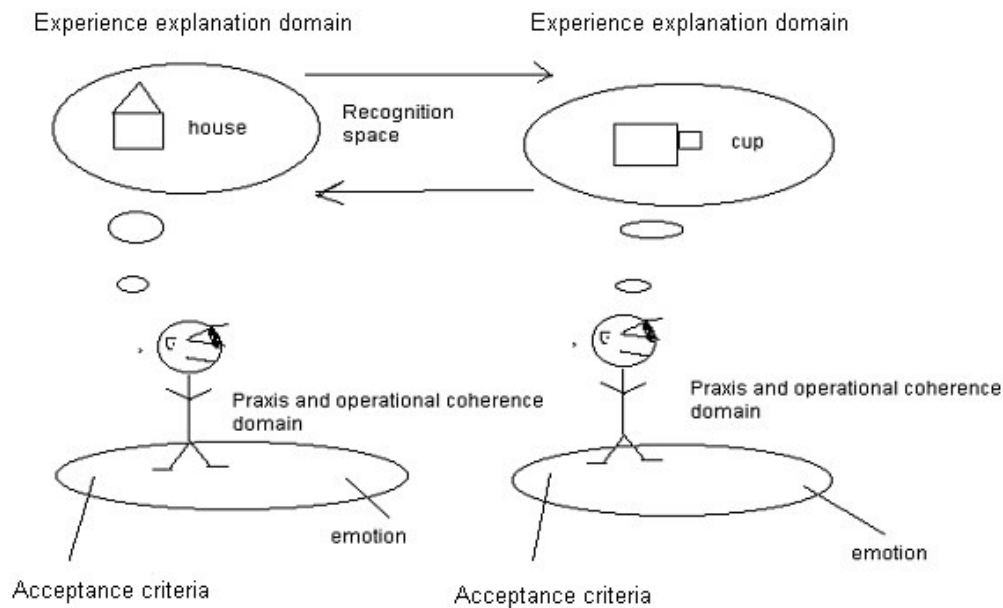
Figure 2. General Diagram for Recognition from Biology of Cognition in the Constitutive Ontology.

Is it possible to explain System Dynamics Recognition on terms of any way of recognition, according to the System Dynamics foundation? To answer this question, we propose the following presentation of System Dynamics foundations, which will support the interpretation of the basic document of this practice.

System Dynamics Foundation: Feedback Cycle Structure

Forrester argues, on the paper under study, that System Dynamics provides **"a common foundation that can be applied wherever we want to understand and influence how things change through time"** (Forrester, 1991, pag 5). This common foundation is the feedback structure. The System Dynamics modeling process **"starts from a problem to be solved—a situation that needs to be better understood, or an undesirable behavior that is to be corrected or avoided"** (Forrester, Ibid). The main idea of this process is to organize the mental data base information of the ones that are involved in the system. That configuration obeys the feedback structure. Forrester characterizes the mental data base like **"a rich source of information about the parts of a system, about the information**

available at different points in a system, and about the policies being followed in decision making" (Forrester, 1991, Ibid). System Dynamics offers a configuration for the experience information. The experience explanations will be organized thanks to feedback structure.

Forrester explains that such structures dominate the decision making process in a system. The System Dynamics structure is that configuration in which the conditions are defined in such a way that they could have influence on the decision making process. This structure turns out to be the origin of all human actions.

The Feeback Structure

Forrester says that "By a feedback structure, I mean a setting where existing conditions lead to decisions that cause changes in the surrounding conditions, that influence later decisions" (Forrester, 1991, Ibid). We understand that the ignorance of the existence of this structure is the fact that produces anti intuitive behavior into the social systems, as they are affected by policies. He says that we do not live in an unidirectional world in which a problem leads to an action that leads to a solution. This configuration of the people´s experience information is named **'Open-loop impression of the world"** and is criticized and replaced by the System Dymanics assumptions.
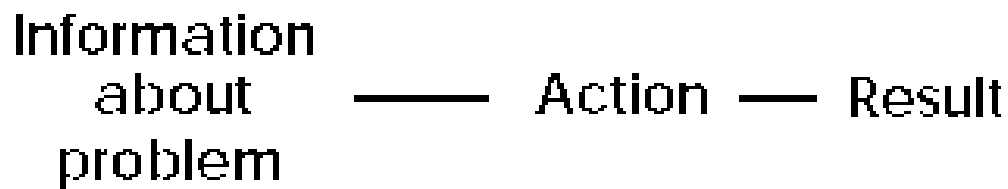
Open-loop Impression
of the World

Information
about   ——— Action ——— Result
problem

Figure 3. "Open-loop Impression of the World" by Forrester (1991).

In Forrester´s words: **"The image suggests that the world is unidirectional, that the problem is static and we need only act to achieve a desired result"** (Forrester, 1991,

Ibid). As an answer to the previous idea, Forrester proposes that **"we live in an on-going circular environment like Figure in which each action is based on current conditions, such actions affect conditions, and the changed conditions become the basis for future action. There is no beginning or end to the process. People are interconnected. Many such loops are intertwined."** (Forrester, 1991, Ibid).

We take notice of the fact that feedback loop structure is also an image and an impression of the world, but we understand that Forrester thinks that the world is made of Feedback Loop Structures.
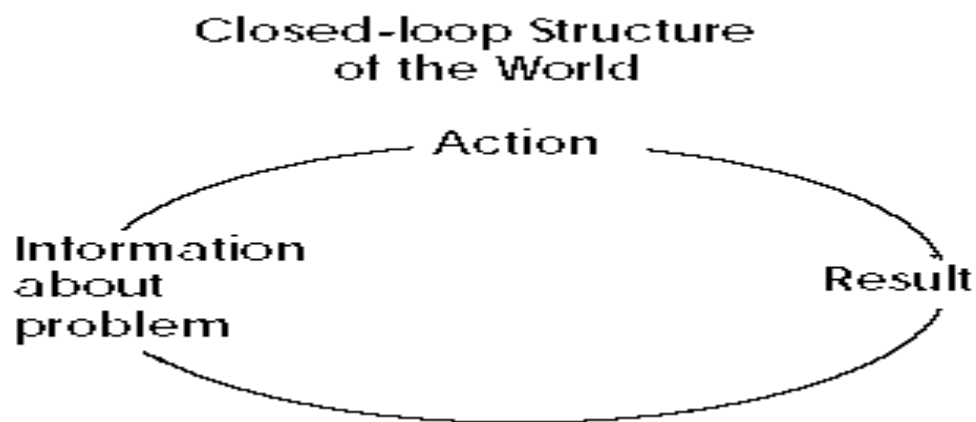

Figure 4. 'Closed-loop Structure of the World" by Forrester.

System Dynamics Recognition

This paper proposes to think about the possibility and impossility of the system dynamics recognition under Biology of Cognition Theory. But first, we must make an interpretation of System Dynamics Recognition from our recognition notion of Biology of Cognition conceptual model. In this way, we have a problem: the feedback cycle structure ontological character. In other words, does System Dynamics assume the existence of a feedback cycle into the independent external reality? Or does System Dynamics assume a feedback cycle structure as a recurrent distinction made in a language; or as a structure that is more comprehensible than the lineal structure, that defines the action in the experience explanation? These questions may let us think, first, in regard to a way of answering, about two possibilities for a System Dynamics Recognition according to our interpretation of Recognition under Biology of Cognition.

In the first possibility, System Dynamics Recognition is compatible with transcendental ontologies for recognition. In this way, the feedback cycle structure is a component that reality has been made with. The observer makes explanations thanks to his ability to use the most important external transcendental object, with its own rules and logic: the Feedback Cycle Structure.

In the second possibility, System Dynamics Recognition is a language domain made of a recurrent distinction named Feedback Cycle Structure. This structure can widely represent experience explanations for other domains. The System Dynamics Recognition language domain has a set of rules and logic that enables us to make experience explanations comprehensible for others and us.

This paper offers the following questions: in regard to the possibilities for recognition, which one is the most compatible with the System Dynamics foundation? In regard to experience explanations, which one is the most coherent with the System Dynamics Recognition Experience?
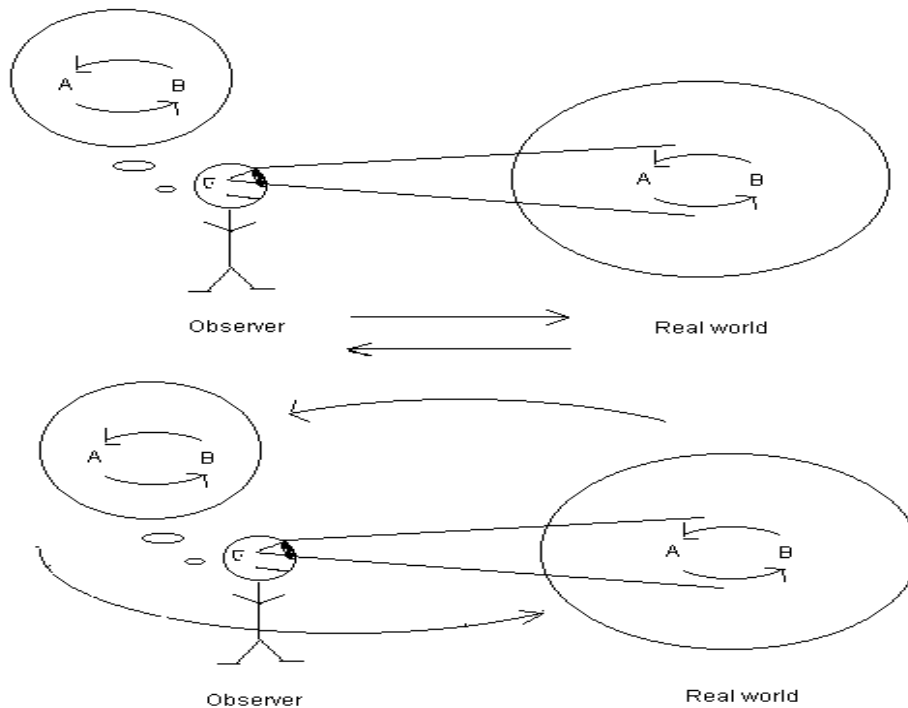
Figure 5. Feedback Cycle Structure in Transcendental and Constitutive Ontologies.
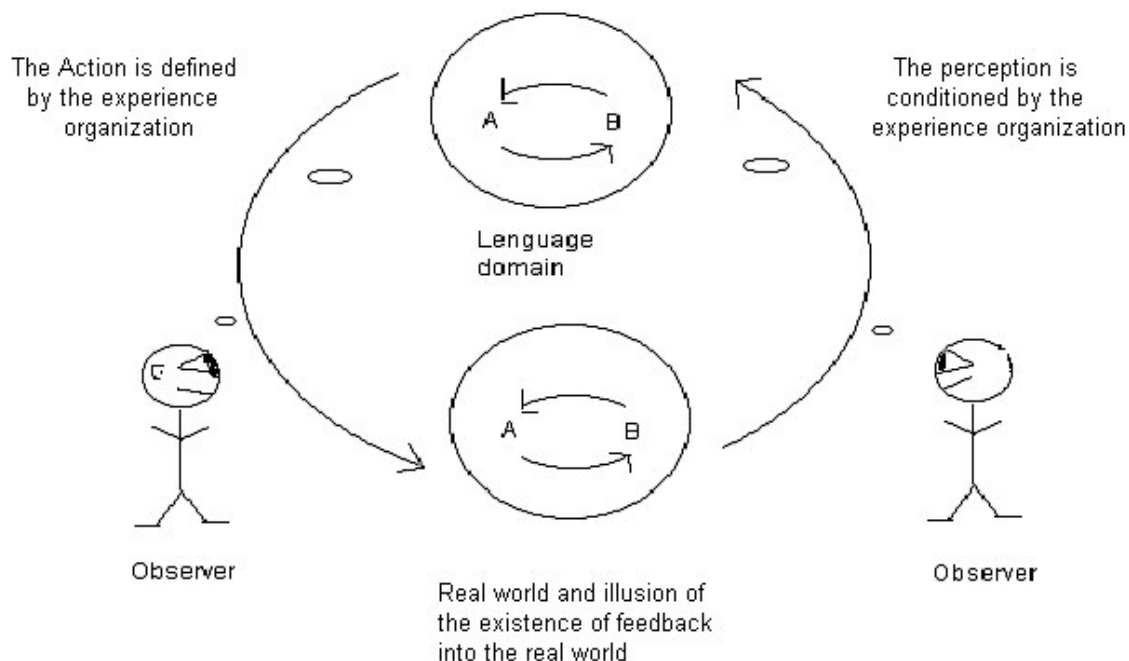
Figure 6. Feedback Cycle Structure as a Recurrent Distinction in the Language and Feedback Cycle Structured World Illusion.

Conclusions

This paper is located in the line of works that try to explain the phenomenon shared in the System Dynamics Community, from varied ontological basis. This work, still developing, tries to contribute to the understanding of the System Dynamics problem, from an interpretation of Biology of Cognition Theory: the Recognition; and what it proposes will be crucial in the System Dynamics studies that deal with manners to support the Organizational and Scholar Learning.

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