SYSTEMS APPROACHES: A TECHNOLOGY FOR THEORY PRODUCTION

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Keywords: Epistemologies of production, observation, self-observation, economy, ecology, machine, technique, technology, theory, metaphor, epistemic frame, subject/object, product/producer, non-trivial machine.

Contents

Summary

The following text tries to accomplish a double task: to summarize the key ideas and lines in articles devoted to systems approaches, and to pose a general framework, at once philosophical, historical, and socio-cultural; that is to say, a genealogy for the comprehension of systems approaches contributions to the transformation social sciences. The first of the tasks is assumed by R. Beneyto in order to provide a panoramic account of current contributions. The second task is assumed by Gutiérrez

and Aguado on the basis of their previous work on technology and sociogenesis. It is addressed so as to locate systems approaches in a long-term context of social and philosophical evolution which is deeply attached to science and technique.

When von Bertalanffy conceived General Systems Theory (GST) as the theory of the organization and relation of the sciences, he posited science and knowledge as systems, and GST as a technology. Insofar as the systems approach is an epistemology of the GST systems technology, the systems approach should be considered a technology of knowledge.

It is common to approach systems theories by focusing attention on their revolutionary aspects. However, the problems systems approaches deal with, such as complexity, observation, model efficiency, or intentionality, are key issues in the development of Western Philosophy. The point is not that systems approaches pose new problems, nor new thoughts about old problems, because all of the thematic issues systemic perspectives deal with have a place in a longstanding philosophical tradition and are, in our view, keystones of western thought. The point is that, through systems approaches, those problems that before were restricted to the sphere of philosophical reflection now become a matter of methodological work in the field of social and organizational sciences. Systems approaches are the window through which philosophy enters science and, at the same time, they are the mirror that opens science to a self-reflective movement.

Systems approaches thus prefigure a conceptual technology, the very thing that facilitates the transformation of subject/object relations into product/producer relations, which allows conceiving machines as any order of producer device and, consequently, permits dealing with subjects and society simultaneously as products and producers. Systems approaches are then a technology in the sense that they formalize the epistemic key for social sciences: subject/object crossbreeding. The metaphor of machines appears to be the conceptual tool that embodies the epistemic and pragmatic ground of the subject/object relation. And it is precisely in this concept where the idea of system has its organizational roots. The epistemic contexts in which such genesis is possible are called *epistemologies of production*.

1. Review of Subject Articles

There follows a brief summary of the 18 articles included in this topic.

The Systems Sciences in the Service of Humanity—A. Laszlo and E. Laszlo

After a brief overview of the development of systems sciences, the authors emphasize the important role that the systemic approach can play in finding a new and more balanced universal society. Looking to bridge the gap between Snow's Two Cultures, authors give special relevance to those normative aspects of social systems that play a decisive role in the distribution among the population of symbols, values, social entities, and cultures. Systems sciences can be one of the most important instruments to achieve this humanistic policy for all the inhabitants of the world. Such would be their main role, and from this first article until the last one by Acropolis, almost all of them seem

oriented to this end.

"General Systems Weltanschauung."—J. L. Elohim

The author is also concerned with the possibility of inducing new societies, including the eventual possibility of transforming (undesired forms of) existing groups to another (desired forms of) groups. General Systems Wealtanschuung (GSW) appears to be the conceptual medium in which social systems requirements and decision makers' features may coincide. In the author's mind, GSW acts as a catalytic agent when somebody aims to attain reliable appraisals in any possible human enterprise.

"Metamodeling"—D. Singer

The typical fuzziness of social systems depends at least on two elements: The nature of the empirical system under consideration and the state of our knowledge about this system. In the beginning, all theoretical systems are fuzzy; the precision is obtained progressively in a process that Singer calls "metamodeling", a recursive confrontation between reality and conceptual models. In this confrontation, knowledge about reality, the conceptual models that intend to capture it, and formal systems which arrange and interrelate the concepts are all taken to improve their precision and efficacy through this process.

"Social Systems Design"—B. Banathy

A comprehensive account of what social systems design is, and why it becomes a relevant instrument today concerning scientific and moral imperatives for social scientists. In order to do this, Bela Banathy depicts a process in which "systems analysis, operation research, and engineering" play necessary parts. In this process, Banathy includes four major processes. (1) Transcend the existing state. (2) Envision a future desired state. (3) Create an image of that future state. (4) Based on that image, design and describe the new system which—when implemented—will transform the existing state to the desired future state.

"A Systems Design for the Future"—M. Bunge

The author starts by assuming our inherent capacity to act on and shape the future of the institutions in our social environment. There is no such thing as a 'perfect society', but there are operational and ethical criteria for decisions about adequacy. The first step to improve adequacy is a correct diagnosis, and the second to design an appropriate new model of society. The next step deals with how to reconcile planning with systemic democracy: how to conciliate an top/bottom scheme with a bottom/top context. Bunge espouses the convenience of abandoning the upside/bottom scheme and proceeding from "the middle" rather than from "below" or "above". Consequently, he also discusses the advantages and disadvantages of a piecemeal reform or a global and systemic one. The evolution of societies—that is, the necessity of integral and sustainable development for the World—leads Bunge to predict an increase of social studies as well as to reflect upon the status of sociology as a specific science.

"Soft Systems Methodology"—R. Rodriguez-Ulloa

According to the author, it is possible to find a "soft" problem where "the 'what' is very difficult to define and the 'how' is even more difficult to achieve". The very specific nature of systems methodology lies in its modeling power, and consequently it is necessary to consider its relation to the definition of problems and phenomena (delimitation, isolation, relation, etc). The author suggests a pragmatic and phenomenological approach, because "human beings cannot perceive 'objectively' the real world, so that it is impossible ... to propose a unique and 'true' definition of a 'problem situation' " which always will depend on the Weltanschauung of the observer. Under such epistemological assumptions, social problems and phenomena are to be defined as an adequate object for soft modeling.

"Social Systems Diagnosis: A Sociopathology Identification Model"—P. Arnopoulos

The author seeks to understand the social phenomena under a "triadic paradigm and systems unification model". The point is to define a method to understand and analyze social systems pathologies. To achieve this, Arnopoulos postulates in the first place a physiology of social systems. Then he considers and establishes the kinds of abnormalities or "disturbing situations or dysfunctional conditions" of the social groups (their pathologies). Within this context, the author develops a socio-diagnostic methodology (SAS) on the basis of an algorithm that joins epistemological, semiotic and socio-therapeutic perspectives.

"Critical Systems Thinking"—K. Simon

The Critical systems approach appears as a common reference point in several contributions (as in Laszlo & Laszlo). The Critical approach emerges as reaction against an excessive formalization of systems methodologies that stressed their instrumental features but obviated social, cultural, and ethical implications of their use as well as of the modeled phenomena. Such an approach is strongly critical of the hard approach when applied to social problems. It is indeed a call for attention concerning the relation between cognition and action, which in the case of the social sciences appears to be particularly sensitive.

"Total Systems Intervention"—L. Warren

The author describes the steps in a scheme for the development of a systemic intervention, from the "TSI 1" version presented by Jackson and Flood to the later version developed by Flood, "TSI 2" or "LSI" (Local Systemic Intervention). Both approaches are based on the Critical Systems Thinking and are especially concerned with the global/local complementary relations.

"Integrative Systems Methodology"—M. Schwaninger

In a similar vein, author describes a general heuristic which combines methods and

methodologies that intend to go beyond the simple eclectic approach. The suggested methodology is constructed on the basis of a double loop (content and context loops). It consist of the iteration of four operations (modeling, assessing, designing, and changing) that give rise to the emergence of searching criteria addressed to unknown content objects. There are procedural similarities between ISM and Singer's metamodeling.

"WSR Decisions for a Sustainable Future"—Z. Zhu

Similarly, Z. Zhu offers a methodology based on three major sources: ancient Chinese Thought (neo-Confucianism), integrative position in system theory and social practice in China in the last decades. The real social problems are for Zhu a net of many different relations; but all of them can be reduced to three relevant kinds: relations with the world (wuli), relations with the mind (shili) and relations with the others (renli). The author's methodological proposal consequently deals with the emergence and preservation of equilibrium processes among these three kinds of subject relations: subject/world, subject/mind and subject/other.

"Psychological & Cultural Dimensions of Sustainable Human Systems"—P. Maiteny

It seems clear then that in social groups cultural elements have much to do; but cultural elements are social products; they are elements that emerge in the interrelations of the individuals. The author is concerned with the dynamics of human people, where the psychological aspects cannot to be separated from cultural, social, ecological, and biological processes. Culture "mediates between the inner world of human experience and the external world". There is, subsequently, a necessary relation between individual motivations, cultural symbols and values, and societal interactions with natural environment. The change from a sacred to a narcissist understanding of man's place in society and nature led, in Maiteny's mind, to a counterproductive relation in individual/individual relations, individual/society relations and society/nature relations. The challenge, thus, lies in conciliating the both subject/society split and culture/nature split.

"The Dynamics of Social and Cultural Change"—R. Vanderstraeten

The author is concerned with conciliating Luhmann's conception of the autopoiesis of social systems and its epistemological implications as to self-observation and observation theory, with Parsons' idea of instrumental activism that defines the process conditions of our social systems' history and their cultural pattern. Vanderstraeten's point lies in the impossibility of a social system's absolute externalization, which in fact implies a socialization of natural environment that addresses any ecological perspective to a social, organizational, and communicational reflection—to a revision of the system's self-observation premises.

"Formal Approaches to Systems"—A. Caselles

The author discusses the possibility of a unified theoretical and methodological

approach to systems thinking by comparing seven different formal approaches. He specifically addresses the targets of a General Systems Theory, subsequently confronts the seven formal approaches to the targets of GST, and finally considers the possibility of a unified approach (or at least the possibility of relating every situation to its respective and most adequate approach).

"The Quantification of System Domains"—J. Van Gigch

A different consideration is needed with respect to the contributions of A. Caselles and J. P. van Gigch. In this paper van Gigch reflects on the concept of quantification. He suggests the need for special care with the application of hard methodologies in the case of soft systems. He assesses to what extent mathematical modeling and quantitative approaches can be carried out by considering if quantification is permissible, distinguishing between qualitative and quantitative forms of measurement. He also uses a hierarchy of conditional imperatives to illustrate what he calls "implicit" quantification, which resides in the meaning of concepts rather than in their description.

"Chaos: Back to Lost Paradise"—L. Ferrer

Author is concerned with identification of regularities and order prediction within systems. Ferrer's point is to pose chaotic dynamics as a relevant mathematical instrument and, in terms of theoretical framework and methodology, to answer key questions on systems dynamics: change, regularity, predictability, reversibility of time, structural determination, etc. Chaos dynamics are especially useful when dealing with complex systems in which multiple interrelations are extremely sensitive to changes and order is produced by the own dynamics of the system.

"Transdisciplinary Unifying Theory"—M. Lunca

In an age when it is a necessity to face complex problems such as the ecological and environmental questions, which require the activation and coordination different scientific areas, the very disciplinary structure of scientific knowledge has to be questioned. Lunca's contribution focuses attention on the role of systems approaches as a counterbalance for such fragmentation and its potential as a transdisciplinary source. According to that premise, Lunca poses a theory of the processes of unification in a semiformal language, which allows a controlled integration of disciplines and systems into a metatheory.

"General Systems Problem Solver"—G. Klir

Klir introduces a methodological scheme known as GSPS, which constitutes a conceptual framework supported with a collection of software tools designed to develop its application. The aim of GSPS is to provide a general category of systems that allow one to organize and schematize system problems in order to optimize strategies addressed to their solution. GSPS can be considered an expert system designed to provide researchers with efficient systemic tools.

2. Epistemologies of Production

2.1 The Instrumental Shift of Subject/World Relation

The development of systems approaches and various methodological extensions constitute a singular point of confluence for those semantic vectors that define our culture: science, technique, and technology. The specific singularity of system theories lies in its capacity to reorganize relations among these vectors, which have been traditionally considered to be linear and deterministic. Moreover, systems theory opens the floor for the self-referential development of these vectors in their socio-cultural environment: the science of science as a logical epistemology, technique of techniques as an instrumental methodology, and technology of technology as an instrumental methodology. Thus, system theories, within the context of human knowledge, constitute a sort of *epistemic attractor* that reorganizes links between subject and world as well as between society and nature. The substitution of the object by the system during the second half of the twentieth century, posed by Bertalanffy, Jackson, Beer and others appears to be the first step in the re-organization of knowledge. However, systems theory's singularity is deeply rooted in the very same cultural characters that prefigure our societies.

The socio-cognitive cultural context in which system approaches emerge can be named as *epistemologies of production*. Western culture, including its thought and its science, can be generally identified as a technical culture radically oriented to production (of resources, devices, artifacts, tools, signs, meanings, states, processes, rules, procedures, experiences and, in sum, social subjects and societies). The term *epistemologies of production* refers to those worldviews (as paradigms or epistemic frames) that understand subject and object as different states, rather than as complementary processes.

As far as epistemologies of production ignore the complementary nature of the subject/object relation, they tend to obviate the very impossibility of any logical priority between them. Thus, for instance, the materialist assumption of the existence of matter sinks, if it is obviated, the cognitive subject and its cognitive action, which imprints the whole process that constitutes the object. Or, on the other hand, if a subject isolated from the world is supposed, it should be necessary to face the problem of a nonexistent pure subjectivity. If there is a world without the subject, this is not the case: it is not possible to conceive a subject without world or a world without subjects. Consequently, there remains the phenomenological option of conceiving a subject that produces itself through action in the world, producing at the same time the world that produces it. But there is still the problem of the object's resistance; the obsessive attempt to solve this problem drove Hölderling to the tomb, Nietzsche to madness, and Schopenhauer into aesthetic exile. Any radical position in such problem drives towards tautology. It seems there are two possible ways left to avoid epistemic tautology: to pose an argumentative strategy that explicitly ignores subject/object dichotomy (as in the case of Schopenhauer), or to pose the complementary nature of the subject/object relation. The case is that production epistemologies derive from radical positions (formalist and/or objectivist perspectives the focus on the instrumental nature of the concept) to "complementarist" positions.

Consequently, it can be argued that although constructivist epistemology, which

embraces some systems approaches, cannot be considered as an epistemology of production (so far as it considers subject and object as complementary processes), the origin of systemic thought is rooted in the very evolution of production epistemologies, particularly in the instrumental use of representation.

In general terms, epistemologies of production define a productive organization of subject/world relations. As such, they develop within an opposition between economy and ecology understood not so much as the classic scientific disciplines they name, but rather as the epistemological implications contained in their very etymological sense. Thus, economy and ecology come to be different, quite opposed, conceptions of subject/world productive relations. *Oikos* (gr. '*home*') refers to world, environment, the context of the observing system. *Nomos* (gr. '*rule*') deals with government, steering, or programming: any intentional organized procedure that points to design and planification as its typical products. *Logos* (gr. reason, inner sense or eigen-meaning) is addressed to comprehension or understanding that produces agreement or operational integration. Thus, *oikos-nomos* versus *oikos-logos*, the 'steering of the home' versus the 'understanding home's own sense', depict the opposition between two epistemic frames that understand subject/world and observer/observed relations in different ways: normative knowledge on one side, organizational knowledge on the other. Simultaneously, such a dichotomy speaks of two different conceptions of being-in-the-world: *intervention* versus *action*: hetero-organizational control versus self-organizational control. Here lies the leading dichotomy according to which systems approaches have developed during recent years: an exogenous perspective of observer/subject/world relations opposite to an endogenous perspective of observer/subject/world relations.

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Bibliography

Aguado J. M. (2001). Making of social subject: the role of theory and technology in social emergence. *Journal of Sociocybernetics* **1**(2), 7-14. [An introductory reflection on the links between logic machine as order producing devices and social theories as producers of given social self-images.]

Dupuy J. P. (1998). *El sacrificio y la envidia*. Barcelona: Gedisa. [A sharp work on individual-society relations in classic social theories within the context of the eighteenth century's economic revolution and the transition from sacred to narcissist society.]

Duque F. (1986). *Filosofía de la técnica de la naturaleza*. Madrid: Tecnos. [A comprehensive essay on the naturalization of society and the socialization of nature through techniques.]

von Foerster H. (1983). *Observing Systems*. Stanford, California: Intersystems. [A compilation of essays that presents the leading ideas of second-order cybernetics.]

Gutiérrez and Aguado (2001). Tecnologías de la producción teórica: la construcción del concepto *Ciencia y Método*. Visor: Madrid. [A reflection on the foundations of theory as technology and its methodological implications.]

Luhmann N. (1989). *Ecological Communication*. Cambridge: Polity Press. [Probably the most extensive work devoted by Luhmann to the role of communication and self-observation in the system/environment paradox.]

Maturana H. and Varela F. (1980). *Autopoiesis and cognition: the realization of the living*. Dordrecht: Reidel. [A concise development of autopoietic systems theory with regard to its implications as to cognition and operational adaptation ideas.]

Morin E. (1977). *La mèthode I. La nature de la Nature*. Paris: Editions du Seuil. [The first volume of a tetralogy devoted to compile the philosophical implications of complexity paradigm.]

Prigogine I. and Stengers I. (1990). *La Nueva Alianza. La metamorfosis de la ciencia*. Madrid: Alianza Editorial. [An intensive reflection on the consequences of complexity and self-organization in sciences.]

Varela F. and Dupuy J. P. (1992). *Understanding Origins. Contemporary Views on the Origin of Life, Mind, and Society*. Boston, MA: Kluwer Academic Publishers. [A compilation of essays on self-organizing paradoxes in modern and postmodern perspectives on life, mind, and society.]

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