Alfred Locker [**]

Meta-theoretical Presuppositions for Autopoiesis – Self-Reference and "Autopoiesis"

INTRODUCTORY REMARKS

(by Milan Zeleny)

Locker's writing is complex, flowery, and often singularly poetic. The reader is invited to read Locker's last paragraph in order to appreciate the editor's task. Yet, I have interfered only minimally because Professor Locker's underlying ideas and reasoning are highly original and a price must be paid for understanding them – by the reader and the author equally.

Locker turns our attention to autopoiesis again. Some of his conclusions have been characterized as "brave," or at least "boldly asserted." It will become obvious to the reader that during the process of writing and rewriting of papers, Locker and Glanville have become intellectually and mutually self-respecting unities.

Essentially, Locker grapples with the problem of the origin of autopoietic systems – through partially vindicating Virchow's *omnis cellula e cellula* with his *omne systema e systema*. Another variation on this ploy (in English) would be Weiss's earlier "System begets system" and even its precursor, *omnis organisatio ex organisatione*. Life cannot originate "by itself."

Locker reinstates the role of a "program," conceived as a creative-generative system comparable to the subject, or "self." The subject has to precede, as a creative system designer, any occurrence of "origin." Locker's attack on scientism, and his inclusion of autopoiesis within its realm, represents a metaview of considerable import. In more simple terms, autopoiesis is only a result of human reflection, a construct of the human mind, a fruit of a self-referential comprehension of ourselves.

It is interesting to follow how Locker "takes on" Eigen's hypercycles, a theory that is becoming central to Jantsch and respected by both Atlan and Varela. Locker insists that *nothing* arises "by itself" and that the objective origin of anything is not only impossible but unthinkable: the cognizing subject is always indispensable for an origin to be recognized, and the creative subject (God?) is always indispensable for an origin to be accomplished.

As Locker refers to the object of his attacks as "scientism," without specifying any of its various meanings, the reader might find it useful to recall its most common definition: an exaggerated trust in the efficacy of the methods of natural science to explain social or psychological phenomena, to solve pressing human problems, or to provide a comprehensive unified picture of the meaning of the cosmos.

The following should be pondered: Locker has used the established methods of natural science (logical reasoning, mathematics, empirical argumentation, and referencing other scientists) to reach rather unitary and systemic conclusions on the questions of cognition, self-reference, consciousness, cosmogeny, language, and origin. If we accept that there is something outside the picture derived by the methods of science and scientism, as for example Locker's logically derived implication that "nothing arises by itself," are we then justified in entertaining the opposite idea, that of spontaneous generation?

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Chapter 13

Metatheoretical Presuppositions for Autopoiesis – Self-Reference and "Autopoiesis"

Alfred Locker

13.1 *Introduction*

Autopoietic organization has been defined (Varela et al. 1974) as

unity by a network of productions which (1) participate recursively in the same network of productions of components which produced these components, and (2) realize the network of productions as a unity in space in which the components exist.

Additional defining remarks by the same authors specify "that the realization of an autopoietic organization is the product of its operation," thus separating this kind of organization from the allopoietic one that "characterizes systems in which the product of their operation is different from themselves."

In order to formulate the problem under consideration in relation to autopoiesis, we have to ask, (1) What is autopoiesis? In conformity with the definitions quoted above, we may find, as a preliminary answer, that it is both a process and a state; since the process apparently is characterized through its equality to its own product, the statement can possibly be translated into "equality (or complementarity) of process and state." When we continue to ask, (2) How does autopoiesis come into existence?, we raise a question about a process that can again be regarded as equal to autopoiesis itself. It could be maintained that in addition to the operation within the system – the meta-operation also leading to the occurrence of autopoiesis as a kind of principle out of which autopoietic systems arise – is again equal to autopoiesis. Thus, the recursion invoked in the definition does not only refer to autopoiesis from "inside."

When we ask about the presuppositions required for an autopoietic system to come into existence, we are first confronted with purely scientific presuppositions that do not properly deserve their name, such as theoretical mechanisms that (according to some scientific hypotheses) should have brought about the system that exhibits an autopoietic character. This character is explained in familiar terms.

The moment we realize that the scientific answers with which we have contented ourselves cannot be considered the ultimate ones, we can begin questioning with interest the presuppositions for science itself. For our particular problem the reasons we have to challenge the assumptions generally made in science are the following:

1. The definition of autopoietic systems deals with recursiveness (i.e., a part of the theory of computation).

2. There is no doubt that autopoiesis, as a kind of continuous self (re)production of the system, must be brought into connection with self-reference and hence with ourselves. Thinking about ourselves is the task of philosophy.

When hidden assumptions are made explicit something very astounding may be revealed: apparently the relationship of autopoiesis to self-reference and to consciousness does not occur because of the "emergence" of consciousness due to the evolution and increase of complexity of autopoietic systems (e.g., the brain) – construed even as an epiphenomenon (Varela 1971) – but rather for an opposite reason, namely, that the self-evident comprehension of ourselves has to precede the contrivance of autopoietic systems. What seems to be objectively given emerges as the result of the projection of knowledge of our own properties, as self-referential conscious subjects, onto an object that happens to be, in the very nature of the organism, a subject as well.

Admittedly, there are three available methodologies for tackling the problem of what presuppositions are required for the conception of autopoietic systems: (1) the scientific, (2) the systems theoretical, and (3) the meta-theorctical (Bense 1960). Our main concern here is the question of to what extent any result that considers self-reference and the subject nature of systems contributes to an appropriate understanding of autopoiesis. The investigation we pursue is, in parts, polemical and we shall paraphrase the answer several times.

13.2 *The Inadequacies of a Scientific Approach to Autopoiesis*

Autopoiesis presents a new conception in that, rather than being a mechanistic approach, it confronts an intuitively understood fundamental property of the organism, that is, its existence as a unity or a "whole." However, appropriate recognition of the significance of this new apprehension of a known item necessitates the avoidance of seductive conceptual schemes; in recent years the most coercive one seems to be the evolutionist empiricist scheme, the acceptance of which, after the advent of the cybernetic paradigm, would indeed lead us into an inexcusable relapse. This without doubt would be the case if we were to consider the evolutionary scheme, especially in the most suggestive form as given by Eigen (1971), as an example of the only valid line of treatment. In Eigen's theory, because of the encounter of the two main classes of biomolecules, nucleic acids and proteins, life originated as a pure chance (or probability) event; because of the mutual profit by the features of the constituent biomolecules, the resulting primitive organism, called "hypercycle," exhibits a set of properties indicative of life. Due to competition among several specimens of hypercycles as against the challenge of selection, the organisms are subject to evolution.

Despite the fascination this theory now arouses in public we have to face some difficulties:

(1) Autopoietic organization is *recursive.* A predicament for evolution theory is that recursive functions should become operative in nature via the mechanisms evolution theory propounds. Since it makes use of the concepts of "chance" (i.e., mutations) and "necessity" [i.e., natural laws restraining the outcome of mutations (Monod 1975)], the "emergence" of recursive relations (in time) is unthinkable unless one considers the togetherness (and mutual conditionality) of "chance" and "necessity" itself as an expression of the (atemporal) existence of recursiveness (and circularity). Indeed, astonishingly simple computer algorithms, such as those

for the "Garden of Eden" simulation of the evolution of life (Gardner 1971), are based on recursiveness. Thus, the objective occurrence of recursiveness in nature seems to be one of the presuppositions that exceed scientific contexts and of which science generally is not aware. But how could we take notice of recursiveness (or even invent recursiveness as a mathematical theme) if we were not subjects with self-reference?

(2) We have to examine the *language* in which a scientific theory in general and the theory of evolution in particular is being formulated. We find immediately that evolution theory is developed within the context of a language that allows the expression of an "emergence theory" (E-theory). Within the confines of this theory one thinks of observing and describing something objectively existing that allegedly arose de novo, but one does not ask about the presuppositions that make this description possible. These presuppositions can be distinctly expressed only if another language (level) is assumed and it is shown that the language in which the theory has formerly been uttered – and the contents of the theory – is valid only relatively. This elucidation is made possible by the language of a "transition theory" (T-theory) (Rosen 1973), which naturally comprises E-theory. Whereas in E-theory some events appear as randomly occurring and thus not predictable, just the opposite holds true for the same event described in T-theory. Here, according to laws that have to be sought out and formulated according to the requisite boundary conditions, the event appears as determined and predictable. However, the laws to be assumed here are also the laws that characterize the subject's organization for obtaining knowledge. Since we have to distinguish here between immediate description on the one hand and consideration of the possibilities of this description on the other, we are inevitably dealing with the cognizing subject.

(3) Highly indicative of this involvement of the subject in the outcome of cognition is the occurrence of *complementarities* (or dual statements). In evolution theory the complementarity between chance and necessity, or between "additive" and "subtractive" processes – in line with the "arched structure" model (Cairns-Smith and Walker 1974) – is overlooked, although any single event is the result of both of them.

Having taken the difficulties of comprehending evolution within the usual theoretical framework seriously, we have to see in them strong hints at the necessity of asserting the precedence of the cognizing subject, that is, the observer and theory builder. Ordinary science, however, tends deliberately towards hiding this precedence. Thus, in criticizing the inadequacies of the scientific approach we affirm the centrality of the subject.

13.3 *The Difficulties for a Systems Theoretical Approach to Autopoiesis*

13.3.1 On the Systematization of Instrumental Systems

Taking autopoiesis as akin to self-(re)production we have to deal with two problems:

1. What are the possibilities for a system to produce something else (e.g., another system), and finally itself?

2. Which systems theoretical presuppositions are required for this kind of activity?

We understand as systems theoretical presuppositions those suppositions that are antecedent to the acquisition of knowledge about the system's activity as well as to the activity itself, provided the latter can be separated from the former. We attempt now a systematization on the basis of the system's ability to produce something else (as an allopoietic or aP-system), or to produce itself (as an autopoietic or AP-system).

The criterion for this systematization is the system's function as an *instrument* for some task (or purpose), which recognizes that the system's instrumental character cannot be disconnected from the notion of purpose. We preliminarily limit our consideration of *instrumental* or I-systems to the observable and describable body-machine (b-machine, comparable to "hardware"); but it will be shown that the mind-machine (m-machine, comparable to "software" or program, the latter being called p-System) will increasingly gain importance. Our array is the following (Figure la-f):

(a) About the *executing* or E-system we know nothing more than that it simply "works," that is, executes the instruction given by a p-system, although the latter is not explicitly beheld. Therefore, any discussion of purpose cannot be contemplated, and consideration is limited to "what" the system is doing. The dependence on the constraint of the view an observer might choose allows the Statement that any arbitrary system may suit the character of an E-System. Here a distinction between a producing system and a product system (or process and state) does not make sense.

(b) The *making* or M-system is a system that, according to the aspect of the observer, enables one already to obtain a vague specification for the System. In addition it may be stated that the product of the M-system does not exceed certain features (e.g., complexity) of the M-system itself.

(c) The *producing* or P-System has a clearly specified function, that of producing a product. The latter's complexity may be less than, equal to, or greater than the complexity of the P-System itself. It is evident that the P-system obeys the instructions given by the pertinent program, that is, the p(P)-system.

(d) The *reproducing* or R-system represents a subclass of the P-system system; it "aims" at producing a series of copies of itself, each of which exactly resembles the original without being, of course, identical to it. The products are not connected, and the production goes on in one direction only. In order to understand the activity of the R-System, its pertinent p(R)-system has to be taken into account.
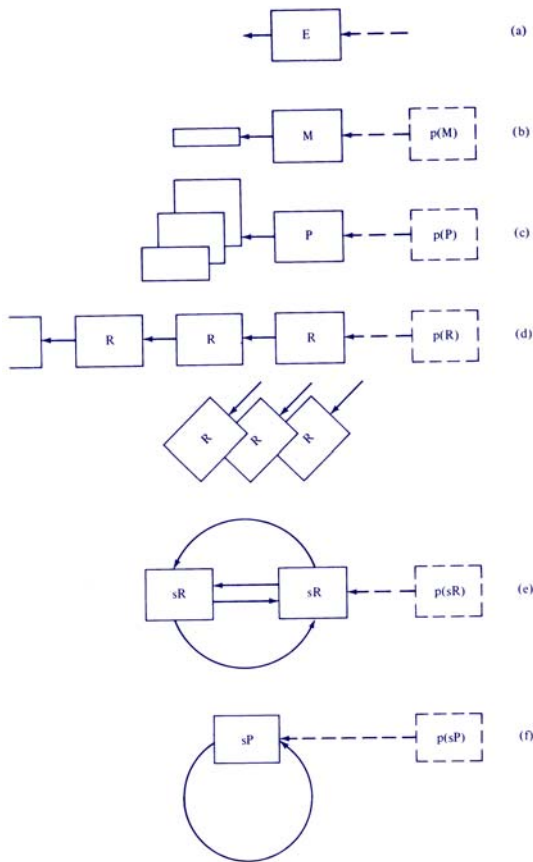
(e) The *self-reproduction* or sR-system represents an *improper* autopoietic system. It appears as a subclass of the R-System in that its outcome should, abstractly speaking, be (complementarily or dually) identical to itself[1]; its product, by be-

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[1]   This argument also applies to the definition that the sR-System (well understood as improper "autopoietic" system) "emerges, given a domain of processes of production of components,

ing connected with its producer, can reversibly (and recursively) assume the role of the producer. Here we are confronted, not with a potentially infinite series of quasi-identical systems, but with a totally new kind of system; it is not characterized through a one-directional relation between constituents that are linearly threaded, but rather through an intrinsic circularity, forming a unity. If we regard the circular relation underlying an sR-system abstractly, then it can be called a self-referential relation, the significance of which will be examined.

Figure 1. Display of I-systems (i.e., E-, M-, P-, R-, sR-, and sP- (≡AP)-systems) (center) with their pertinent programs, or p(I)-Systems (right) and products (left). (d) The distinction between complete reproduction (each product shares the capability of reproduction and continues the series) and incomplete reproduction (the products are sterile). (See text for further discussion of parts a-f.)

(f) The autopoietic or AP-system *proper* differs from the foregoing system in that it *self-produces* (therefore also called sP-System) in the most astonishing way, (1) by letting the producer's system product become virtually identical with the producer system and (2) by connecting the two in such a peculiar way that they become a new, "*in itself*" *identical* and autonomous unity. By doing so, the AP-system proper (called AP-system for short) surpasses even the sR-System in a qualitative way; the latter is still dually organized, while the AP-system is unitarily built up. No difference between the producer and the produced system exists any more; they become (or better, they are) immediately one with the other at the moment the AP-system arises.

The systematization of I-systems serves a better understanding of the AP-system. In the AP-system a concentration (or better, *centration)* of systems characters becomes obvious. The series from the E- towards the AP-System shows an increasing subjectivization and, more and more, a "becoming itself"; in the AP-system's identity, its own connectedness "in itself " is incorporated.

The growing role of the program (i.e., the p-system) and the problems of cognition are studied next.

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when and only when such processes concatenate in a recursive fashion" (F. Varela, personal communication).

13.3.2 A Systems Theoretical Approach to the Problem of Cognition

The systematization of I-systems was carried out without considering the *cognitive domain* (CD); that is, the closed domain in which a system is located and the location of which is taken into cognizance by an observer (O-system) equally belonging to the CD (Figure 2). It is conceivable to look at the CD quasi-objectively, as if, in speaking about the CD, we were exempt from an entanglement in it. Then we may perceive how the O-system describes, in the CD, the system (here called S-system). But we may in addition surmise that the O-System is bound to make a hypothesis on how the S-System came into existence and to assume that it did so through another system in just the way explained for I-Systems. For a natural system (i.e., the organism), the whole physical universe is usually accepted as such a system, making entry into existence of the system under observation possible; then the mechanism of evolution is proffering itself as the execution of that system's activity, leading to the system under specification. In order to distinguish in the CD between the S-system (proper) and the system that brought the former (instrumentally) into existence, we call the latter the designing system, designer, or D-System.
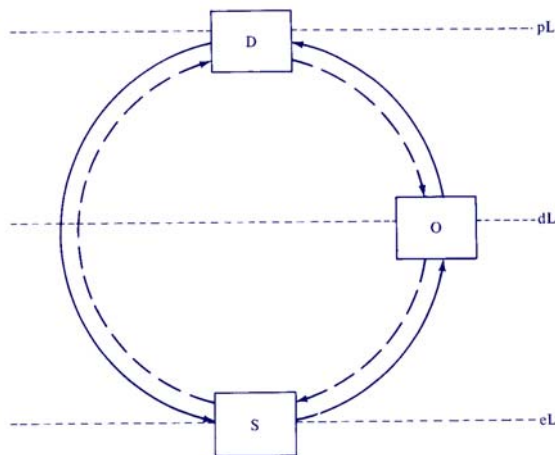
Figure 2. Mutual interrelationships between the D-, O-, and S-systems in the CD_{obj}; the language levels (pL, prescription language for program formulation; dL, descriptive language for model representation of the S-System through the O-system; eL, executing language of the S-System) have not been mentioned in the text.

Within the CD the S-system can be assessed by the O-system only in the form of a *model*. The notion of model is always ambiguous since for one and the same bulk of data (observable about the S-System) the O-system can formulate quite different descriptions. Depending, however, on whether the S-System is viewed quasi-objectively (by us) or subjectively (by the O-System in the CD, taking the S-system's model character explicitly into account), we have to refine the notion of the CD and to distinguish between (1) the CD_{obj}, consisting of relations between the O-system, the D-System, and the S-system, and of having the other observer (i.e., us) only available as a "hidden parameter"; and (2) the CD_{subj}, consisting of the relations between the O-system, the S-system, and its model and of having the D-system (i.e., "objective" reality as designer for both the O-System and the S-System) again available as a "hidden parameter." The CD can thus be interpreted as the environment (surroundings) of each of the three systems, which for each of these three systems (because of the complete connectivity between them and closure of the CD) perfectly coincides.

The CD of the AP-system poses a different problem. Because of its autonomy the AP-system does not share the CD with any other system; the D-system, the O-System, and the S-System fuse within it. As a consequence of this feature the AP-System is essentially unrecognizable from outside (e.g., not simply identi-

fiable as an I-System) by any O-System that wants to pin down the AP-System as the S-System of the O-system's *own* CD. In order to avoid speaking about purely fanciful products or figments, the observer making propositions about an AP-system must empathically (or intuitively) share the AP-system's properties on the ground of self-understanding, and then project this understanding into (or onto) the system. Other possibilities are not available unless the observer wants to destroy the system in order to explore it and thereby degrade it into systems of lower classes.

13.3.3 On the Significance of Program and Purpose

During the systematization of I-systems, the underlying programs (m-machines or p(I)-Systems) became increasingly significant. Although it may be an oversimplification, we equate the notion of program with the notion of purpose and therefore apply some ideas proposed by Pask (1970) (Figure 3). In the CD the D-System (i.e., designer), before doing its job, has to formulate a program for its own activity, and this program predestinates the S-system's production (i.e., the program is the program "for" the S-System, in short, for-program). When the production of the S-system has been performed, the latter possesses the program (as its own p(S)-system *in* itself. The third partner in the CD, the O-System, must hypothetically infer from the S-system's behavior the program underlying this behavior, which the O-system then interprets *post festum* as the program *of* the S-System. Thus, the of-program becomes the model of the in-program.
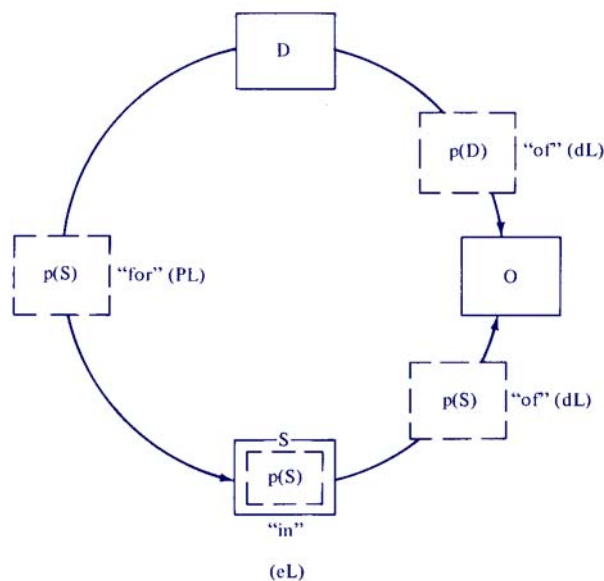
Figure 3. Role of programs in the CD. The p(S)-` `for"-program, formulated in *pL* by the D-System, becomes the p(S)-"in"-program of the S-System, executed in *eL*. The O-system, in order to gain insight into the S-System, formulates the latter's p(S)-"of"-System in *dL;* the p(D)-"of"-program is tentatively formulated by the O-System in order to gain access to the D-System.

In any p-System two major features may be discerned:

(1) A program of an I-system (i.e., a p(I)-System) can be *realized,* or made on m-machine for a b-machine, in different ways; several I-systems realize one p(I)-System (Rosen 1966). Therefore, an individual I-system's program exhibits less "content" than the whole p(I)-System set. The p(I)system in turn is more complex than the I-system, in the sense that it not only represents the in-program, but also (and prerequisitely) the for-program. It contains the instructions for each individual I-system, that is, how it may be built (in one of the ways M-, P-, or R-Systems indicate), and how it may work (as an E-System). In the for-program, the p(1)-System comprises the m-machine and the b-machine, as well.

(2) The p-system undergoes a *conceptual movement*. When being formulated ("produced") as a program by a p[p(1)]-System, it is first part of that system (as in-program in the p[p(1)]-system); then it is conceptually moved (and made operative via the CD to its product system. Furthermore, when the latter now plays the role of the D-System, the p-system becomes part of that system's program as p(D)-system; from there it finally moves to the S-system produced (becoming its p(S)-System).

Here we note that the connectivity of the CD, predominantly considered with respect to p-systems and pertinent b-machines, is conterminous with actional connectivity. Anticipating meta-theoretical considerations that we will make extensively later, we assert that both connectivities are relational expressions for the "being," that is, the constant basis subsisting cognition and action.

The significance of *programs* for *models* may be outlined as follows:

1. The model maker who simply conceives of a model of the S-System, without taking simultaneously into account the S-system's dependence on its own D-system, assumes (subjectively) the role of the D-System. Inferences are drawn from the data obtained through observation of the S-System as to the underlying p-system.

2. As soon as this assumed role (that of the D-system) becomes obvious, the model maker realizes that any system that conceives of the p-system has necessarily to slip into the nature of a subject.

3. The model maker may then also suppose that, like the model ascribed to the S-System or designed instead of the S-System, a system can come into existence only through a D-system (now believed to exist objectively, although still representing a subject; Figure 4).
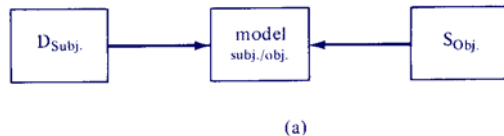
Figure 4. Schematic representation of how the model maker, (a) assuming the role of a subjective D-system (for the model of the S-System), transforms this role into the hypothesis (b) that, for the system's objective existence, an objective D-system has to reassumed.
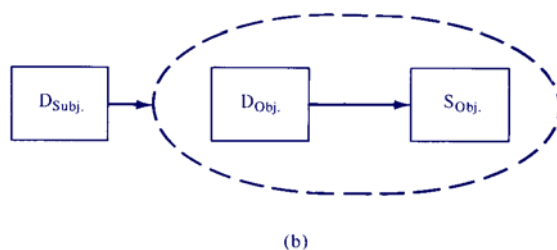
From the standpoint of Systems theory it is necessary to ask how a system that is able to formulate a p-System (or only a model of an I-system) needs to be constituted. Such a system should at least be postulated as the *creative or generative* system (or C/G-System), whose activity consists of creating or generating from the beginning everything that is needed by a system. The main point is that such a system would (by definition) be able to formulate not only a program for any arbitrary System, but also a program for itself. The C/G-System thus has to share with the human subject not only the property of self-reference, but also those of self-recognition and self-determination. It is obvious that an AP-system, revealing a producer-product (or D-System-S-System) relationship that tends to the final (and/or initial!) identity of

the two, has, together with the O-system (recording this identity from "inside" the System), very much in common with the C/G-system.[**2**] But we may also grasp, from our own self-understanding, that certain features of man, particularly his endowment with "intelligible" freedom (as against the "empirical" freedom of organisms), cannot be shared by an AP-system, yet are beyond the scope of Systems theory.

In the well-elaborated systems theoretical methodology are certain clues to the questions raised at the outset. But difficulties still remain in that thus far we have only touched upon solutions that, by their very nature, can not be found in systems theory. Thus, an entry into meta-theory is required.

13.4 The Possibilities for a Meta-theoretical Approach to Autopoiesis

13.4.1 The Paradox of Cognition and the Significance of the Subject

Metatheory, by making explicit the conceptual presuppositions held hidden in almost every theoretical construct, brings attention to doubts about the universality claim of science. The significance of the cognizing subject becomes more obvious as meta-theory itself is forced to bring its own presuppositions to light. This aim can be achieved if one avoids believing in arriving merely at a definite position, but instead recognizes that one has to permanently transcend and relativize one's own point of view. Such a transcending methodology is, for instance, circumscribed by the conception of the "cybernetics of cybernetics" (von Foerster 1974). It must permanently focus on the fact that the attempt to attain another aspect, for example, by mounting language levels or by looking for alternative descriptions (Pattee 1973), necessarily relativizes the subject's position. It follows that it is impossible to recognize something without recognizing cognition itself.

In order to treat the problem of cognition meta-theoretically we have two methods at our disposal; these are themselves complementary or dual to one other, thus signaling an irritating initial paradox.

(1) We may start from the assumption that there is a precise *correspondence* between the being (i.e., "what is," or the so-called objective reality) and cognition (i.e., the cognizing activity of the subject). This correspondence is brought about by the underlying (founding or fundamental) *idea,* the equivalent to some formal structure (but actually infinitely more than this) that can be depicted as uniting the observer with the observed and thus displayed by a circular relation (Figure 5a). It would be impossible to speak sensibly about the correspondence of the being and the cognition of that being without the assumption of the idea.

(2) However, in order to speak about the correspondence there must exist a subject, called "transcendental" (by Kant), that reflects on what is and on cognition; the subject hence presupposes, recognizes, performs, and even partly founds the unity expressed in the correspondence. Therefore, we need to counterpoise the as-

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2   This holds inasmuch as the AP-System is *the* product of the C/G-System that is closest to its producer.

sumption of the correspondence that is objectively stated (compare it with the CD_{obj}!) to the complementary assumption of the cognizing subject that (a) is placed (or places itself) amidst the correspondence, (b) formulates statements about the correspondence, and (c) characterizes, by means of these statements, the correspondence as *coherence* (Heintel 1974) (i.e., as consistency of the statements about any object of cognition, taking the object itself, statements about it, and statements about the cognizing subject into consideration equally). This situation can be illustrated by a circular relation that now bears another meaning (because it is comparable with the CD_{subj}) (Figure 5b).
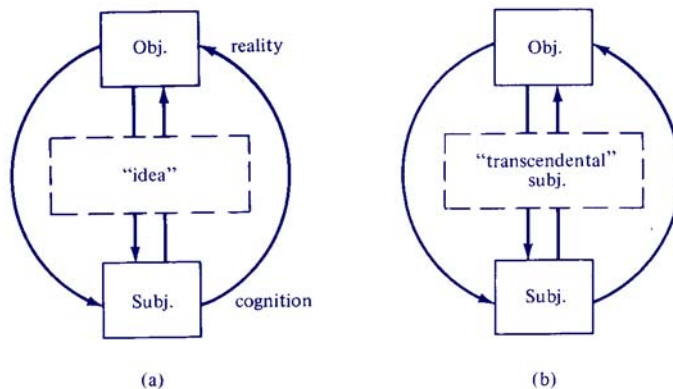
Figure 5. Similarity in (a) correspondance and (b) coherence; the difference between the two circular relations is that in coherence, instead of the idea being fundamental for correspondence, the transcendental subject assumes the job of foundation.

We come to recognize that the notions correspondence and coherence, respectively, can be connected to other attitudes the subject assumes when it acquires cognition: *discovery* of something contrasts with *construction* of the same something. Unreflected *"givenness"* (i.e., conceiving of reality as devoid of presuppositions for cognition) may oppose *"mediation"* (i.e., reflecting upon the presuppositions that are required). A rephrased proposition about "givenness" vis-à-vis "mediation" could read thus: Every entity that is recognizable as an entity must be given (i.e., be part of the so-called objective reality); however, in taking this givenness into cognizance, the presence of the cognizing subject must evidently be presupposed. But the subject too must be considered as given, otherwise it would not be possible to speak about itself. Viewed in this way, the problem of cognition appears even at its root to be deeply paradoxical.

Therefore, we shall strive for some clue to that paradox. It should be mentioned that the CD, whose (minimal) structure is described above, is isomorphic with (1) the *conversational domain,* that is, the domain between partner 1, partner 2, and the theme in a conversation (Locker 1980), and (2) the *self-referential domain.* The last-mentioned domain is built up by a subject ("self 1"), which by "disunion" is able to distance from itself and to see itself as "self 2"; this performance of seeing is "reconciled" by the "self 3," which watches the mutual observation of "selves 1 and 2." The connectedness of the three domains (CD, conversational, and self-referential, respectively) poses a problem similar to the connectedness of "givenness" and "mediation"; in these instances something (some notion) that unites and founds the opposing terms is required. Having arrived at this point we concentrate now on the notion of the "self."

13.4.2 On the Several Meanings of "Self"

The meaning of the prefix "self" in words such as self-reference or self-reproduction certainly depends on the view chosen and the context elicited by that choice. The following meanings of "self ' can be discerned:

(1) When it is supposed (Löfgren 1968) that *"description of description"* (i.e., a description referring to a described object itself being described, albeit at a higher language level) is equal to self-description, then we encounter here the *"relational self."* In it the pronoun "self" indicates the grammatical object to which the transitive verb (e.g., describe) points; but the word "self" remains a pronoun. The "relational self" thus is the *formal* basis for any usage of terms in which the prefix "self " appears.

(2) A content-based *(material)* interpretation (i.e., an interpretation regarding the content of the term) shows that the meaning of the word "self" can be grasped as a *self-directed* or *self-dependent* activity – i.e., an activity whose paradigm is possibly expounded in the saying, "I do it by myself," equivalent to saying, "I do it alone, without external help." Here, the prefix "self" appears as the token for origin and goal of activity, and relies on the meaning of "self " as noun. In addition to the necessity of unfolding the "relational self " contentively (i.e., materially) by activity conforming to this relation, the *self-knowing* (or self-cognizing) activity needs to be envisaged.

(3) Independently of any (material) activities formally guided by the "relational self," a carrier of these activities is demanded as necessary. It can be called *the Self* as noun (now written with capital S) and represents the cognizing subject in its full import, the "transcendental" subject that corresponds to the conception of "substance" in ontology.

13.5 *On Self-Reference and Self-Consciousness as Paradigms for Autopoiesis*

13.5.1 On the Activity and the Knowledge of the "Self

In order to function appropriately in the CD the observer (who becomes self-observer when the observation expands into the self-referential domain) must possess consciousness. Consciousness comprises

1. *intentionality,* that is, directedness towards outside objects (this attitude is more or less in conformity with the acceptance of "givenness"); and

2. *reflection,* that is, directedness of consciousness towards itself (Oldemeyer 1970) (being more or less in conformity with "mediation" or "self-mediation"). Here, of course, there also needs to be

3. the presupposition of a unifying, founding principle, the underlying "idea" or the "transcendental" subject, that is, the subject that embraces all those conceptual principles without which no object can be thought of.

In line with our assertion that there is a similarity between autopoiesis and self-reference, we look more closely at reflection. As already stated, reflection can

be either an expression of the activity of the Self or of the knowledge of the Self. From this follow important consequences for autopoiesis.

If we regard reflection as the *activity* of the Se1f, then it is necessary to pre-suppose that the Self already possesses the *ability* to perform reflection. Ability-or, in Chomsky's (1972) terminology, competence must precede perform-ance; therefore, performance of reflection cannot found (i.e., be fundamental for) consciousness (Henrich 1970). Setting consciousness roughly equal with auto-poiesis forces us to conclude that *self-referring relations cannot explain* (or found) autopoiesis. We cannot simply invoke the existence of self-referring rela-tions to give rise to an AP-system.

Further, if we look on reflection as the Self's *knowledge* of its own self-referring activity, then it is impossible for the Self to become conscious of any state of affairs by simply reflecting on this state of affairs. Since reflection can sensibly be understood solely as an intended or aimed reflection, a knowledge of the purpose needs to be provided beforehand (Henrich 1970). In other words, any knowledge the subject has of itself cannot be obtained by self-reference. This result amounts to the assertion that autopoiesis *cannot be obtained by circular* (closed, recursive) *relations* alone.

13.5.2 On Modes and Models of Self-Reference

In addition to the underlined inability of self-referring relations to found auto-poiesis, we have to ponder the following questions.

To understand the Self more fully, we also have to equate it with the *concept* (or the p-System) of the Self. A concept does not make sense without taking into account the subject that conceives (of) it; this is even more valid when the concept refers to the subject contentively. Thus, since the subject requires knowledge of itself before it undergoes self-reference, this knowledge is to be equated with the concept (i.e., the own p-System) that the subject consciously has of itself.
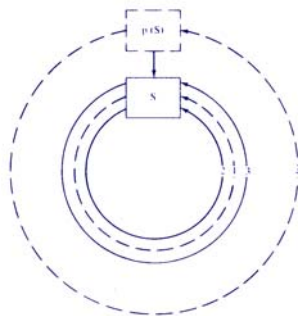
Figure 6. Schematic display of self-reference. The formal relation in itself (1) enables the system (S) to perform subjective reflection for itself (2), which is objectively recorded as reflection on itself (3). All modes of self-reference must be formally prescribed by the self-referential nature (4) of the system's program p(S).

However, we have to constrain our former statement and add the correction that it is only *one* kind of self-referring relation that is incapable of founding the subject. A closer understanding of the connections between self-referring relations and the Self can be reached by drawing further distinctions on the basis of the terminology intro-duced by Hegel, employing *personal pronouns* and *prepositions*. Remember that prepositions serve also to clarify terminologically the theory of p-Systems (or purpose). There is, first, reflection *in itself,* meaning something solely formal, thus comparable to the formal "relational self" mentioned above. By reflection in itself we mean a relation leading "from" an entity "to" the very same entity. Because the CD is left out of consideration, this "definition" tells nothing about the mode of

cognition regarding the occurrence of reflection in itself. When the CD is taken into account, two further distinctions show forth. The existence of the self-referring relation is objectively stated when one calls it reflection *on itself* (in German, *an sich*). This preposition reveals again a twofold meaning: either (1) it is simply caught as a matter of affairs that can be observed and described, because the prepositional and pronomial term "on itself" characterizes a b-machine; or (2) it is contended that the "source" (a term whose meaning will be specified forthwith) for the objectively existing self-referring relation "on itself" lies *outside itself.* Then, self-reference is not actively, but only passively performed, upon some order laid down in a p-system stemming from some alien authority.

In sharp contrast with the foregoing, reflection *for itself* asserts that the self-referring relation is actively brought about and performed by the entity from which it proceeds and to which it returns. Differing from the activity carried out under the item "on itself," which is only objectively stated, reflection for itself denotes the "source" of the reflective activity as lying *inside itself,* although the p-System "for" the reflection for itself must be given beforehand. The prepositional and pronomial term "for itself ' nonetheless characterizes the state of autonomy.

Of course, the knowledge that accompanies reflection for itself is (known) reflection of *itself,* possibly incomplete (Figure 6).

The performance of self-reference can easily be aligned with characters of the sR- and sP-systems. Our own introspection teaches us that in the sR-system two complementary (parts of) "selves," both dually identical with each other, can be discerned, although the performance of self-reference demonstrates that it is impossible to hold both of them in attentive consciousness simultaneously. Attention needs to switch from one part of the sR-System to the other part (i.e., from Self I to Self 2) and back. This makes the deep split ("disunion") in the system obvious, whereas in the sP-System ($\equiv$AP-System) the unity is perfect and the complementarity thus "elevated" (*aufgehoben*) *or* "reconciled" (to use Hegelian terms). Actually, the unity and the complementarity are both expressions of our approach, which necessarily has to switch between these two modes. It is pure self-consciousness, being indeed something qualitatively else-the mental or spiritual state of the "true" inmost Self within oneself (of which the C/G-system or the p[p(sP)]-System only gives a skimpy intimation), which is, as such, a permanently unchanging and yet active unity without internal disseverance.

13.5.3 Systems as "Selves"

It has been said that each system consists of a b-machine and an m-machine. But there is a compulsion to go further to the concept of Mind, settling upon the meaning of something that is representable by the program but is not the program itself. The Mind has to be equated with the Self.

At this point in the discussion it may seem acceptable to state that every system has the character of Self or subject. Again several possibilities open up:

1. The system is a subject, because the subject is *within* it, such that the b-machine provides the exterior representation of the subject (= Mind plus m-machine).

2. The system *represents* a subject: the latter is not interior, but rather exterior to the system. This instance is given when the subject of a system that acts as a D-system programs on S-system, which in turn contains a program of itself (as p(S)-System) but did not formulate the program for itself.

Further specifications are possible:

1. When the system is a subject then it is already a creative subject (aC/G-system) when it conceives of a program for another system.

2. The system's subject nature can still be augmented when it conceives of a program "for itself."

The program for itself can only be achieved through self-reference, followed by self-recognition. Then the (human) mind recognizes itself as dependent and may conceive of a model of a Mind that is conceiving of itself, although it does already (forever) exist-the Mind of God. The true subject of man recognizes that it cannot bring itself into existence.

13.6 *On the Origin of Autopoiesis*

13.6.1 The Origin Paradox and How to Overcome It

We used previously the neutral word "source"; it can be used with several ranges of meaning: (1) "cause," understood as the purely scientific term; (2) "foundation," understood in its meta-theoretical aspect; (3) "origin," a term which we will adhere to, and which falls between the two aforementioned terms in that it also expresses their togetherness. In addition it accords with the notions of time (cause) and of atemporality (foundation).

Whenever we try to speak of an origin (i.e., a beginning), the expression seems to be fraught with a disturbing paradox, be it in the case of the origin of language (Lohmann 1965), the origin of life (Cairns-Smith and Walker 1974), or the origin of the total creation (Bonhoeffer 1969). Language always seems to fail, especially when we are seizing upon the origin of language itself: language as a means for expressing something already presupposes itself as that which is to be expressed.

Three principal *means* are available *to handle* any paradox:

1. Leave the paradox untouched and sustain it as an unsurpassable boundary to cognition.

2. Escape it (or better said, try, self-elusively, to escape it) by inventing a mechanism that fits a certain conceptual scheme generally taken for granted. For such a mechanism, physical *time* is made absolute so that entities that inherently belong together (and in their very togetherness exhibit the paradox) are torn asunder and placed as subsequent events in the time frame, with a putative initial event (like the "big bang") as the punch of an origin. However, the postulate of a physical mechanism pretending to avoid the paradox (although it exclusively deals with the b-machine and with nothing else) must be paid for! By destroying the origin paradox the scientific myth of evolution is created.

3. Neither escape it nor leave it as a stultifying scandal before us. This is the meta-theoretical approach and consists of permanently transcending the paradox. Methodological guidance is again provided by Hegel's dictum of "identity of identity and nonidentity," which for the problem to be treated here is to be transformed into "mediation of mediation and givenness," thus postulating that "mediation" always outruns the point of view once achieved.

Following this dictum we also receive a recipe for moving out of the dilemma of cognition. Since nothing is immediately given that is not concomitantly mediated, the apparently endless possibility of contrasting immediateness with reflectedness comes to an end as soon as the "transcendental" subject outdistances even these oppositions and "elevates" them to itself.

By leading back this conclusion to the CD, we find that (1) it is the O-system that necessarily precedes the build-up of the CD, and (2) it is the O-System that has the capability to transcend itself such that it can convey its own position to a hypothetically assumed D-system's model. The O-system does so when it recognizes that its own ability concomitantly to *discover* and *construct* any arbitrary entity (e.g., a system and a model thereof) is superseded by a third activity, being "more than the sum of the two" and called the *founding* function. The model of a D-system precedes in the O-system's understanding any S-System. (3) From this position, one can achieve, not too deviously, the conception of a total "being" (as universal system) that is preceded by a subjective designer (i.e., the Mind of God).

13.6.2 The Precept of the Intension/Extension Relation for the Origin Problem

A rather abstract but useful access to the problem of the origin is provided by the theory of concepts. Distinguishing the intension from the extension of a concept shows that the former denotes the definition and the latter points to the objects to which the concept refers. The relation between concepts (the *Sense* or imposition relation) has to be considered as atemporal, like any mathematical entity; the *reference* relation, on the contrary, relates concepts to objects and therefore deals with temporal occurrences. The Sense relation represents *ontological* preference; it also implies the subject conceiving concepts, thus "setting" or "positing" an origin.

The attitude that neglects the mode of cognition in science frequently leads to the pretension that intension is "nothing but" the result of inductive inference drawn of extensions. However, it is impossible to derive intension from extension in logic just as it is impossible to derive competence from performance in language, to derive the p-system from the I-system in systems theory, or to derive existence from action, theory from practice, substance from motion, or the "being" from the "becoming" in philosophy. To insist upon implementing the impossible must inevitably engulf one in a spiritual insularity, despite one's participation in the vast community of scientists.

What can be made applicable from these considerations to the problem of autopoiesis is that the concept of autopoiesis has to precede the realization of autopoiesis. It cannot be emphasized strongly enough that (contrary to scientifically

camouflaged superstition) the m-machine does not arise from the b-machine and that mind does not arise from matter!

13.7 Conclusion

In the upshot of our investigation the only valid conclusion we maintain as admissible is that an interpretation of autopoiesis in mechanistic terms is completely fallacious. Although the term evolution is suggestive of a principle pretending to exist by *itself,* operating on physical objects and events; and although causal mechanisms seem to perfect "themselves" by adaptation to the environment, evolution is a pseudo-idea implied by scientism (Barzun 1959) (i.e., a science absolutizing itself and claiming that there is nothing outside its own scope). Therefore, not only the concept of purpose is rejected, but also the concept-nature of programs (i.e., natural laws) misinterpreted and bowdlerized into a quasi-objective existence. Autopoiesis as proposed (Varela et al. 1974) does not outdistance scientism decisively enough.

I wonder whether scientists will soon become cloyed by a stale propensity toward alluring schemes whose alleged universality is a constant din in our ears. Scientists should vie among themselves not to repudiate what they have not thoroughly examined for its underlying presuppositions. However, even after having got rid of the gyves of the evolutionary scheme, scientists often fall victim to another imposition whose nature is disguised by the neatness of new schemes that are quickly ushered in and heedlessly accepted, lest the scientist had to fear the disdain of the layman's expectations that his flatly materialistic *Weltanschauung* is scientifically confirmed. Indeed, people who fortunately have sloughed off the evolutionary scheme are swayed by the system's paradigm, the validity of which apparently cannot be impugned (although another seductive universality claim should be emphatically objected to). To plunge into systems theory without being aware of the theory's dependence upon its pertinent presuppositions means repeating a fallacy at another level, albeit cloaked through a suggestive terminology, pilfering from philosophy without admitting doing so.

Our study has shown that only under the acceptance of philosophical ideas proper (even when squeezed into systems theoretical terminology, obviating the objection to having adroitly sneaked in "mysticism") can the whole story become understandable. It would be too immodest to hope for an imminent revulsion in the attitude of taking long-accustomed thought schemes for absolute, and for a growing opposition to "scientistic" pretensions. A true upheaval in thinking would be brought about were the solution, at which we arrived by analyzing the meanings and diversities of the term "self " and its impact for autopoiesis, accepted as the proposition that nothing arises "by itself" or, that an objective origin of anything is not only impossible but unthinkable: the *cognizing* subject (O-System) is always indispensable for an origin to be recognized; and the *creative* subject (D-system) is always indispensable for an origin to be performed. Both subjects, in the ultimate respect, become one.

As a consequence of this survey, a vindication of a formerly much disputed and erroneously refuted dogma of biology appears on the scene: the meta-theoretical version of this dogma (better circumscribed as fundamental axiom) reads thus: *Omne systema e systemate.* Whoever (unfortunately, usually a member of the great

majority of present-day scientists) comes forward with the assertion that life originated "by itself " such that autopoietic systems arose has to be taught that rather restricted schemes of thinking have, by their bent for the all too obvious, led to neglect of the necessity of simultaneously regarding oneself as the utterer of one's assertion.

I conclude by expressing my conviction that unyieldingly withstanding naiveté and unmasking the preposterous ostentation of scientism will result in a break-through toward the surcease of prejudices and regaining the regrettably lost fran-chise in the land of ideas.

Glossary of Terms

aP-System:	"allopoietic" system
AP-system:	"autopoietic" system
E-theory:	emergence theory
T-theory:	transition theory
O-System:	observer
D-System:	designer
S-System:	system proper
M:	Mind
m-machine:	mind-machine
b-machine:	body-machine
p-system:	program ($\equiv$ purpose)
p(I)-system:	program specified for any 1-system; e.g., p(P)-system: program for a P-system, etc.
I-system:	instrumental system
E-system:	executing system
M-system:	making system
P-system:	producing system
R-system:	reproducing system
sR-system:	self-reproducing system
sP-system:	self-producing system
C/G-system:	creative-generative system
CD:	cognitive domain

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