Chapter 4
Logically Living System: A Generative "Machine" for Autopoietic Systems

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ABSTRACT

The chapter focuses on two basic objectives: a) to introduce and qualitatively examine the concept of logically living system as abstract prototype for any possible auto-poietic system and b) to analyse the co-evolution as matrix of autopoieticity of any system. To this end, based on primitive concepts as property, relationships, network, and entropy, the chapter defines an abstract "logic machine" which is named logically living system. Here, the focus of research is directed to prove that such a "logic machine" could deliver any auto-poietic system (or process, after the case) so that it is functioning as a generative grammar (as syntax) in this context. Regarding the co-evolution linked to auto-poieticity, the chapter develops discussions on some paired concepts as memes vs. semes, natural vs. institutional, or system vs. network. Finally, the chapter approaches five kinds of auto-poietic systems as generated by the "logic machine" proposed: biological, social, psychic, theory, and paradigm.

INTRODUCTION

The topic of living (or of living entity) was, as known, triggered by the inspired book of Chilean biologists Humberto Maturana and Francisco Varela (Maturana & Varela, 1991). This idea, which brings an ingenious explanation of the living has then generated, as expected, many other taking overs. The concept of *autopoiesis* tries to put together the basic elements of continuously assuring of life, based on internal principles of the systems (that is, living systems). All the intellectual efforts done in the matter are aimed at to provide the fundamentals of the living fact. We do not want to do a review of the specialty literature in the field of autopoiesis, because the chapter's goal is not focused on this concept as such, but on that of the logically living system, as logical prototype of any imaginable autopoietic system. However, some basic introduction could be of usefulness.

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1. The concept of autopoiesis is originated in the biologically living entities, even at their basic level (cells). Not only the two mentioned Chilean biologists do not expand the concept of autopoieticity beyond the biological life, but they have even rejected the very idea of such an expanding (especially, towards social entities);
2. The concept of autopoiesis and that of cognition are put together and are, in fact, considered equivalent. But such an equivalence requires some clarifications:
   a. Cognition is not anymore assigned to consciousness only, but to any ways of knowing what must be made by an entity which, just based on that knowing, could repeat the experience of knowing again, by its reproduction;
   b. The very idea of reproduction of entity based on internal only operations is viewed as the essence of autopoieticity; all the sufficient conditions which ensure such a reproduction by internal operations constitute the basis of the autopoieticity;
   c. Although cognition is assigned to the observer of biological life, such an assignation does not change nothing in the idea that autopoieticity is conditioned by cognition;
   d. To survive in the process of reproduction means that the interactions of the system with its environment are "chosen" by the system so that those interactions be adequate to survive and reproduce itself; the main body of knowing is represented by knowing which interactions are permitted and which are forbidden; Maturana names such set of adequate interactions as forming a niche within the larger environment. But adequacy constitutes the very content of the concept of rationality (more precisely, of the instrumental rationality). Thus, it seems Maturana thinks the rationality does not imply the consciousness. So, even the artificial intelligence could be rational as well;
   e. Since, however, cognition, understood as associated with consciousness, is not denied, then the extension of autopoieticity to non-biologically life entities is open. In fact, many scientists (the best known is Niklas Luhmann) produced such extensions of autopoietic property, linking it also to the entropy, more exactly, to social entropy (Bailey, 1990). In fact, Bailey proposes, somewhat, an autopoietic sort of social entropy, based on his PISTOL/PILOTS model).
3. The fundamental ideas featuring the autopoieticity topic, remains, however, quasi-invariant, as follows:
   a. *operational closure* and *interactional openness* of the system to its environment (to its niche); both are intermediated by membrane (Spencer-Brown, 1994);
   b. *evolutionary behaviour* – a cognitively-based selection of the adequate interactions with environment, capable to ensure the identity invariance of system and its reproduction inside such an identity;
   c. *structural determinism* – the Darwinist idea that functions are emerging from structure and never inversely. In social system the evolutionary path seems be rather Lamarckist than Darwinist.

The generality of Maturana and Varela approach encouraged other scientists to examine the concept of autopoieticity. One of the most original was the German sociologist Niklas Luhmann. He tried to abstract further the results obtained for living systems, in order to apply them to human social systems. Like in Maturana case, we do not examine the entire social theory of Luhmann, but only those items which interfere with our intention to design an abstract machine (something which could be similar with

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