Why Complex Systems Are Also Social and Temporal

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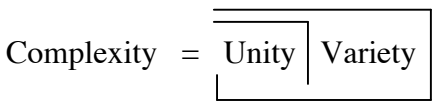
ABSTRACT: The paper inquires into the paradox of complexity, the unity of variety, in order to first ask how a system may be able to unfold that paradox and then to look at two features informing the system to self-organize its complexity, which are the features of the social and the temporal. The paper refers to G Spencer-Brown's calculus of indications as a suitable notational tool to both denote, and to inquire into, the form of a complex system.

I.

Complex systems are social because this is their only way to both unfold and reproduce their paradox, which consists in having to combine unity and variety, or operational closure and structures of reproduction. As to the paradox, it assures the use of, and reproduction of the system in, time.

Start with the acknowledgement of the paradox of complexity (Luhmann 1975, 1980, 1990, 1997: 134-144), which may be regarded as a recent translation of the philosophical tradition's venerable problem of how to conceive of variety if the human mind produces unities of objects, events, and ideas (Konhardt 1980), turning this problem into the problem of any system managing its self-organization without classical observers, who stick to concepts of causality and statistics, know how they do it (Weaver 1948). Using the notation of forms of distinction introduced by George Spencer-Brown's calculus of indications (Spencer-Brown 1994) we may denote the paradox of complexity in the following form:



This notation enables us to see that (1) the distinction between unity and variety and (2) their connection as two states of one form, as well as (3) the operation of their distinction, (4) the operation of the re-entry of that distinction into the space of the distinction, and (5) the unmarked state outside the two states of the distinction, are elements of the form of complexity.

The advantage of this formulation is that we may begin to inquire into the kind of operation we have to be able to account for if we try to understand what the notion of complexity may be able to tell us. What operation is doing the distinction between unity and variety and its re-entry into the space of the distinction, thus adding to a form which at some point of its unfolding ends up with being able to observe itself within its unmarked context?

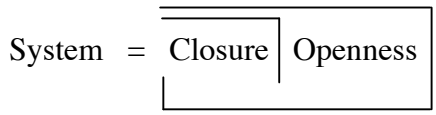
Any requisite variety able to deal with complexity stems from being able to account for a paradox and its unfolding assuring the complexity of the phenomenon (Ashby 1956).

II.

Systems theory from its very beginning is aware of the problem, if not of the paradox, of complexity. Any definition of a system takes care to distinguish between two sides of a distinction of which one may be regarded as being responsible for the unity of a phenomenon, the other for the variety of the same phenomenon. As a blueprint of most systems definitions we may take W. Ross Ashby's who in his book *Design for a Brain* defined a system as being comprised of an organism and its environment: "The free-living organism and its environment, *taken together*, may be represented with sufficient accuracy by a set of variables that forms a state-determined system" (Ashby 1960: 36, emphasis added, DB).

Other definitions like that of open systems self-reproducing as organized wholes (von Bertalanffy 1968), of cognitive systems producing order from noise (von Foerster 1981), or of autopoiesis describing operational closure amidst structures of reproduction (Maturana, Varela 1980) are true to Ashby's definition in that they insist on a mechanism producing redundancy, or unity, among a variety of components, variables, or events, which somehow acts as both challenge and support to that mechanism.

Thus, the form of the system may read as one or other variation of:



The paradox is sure to stay with us since we gain a form which includes not only the boundary between the inside of the system and its outside, but also the outside as the inside of its form, thus turning the relations any system may consist of into relations both internal and external to the elements involved (Bahm 1969).

Yet the one important step systems theory adds to the research into complexity is the possibility to exactly ask for the operation actually doing the closure, and doing it in a non-linear way such that the variety from the environment is selectively included turning the system into the both identical and non-identical iteration of itself (Baecker 2001, 2002).

III.

How are we to conceive of an operation self-reproducing the system in a non-linear and non-identical way? The answer to this question is tantamount to the explicit acknowledgment of complex systems as both social and temporal.

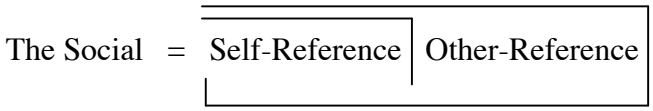
The core idea of course is to accept the indeterminacy brought about by the paradox. The paradox is a state of oscillation between two mutually exclusive assertions like the unity and the variety of a phenomenon or like closure and openness being the two aspects of one system. As we said, while the observer is puzzled the system happily thrives.

There seem to be just about two distinctions which are able to guarantee that the puzzled observer both accepts the puzzle and is able to invent solutions to it which unfold it without letting it disappear. Both of them invite indeterminacy to be become productive or even creative as some prefer to say.

The first of these two distinctions is the one between self-reference and other-reference. We know that systems theory is just another inquiry into the problems of, and solutions to, operational self-reference (Kauffman 1987). We also know that systems theory has its most difficult times dealing with the question whether there is any other to be referred to at all, turning systems theory into just another kind of constructivism (Watzlawick 1977). Yet we

only rarely accept Luhmann's idea to combine self-reference and other-reference in a way such that oscillation becomes possible and productive (Luhmann 1995, 2002).

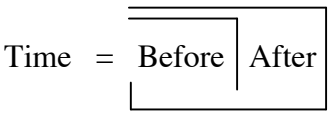
We propose to call the distinction between self-reference and other-reference the distinction of the social, also known as the distinction between *ego* and *alter ego* (Luhmann 1995):



It is a general distinction of the social, not necessarily relating to humans or individuals but also to anything else that happens to be around to make sure that any self-reference is bound by and related to possible other-reference, and vice versa, beginning, by the way, with the very fact that any communication first of all is self-affection thus turning the self into your first other (Mead 1962; Latour 2004).

The distinction between self-reference and other-reference guarantees both sides of the unity of variety since it provides with reference which embodies unity, and it refers to distinction, be it just the distinction between self and other which makes up for indispensable variety. Yet it embodies the closure of openness as well, since reference keeps coming back to itself while constantly having to account for the other.

Add to this distinction between self-reference and other-reference the distinction between before and after and you end up with two forms both of them just making explicit what any Spencer-Brownian form is about: reference, or indication, and time, or the crossing of a distinction made by an operation drawing the distinction:



Note that the two forms of reference and time are only the two axioms of much more complex forms involving all kinds of entangled references to a self and an other (Laing 1970), and all kinds of processes involving operations producing events which distinguish a before and an after (Allport 1940, 1954).

But, again, note as well that both forms of reference and of time might be considered to be just two ways to read and to interpret the implications of the paradox of complexity and the definition of systems being analyzed by putting them into their form as revealed by the calculus of indications.

Thus, we end up with a circular definition of complexity, systems, the social, and time, for once knowing that we can only do complex systems studies if we take the social distinction between different perspectives and the temporal distinction of operations producing events that change states seriously. The indeterminacy brought about by the paradox of complexity is the very frame that holds all of these terms together, the observer being the one who is on its own account bringing temporary determinacy to that necessary and productive indeterminacy (Kauffman 1978).

IV.

Further inquiries may relate to the questions of how social systems may forego their complexity by sticking either to unity or to variety without paying attention to the other side of the distinction, and of how temporal systems may become seemingly static by assuming events of all kinds not to change a before into an after. Both of these questions turn complex systems studies into some useful kind of a research into the pathologies of the living, the mental, and the social.

And then there is the two other questions when the studies of physical, organic, and mental systems will start to acknowledge their social and temporal character and when the laws of form will begin to be applied to all kinds of complex systems.

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