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The Relationship between Autopoiesis Theory and Biosemiotics: On Philosophical Suppositions as Bases for a New Information Theory

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Abstract:

This paper discusses methodological issues related to a possible framework for a unified theory of information. The question we would like to ask here is what kind of philosophical suppositions are important as bases for a new information theory. We concentrate on the relationship between systems theory and semiotics, or to put it more concretely, the relationship between autopoiesis theory and biosemiotics. These theories give rise to two decisive viewpoints that seem potentially contradictory and consequently provoke a fruitful controversy which is conducive for the consideration of philosophical suppositions vital for a new information theory.

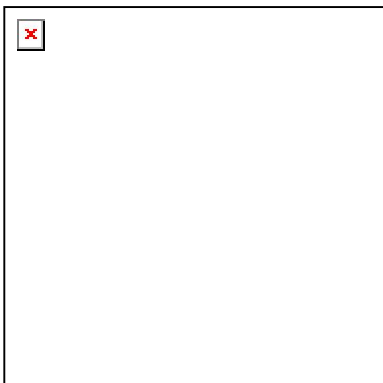
As the first step in our analysis, we examine the cybersemiotics of Søren Brier and Fundamental Informatics (FI) of Toru Nishigaki, which are both oriented to systems theory and semiotics and look toward a new fundamental theory of information. It is pointed out that cybersemiotics eventually takes a pan-semiotic view; FI, on the contrary, is mainly based on systems theory.

Next, we reveal the potential problem between systems theory and semiotics through a discussion on the treatment of the notion of information in the early autopoiesis theory. The standpoint of autopoiesis theory is fundamentally different from the standpoint of biosemiotics. The former presumes that life just keeps operating and has no concern with the difference between inside and outside of itself, whereas the latter presumes that life distinguishes its environment as the other from itself and acts autonomously. This corresponds to the gap between mechanical views on life and semiotic views on life, and constitutes an aporia of views on life.

Nevertheless, a way to overcome this contradiction can be found in systems theory itself. Although semiotic explanations are evaluated as merely arbitrary views of an observer in autopoiesis theory, we have to remind ourselves of the relativity of observing that is the most important epistemological feature of second-order cybernetics and autopoiesis theory. Since any distinction implies the work of an observer, it is impossible to strictly distinguish systemic phenomenology from our description, nor can we insist that either explanation has an intrinsically superior status.

Some philosophical suppositions vital for a new information theory are derived from this discussion. The following three points are given in our context as basic principles: epistemology rather than ontology, constructivism rather than metaphysics, meta-theoretical recursiveness rather than linear consistency. These three suppositions have some affinity to the features of second-order cybernetic systems theory, but we can also see similar features in certain aspects of semiotics.

Keywords: unified theory of Information, systems theory, autopoiesis theory, semiotics, biosemiotics, cybersemiotics, Fundamental Informatics, views on life, epistemology, constructivism, meta-theoretical recursiveness



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Toward a new fundamental theory of information, this paper discusses the relationship between autopoiesis theory and biosemiotics, or to put it in a broader way, the relationship between systems theory and semiotics. As the first step in our analysis, we will also examine the cybersemiotics of Søren Brier and Fundamental Informatics of Toru Nishigaki. We are here concerned with methodological issues related to a possible framework for a unified theory of information. The question we would like to ask is what kind of philosophical suppositions are important as bases for a new information theory.

1. Introduction

As the development of information and communication technologies penetrates our daily lives widely and deeply, there has been growing concern with a new information theory. Claude Shannon's information theory, in spite of its popularity as a fundamental theory of information, is just a theory of signal transmission between telecommunication devices based on a pre-established code. It is obvious that Shannon's theory has a limitation as a general theory of information because it presupposes a specific situation that is not strictly suitable for actual informational phenomena between humans or animals, and moreover, the Shannon's theory has no direct relevance to aspects of the meaning of information.

As often pointed out, the problem with classical computational, formalistic, or mechanistic approaches to information is that they fail to cover aspects of meaning. It would be still important to follow up this point further, but this is not our present concern. It would be enough here, instead, to notice the Terry Winograd's famous argument by which he criticized his own approach to artificial intelligence (Winograd & Flores, 1987). Although Winograd had been already well known within the artificial intelligence field for his distinguished work on natural language understanding program, he realized that his approach based on the classical paradigm was far from the actual operation of cognition from a perspective based on the philosophical ideas of thinkers such as Heidegger, Gadamer and Humberto Maturana, so that he

changed his approach radically. This shows clearly a limitation of the classical approach to information and a necessity to overcome it.

It is for this reason that several studies have been conducted in order to create a new fundamental theory of information over the past few decades. Those discussions are concerned with various fields including phenomenology, hermeneutics, cognitive science, linguistics, semiotics, communication studies, media studies, systems theory and biology. Although it seems almost impossible to take into account these separate fields toward a framework for a new information theory without losing overall coherence, we should not overlook the fact that there appear to be certain directions, such as phenomenological, semantical and biological directions. In particular, the importance of views on life cannot be overemphasized.

In these circumstances, what seems to be still lacking is a consideration of ways to integrate promising ideas in various fields into a framework for a unified theory of information. Indeed this is too complicated to be analyzed in detail here, but it will be helpful to restrict discussions and reconsider some philosophical suppositions that would be important also for other discussions toward a new information theory.

Therefore, we focus our argument on the relationship between systems theory and semiotics, or to put it more concretely, the relationship between autopoiesis theory and biosemiotics. These two theories are relatively easy to consider their relationship because some arguments have already been proposed in parallel based on these two theories toward a new information theory. However, the most important point of the preference for systems theory and semiotics is that these theories give rise to two decisive viewpoints that seem potentially contradictory, so that the preference provokes a fruitful controversy which is conducive for the consideration of philosophical suppositions vital for a new information theory.

2. The Relationship between Systems Theory and Semiotics on Cybersemiotics and Fundamental Informatics

We will begin our argument by considering two frameworks that are both clearly based on systems theory and semiotics toward a new fundamental theory of information. One is the cybersemiotics of Søren Brier and the other is Fundamental Informatics of Toru Nishigaki.

Brier regards the classical research program for information or communication science as ‘*information processing paradigm*’ and criticizes it (Brier, 1992, 1995, 1998, 2008). Information processing paradigm is a logical and mechanistic approach built on an objective information concept. He writes:

“There are many arguments against this. Mine are from a biological perspective. I do not think that meaning can be fully represented in a syntactic logical form. Meaning is very much tied to biological existence.” (Brier, 1995, pp.5-6)

Therefore, Brier insists that information processing paradigm needs to be replaced by a more comprehensive framework that includes such a biological perspective. What is then proposed is cybersemiotics as a new framework for a unified theory of information, in which he attempts to unite the two theoretical streams, cybernetics and semiotics, from a biological point of view (Brier, 1995, 1998, 2008).

On the other hand, Nishigaki develops his argument as Fundamental Informatics (FI) independently of Brier but with the similar intention to criticize the conventional approach to information and bridge the gap between natural sciences, in which aspects of the meaning of information are usually disregarded, and social sciences or the humanities, in which it is taken for granted that information is significant (Nishigaki, 2003, 2004, 2008). He also emphasizes that a biological perspective is indispensable for informatics, as can be seen in the following quotation:

“These discussions about significance gradually made it clear that significance is inseparably related to biological

phenomena. Significance means ‘something that is important’ and ‘something that is valuable’ to a living thing, and an information-bearing sign points to the existence of ‘something that is valuable.’” (Nishigaki, 2003, pp.6-7 (p.5 in English version) footnote deleted)

On the basis of this biological view on information, Nishigaki refers to systems theory and semiotics with a question like “what is life?”

Before we turn to the discussion of the relationship between systems theory and semiotics on cybersemiotics and FI, it will be useful to review the features of systems theory and semiotics separately in terms of their contribution to an information theory.

Note that, in this paper, the term ‘systems theory’ is mainly meant as second-order cybernetics originated by Heinz von Foerster and superimposed on autopoiesis theory of Humberto Maturana and Francisco Varela. Second-order cybernetics is called ‘*cybernetics of cybernetics*’, which implies a focus shift from a system to an observing system. It regards a cognitive system or a living system as a self-organizing closed system; accordingly it is strongly associated with the radical turn of views on information from openness to closeness. To borrow Brier’s phrase, “*Information therefore is not something outside, but rather is a phenomenon created inside the organism*” (Brier, 1995, p.7)¹. From this point of view, we can realize that information is not exchanged between systems, for each system is operationally closed.

Semiotics, on the other hand, contributes toward introducing aspects of meaning into an information theory. As is generally known, modern semiotics has two major paradigms, that is, a paradigm originating in the work of Charles Sanders Peirce and a paradigm proposed by Ferdinand de Saussure as a more general framework than linguistics. Saussurean stream of sign studies, usually called semiology, deals with mainly cultural or

¹ In view of the purpose of this paper, it is not necessary to discuss the definition of information in more detail here. However, its fundamental difficulty will be understood from the discussion in the third section of this paper.

social aspects of signs, such as codes or structures typically found in human language. In contrast, Peircean semiotics is not strongly bound to cultural or social dimensions. It directs its attention mainly to each interpretation process of signs. From this point of view, we can say that Peircean semiotics is more applicable to our informatics which focuses on a biological perspective, for it seems to have a possibility to expand the purview of semiotics beyond human language and culture. In fact, there is a field called biosemiotics which was mainly realized by Thomas A. Sebeok (Sebeok & Umiker-Sebeok Eds., 1992) and has been developed by many researchers such as Jesper Hoffmeyer. Covering more fundamental semiotic phenomena of life, biosemiotics offers the view of the essential connection between life and meaning to a new information theory.

We will now return to our main subject, that is, the discussion of the relationship between systems theory and semiotics. Judging from the review above, there is a same idea of coexistence of life and cognition in second-order cybernetics and biosemiotics. These two theories seem to be sharing the same standpoint that is expressed best by Brier when he says the following: “a *bioconstructivism – that is, they see every living system constructing its own ‘life world’*” (Brier, 2008, p.339). This leads to a constructive view on information, and that serves to overcome information processing paradigm in which objective information and its exchange and processing in the external given environment are presupposed.

Nevertheless, there is a potential contradiction between systems theory and semiotics, as the following section reveals. It can be for this reason that cybersemiotics necessarily approaches to semiotics, and FI, on the other hand, to systems theory, respectively.

Cybersemiotics of Brier can be primarily understood as a discussion that attempts to integrate systems theory and semiotics through the concept of ‘*sign games*’ that is something like Wittgenstein’s concept of language games between prelanguage systems. The direct meeting point of the two

theories in cybersemiotics is on the concepts of ‘*eigenvalue*’ or ‘*eigenbehavior*’, which is used in von Foerster’s discussion and means stable modes of system’s dynamics when the system is perturbed repeatedly. That is to say, a sign is regarded as something like an eigenvalue established through communication, and its communicative meaning is regarded as something obtained or actualized through sign games.

Brier also argues that the concepts of eigenvalue and sign games fit Peirce’s idea of habit into which semiosis (semiotic process of interpretation of signs composed of cooperation of three basic elements, a sign, its object and its interpretant) would develop. Although it might be felt confusing because an eigenvalue as a sign itself is generated by sign process, we must notice that Peirce’s semiotics is pan-semiotics, in other words, it regards all phenomena including natural processes as semiosis.

On the basis of such a pan-semiotic view, Brier eventually presents more comprehensive and metaphysical framework, which is a five-level ontological perspective that is derived from Peirce’s pan-semiotics and modern science. The first level and the second level of that corresponds to Firstness and Secondness respectively that is the two of three categories proposed by Peirce, and the other three levels of Brier, which can be expressed by words such as quasi-semiotic, genuine semiotic and linguistic, would be involved in the category of Thirdness of Peirce.

Cybersemiotics as a whole is now closer to semiotics than systems theory because of this ontological framework. The view on a sign as an eigenvalue recedes and the pan-semiotic scheme seems to be in the foreground. To quote Brier, “*Sign making is thus immanent in nature, but manifest only in full triadic semiosis within living systems*” (Brier, 2008, p.390).

Compared with cybersemiotics, FI of Nishigaki is closer to systems theory. He primarily uses autopoiesis theory to consider informational phenomena fundamentally connected with life, and uses semiotics mostly to reinforce views on life and views on meaning. Thus, he does not attempt to

theoretically integrate the two theories, like Brier does.

Instead, FI fully approves of the constructive view of second-order cybernetics, which is directly related to radical constructivism. Radical constructivism is an radical approach to the problems of knowing proposed by Ernst von Glasersfeld, which has the assumption that *“the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience”* (von Glasersfeld, 1995, p.1). It deals with discussions about cognitive development such as constructing concepts without presupposing an objective external world, and which is quite similar to the discussion on eigenvalue stated above.

It should also be added that FI suggests an original view on transmission of information, which would be applicable to the discussion on signs as well, especially on their communicative aspects. Nishigaki writes:

“A living thing is an essentially autonomous entity, but when it performs operations to transmit information and interpret its significance, are there any ‘restrictions (restraints)’ or ‘bindings (constraints)’ at work that affect its performance? Is not it precisely because a living system is restrained at least in some sense, that it is capable of transmitting information?” (Nishigaki, 2003, p.12 (p.17 in English version))

Although it is intrinsically impossible to literally transmit information from the standpoint of systems theory, Nishigaki attempts to regard it as a *‘fiction (pseudo-transmission)’* and consider a way to understand the fiction based on systems theory.

It is from this point of view that he presents a new systemic concept, *‘hierarchical autonomous system’* or *‘hierarchical autonomous communication system’* (HACS), which enables us to consider such restrictions as the background of the *‘fiction’* of information transmission based on systems theory. We cannot discuss it in detail here, but HACS allows us to take a hierarchical view of plural autonomous systems by making much of a perspective of an observer which may be changed strategically.

3. A Potential Contradiction between Systems Theory and Semiotics

It was pointed out in the previous section that each of cybersemiotics and FI shows affinity to semiotics and systems theory, respectively. That is, cybersemiotics eventually takes a pan-semiotic view; FI, on the other hand, is mainly dependent on systems theory.

This makes us difficult to construct a unified information theory by binding the two. In this section, we will discuss the central issue. A good place to start is to know the treatment of the notion of information in autopoiesis theory. That offers the key to an understanding of the potential problem between systems theory and semiotics.

An autopoietic system is defined as a system continuously regenerating the network of processes of production of components that produces the components (Maturana & Varela, 1980). One of the notable features of an autopoietic system, similar to a system in the discussion of von Foerster, is that a system is closed by the recursive relation of production of components. Consequently, notions such as transmission of information and coding are also not admitted in autopoiesis theory:

“Notions such as coding and transmission of information do not enter in the realization of a concrete autopoietic system because they do not refer to actual processes in it.” (Maturana & Varela, 1980, p.90)

Varela suggests, however, that one of their original purposes was to propose a critical view, against the main stream in biology, on the use of such notions as transmission of information, and to regard information itself as unnecessary for understanding life (Varela, 1981, pp.36-37). Their intention to refuse the notion of information for a system itself can be inferred from their original statements. The following quotation deserves careful attention in this respect.

“An observer beholding an autopoietic system as a unity in a context that he also observes, and which he describes as its environment, may distinguish in it internally and externally generated

perturbations, even though these are intrinsically indistinguishable for the autopoietic system itself. The observer can use these distinctions to make statements about the history of the autopoietic system which he observes, and he can use this history to describe an ambience (which he infers) as the domain in which the system exists. He cannot, however, infer from the observed correspondence between the ontogeny of the system and the ambience which this ontogeny describes, or from the environment in which he sees it, a constitutive representation of these in the organization of the autopoietic systems. The continuous correspondence between conduct and ambience revealed during ontogeny is the result of the homeostatic nature of the autopoietic organization, and not of the existence of any representation of the ambience in it; nor is it at all necessary that the autopoietic system should obtain or develop such a representation to persist in a changing ambience.” (Maturana & Varela, 1980, p.99)

This remark is very important because it clearly shows that the standpoint of autopoiesis theory is fundamentally different from the standpoint of semiotics². In autopoiesis theory, a system is operationally closed and all changes are internally determined, so that the system itself is considered unable to distinguish the origins of perturbations even if they are distinguishable for an observer. Contrary to this, it would be presupposed in semiotics that the system or the subject itself distinguishes something such as the origins of perturbations, and such a presupposition seems even inevitable because the indispensable concept in semiotics is, needless to say, the concept of sign. This contrasts with autopoiesis theory again. In autopoiesis theory, it is presumed that the correspondence between system's conduct and its ambience is not the result of establishment of a representation of the

² The term 'semiotics' is used here to describe the study of sign in the general sense of the word, and it is appropriate to exclude pan-semiotic implications at the moment.

ambience, and we cannot infer such a representation in the system from the observed phenomena. On the other hand, it is exactly attempted in semiotics to understand the fields of such representations or signs.

This contradictory point extracted from the discussion of autopoiesis theory reminds us of a general suspicion for biosemiotics especially from mainstream biology: why do you relate life to signs? Although such a suspicion scarcely appears for anthropocentric semiotics, as subjects in semiotics change from humans to animals to bacteria or cells, it emerges as a problem contradictory to substantial and mechanical views on life in natural-scientific biology.

The same thing may be said of autopoiesis theory. The fact that autopoiesis theory started as a life theory to understand primarily a cell may account for its negative treatment of the notion of information. Autopoiesis theory indeed tends to emphasize its mechanical scheme and attempts to exclude not only the notion of information but also notions such as purpose, function and program. In this sense, autopoiesis theory is similar to the standpoint of natural sciences, even though it decisively differs from natural sciences in a certain sense.

This relationship between natural sciences, in which we include autopoiesis theory here, and biosemiotics reveals the great gap between mechanical views on life and semiotic views on life³. The former presumes that life just keep operating and has no concern with the difference between inside and outside of itself, whereas the latter presumes that life distinguishes its environment as the other from itself and acts autonomously. This constitutes an aporia of views on life.

However, the importance of views on life cannot be overemphasized in a new information theory, as stated in the opening section of this article. We may say that some of the primal problems of a new information theory are on a life theory. Moreover, the remark above in autopoiesis theory seems

³ Needless to say, this is merely one remark in this context. The relationship between mainstream biology, autopoiesis theory and biosemiotics is complicated, and it will offer many meaningful contentions.

almost inevitable at least when a system is regarded as a closed system. The problem, therefore, cannot be solely in the relationship between autopoiesis theory and biosemiotics, but would be the most controversial point which is hidden but emerges when we intend to unify systems theory and semiotics for a new information theory.

4. A Way to Overcome the Contradiction

The problem above indicates the necessity of fundamental discussions to grasp the relationship between systems theory and semiotics and overcome the contradiction. To begin with, in order to gain a foothold for a discussion, let us take a look at the evaluation of semiotic notions, in other words informational notions, in autopoiesis theory from a different angle.

In autopoiesis theory, a system is regarded as a dual existence:

“Systems as composite entities have a dual existence, namely, they exist as singularities that operate as simple unities in the domain in which they arise as totalities, and at the same time they exist as composite entities in the domain of the operation of their components.”
(Maturana, 2002, p.12)

That is, although a system is regarded as a singular entity in the domain of the interaction with its ambience, it is also regarded as a composite entity in the domain of the operation of its components.

Under this conception we can say that semiotic notions require a viewpoint of the former domain in addition to the latter, that is, they presuppose the interaction between a system as a unity and its ambience, while they presuppose the compositional operation toward establishment of such as a representation of the ambience. To put it briefly, semiotic notions consist of connecting these two domains.

The problem is the relationship of these two domains. Following the above, Maturana goes on to say:

“The relation between these two domains is not causal; these two

domains do not intersect, nor do the phenomena which pertain to one occur in the other.” (ibid. p.12)

This leads to the negative evaluation of semiotic notions. That is, semiotic notions are evaluated as merely views of an observer who arbitrarily relates these two domains which have essentially no relations with each other. This is the reason why it is said that such a notion is *“a cognitive notion which represents the interactions of the observer, not a phenomenon operative in the observed domain”* (Maturana & Varela, 1980, p.90). In order that autopoiesis theory may explain the living organization, it is required *“to distinguish in it what pertains to the system as constitutive of its phenomenology from what pertains to our domain of description”* (Maturana & Varela, 1980, p.75).

However, we have to remind ourselves of the feature of second-order cybernetics now. We have pointed out earlier that second-order cybernetics implies a focus shift from a system to an observing system. From this point of view, second-order cybernetics itself can be said as the work ‘observing observing systems’, and when we take into account the fact that we ourselves are also observing systems, it is realized that the work of second-order cybernetics is involved in the dazzling recursiveness of observing which takes the form of observing observing observing...

Autopoiesis theory also shares this epistemological view by its very nature. An important point to emphasize in our context is that, as a consequence of this view, the relativity of observing or describing becomes clear:

“No description of an absolute reality is possible. Such a description would require an interaction with the absolute to be described, but the representation which would arise from such an interaction would necessarily be determined by the autopoietic organization of the observer, not by the deforming agent; hence, the cognitive reality that it would generate would unavoidably be relative to the knower.”
(Maturana & Varela, 1980, p.121)

Maturana expresses this in brief as *“Anything said is said by an observer”* (Maturana & Varela, 1980, p.8).

Under this fundamental relativity of observation we need to reflect the above distinction between what pertains to the system as constitutive of its phenomenology and what pertains to our domain of description. Since any distinction implies the work of an observer, it is impossible to strictly distinguish systemic phenomenology from our description, nor can we insist that either explanation has an intrinsically superior status. In fact, Varela retraces his discussion in the same way and writes as follows:

“When we say that teleonomic-symbolic explanations are not really necessary, it seems to me that we are succumbing to a prejudice of our historical tradition that it is time to revise, because in actual practice we cannot do without both operational and symbolic explanations. Our preference for causal explanations seems to be rooted in the understanding that ‘causes’ are ‘out there’ and reflects a state of affairs independent of the describer. This is, by the very argument used in AS, untenable.” (Varela, 1981, p.44)⁴

That is, we can say that applying autopoiesis theory to itself makes its own argument relativistic. This is also applicable to the negative evaluation of semiotic or informational notions in the early autopoiesis theory.

In addition, Varela advances his view toward more comprehensive understanding of life and reevaluates notions such as information and purpose. He insists that we need to reduce our explanation to a symbolic explanation to cover the developmental or evolutionary phenomena of life, even though he persists in saying that autopoietic understanding is *“true on purely logical grounds”* (ibid. p.44).

This positioning of semiotic notions in autopoiesis theory is still far from the actual discussions in biosemiotics that inquire of the connection between life and meaning.

⁴ Varela used ‘AS’ to refer Maturana & Varela 1973, which was a Spanish version of Maturana & Varela 1980.

However, Evan Thompson who used to be Varela’s co-worker says that Varela changed his mind in his later years into admitting the relationship between autopoiesis and the organism’s sense-making, in other words teleology (Thompson, 2004, p.391). Thompson interprets this aspect as a feature of the coupling of an autopoietic system and its ambience (ibid. p.392).

We will not examine Thompson’s discussion further because of space limitation, nor is it necessary here to discuss that in detail. What matters is rather that we have already obtained a way to overcome the contradiction between systems theory and semiotics through some philosophical suppositions. We can now derive those suppositions from this discussion, as shown in the next section.

5. Some Philosophical Suppositions Vital for a New Information Theory

The previous argument implies some philosophical suppositions that would be important for a new information theory. Even if some of those suppositions seem apparent, they are worth highlighting because taking notice of important foundations would be useful when we attempt to integrate various discussions into a new information theory.

Now, let us examine those philosophical suppositions. The following three points are to be discussed in our context as basic principles:

- Epistemology rather than ontology
- Constructivism rather than metaphysics
- Meta-theoretical recursiveness rather than linear consistency

Since the previous discussion was from the standpoint of systems theory, it might be certain that these three points are quite close to the features of second-order cybernetic systems theory. However, It is also certain that these points are features of some aspects of semiotics, as described later. Moreover what has to be noticed is that these three principles are expressed in a comparative manner and not intended to approve any particular theory. Each of them is intended to

become a guide when one discussion conflicts with another discussion while constituting a new informational theory.

Although these three points are rough and furthermore intrinsically interrelated, we will consider them one by one.

First of all, we can say that epistemology is more important than ontology⁵ for a fundamental information theory. This would be a supposition inevitably implied in the shift from first-order cybernetics to second-order cybernetics, that is, the focus shift from a system to an observing system, as stated above.

The standpoint which focuses on epistemology is also shared with a part of the biosemiotics. For instance, Jakob von Uexküll, who was a biologist reevaluated by Sebeok as a pioneer of biosemiotics, developed such an epistemological view in the famous theory of 'Umwelt' (Uexküll & Kriszat, 1970). He regarded animals as subjects, not merely objects, and proposed the concept of Umwelt as a surrounding world in which an animal perceives and acts as a subject. Umwelt is, to put it briefly, a real world for the particular animal. He argued that every subject including human beings lives in such a subjective world. It can even be said that space and time cannot exist without a subject. Therefore, the theory requires to be conscious of the standpoint of an observer. This is a good example to illustrate an epistemological approach similar to second-order cybernetics in the related fields of semiotics.

Looking back at the history of systems theory, Gregory Bateson's view of information is appreciated to some extent, but it seems still insufficient in the sense of the shift from ontology to epistemology. The well-known Bateson's definition of information, "*a difference which makes a difference*" (Bateson, 1972, p.272), regards every difference as potential information that appears as genuine information through life. To borrow Brier's phrase, Bateson's point of view has "*the difficulty of determining to whom or what a difference makes a difference*"

⁵ The word 'ontology' is used in the general or traditional sense of the word, that is, Heidegger's discussion is not implied here.

(Brier, 2008, p.179). In brief, it seems insufficient in epistemological viewpoint.

However, it would have to be added that Brier's cybersemiotic framework also seems somewhat similar to Bateson's worldview after all. Although this might be partly due to his dependence on Peirce's pan-semiotics, it is more due to the Brier's own view of 'reality' in the background. Brier seems to be struggling to understand reality or existence, as can be seen in the following quotation:

"Although we have rightly abandoned the notion of 'objective reality' in second-order cybernetics, we should not give up the notion of a partly independent 'outside reality'." (Brier, 2008, p.93)

"Maturana and Varela go too far when they claim that there is no world without an observer, that we live in a Multiverse created through our observing and acting, and that we can say nothing meaningful about the world as such." (Brier, 2008, p.194)

Consequently, he approaches ontological pan-semiotic framework.

It must be noted, however, that we needed to recognize that the renouncement to describe the absolute reality is essential in order to overcome the contradiction between systems theory and semiotics. The discussion in the previous section reveals the importance to shift a question from ontological one, which inquires what kind of existence life itself is, to epistemological one, which inquires how we see life. What needs to be emphasized is that the ontological inquiry will eventually encounter the aporia of views on life. This is intertwined with the following point.

Second, we can say that constructivism is more appropriate than metaphysics. A constructive view of cognition is expressed well by Maturana when he says, "*Anything said is said by an observer*". It is fundamentally different from a metaphysical worldview that assumes something independent of any observer.

Indeed we may be disturbed by the problem how to think about reality, existence or truth in constructive view, but this feeling is considered to come from just a confusion between "*Most of the world is as it is whatever*

we think about it" and "*There is something out there in addition to the world called 'the truth about the world'*", as Richard Rorty implies from the standpoint of pragmatism (Rorty, 1982, p.xxvi). There is no reason to doubt the former statement, but this does not mean that the latter is right.

We can consider, instead, that objectivistic concepts such as reality or existence are radically constructed by human beings. This is the very core of the discussion in von Glasersfeld's radical constructivism (von Glasersfeld, 1995). Uexküll would also agree with this view because he regards the world as our Umwelt that is uniquely constructed by human beings.

Metaphysics seems to be required when we set up an ontological question. That is, it serves as a doctrine when we encounter a problem such as the aporia of views on life. Brier says, "*One of the strengths of Peirce's semiotic philosophy is that qualia and mind – as semiosis – are installed in the metaphysics from the beginning.*" (Brier, 2008, p.363).

Peirce's pan-semiotic metaphysics is actually useful in the sense that it eliminates the need to explain a path to semiotic understanding of life. However, this strategy means simply excluding the other views on life and abandoning the meaningful discussions on their relationships. In addition, we have to say that pan-semiotic worldview, in which everything is regarded as a (potential) sign, is close to Bateson's view on information, where every difference is regarded as potential information. As a result, the adoption of pan-semiotics yields some doubt about views on information, because the approach to Bateson causes disregard of the radical turn of views on information from openness to closeness which allows us to overcome information processing paradigm.

However, we must add that Peirce's thought contains a kind of constructivism. As a matter of fact, Peirce describes the reality as something dependent of the ultimate decision of the community (Peirce, 5.316), which can be considered a constructive point of view. If this constructive view is recursively applied, Peircean semiotics will approach to epistemological constructivism apart from ontological metaphysics.

Third, it follows from what has been said thus far that we require meta-theoretical recursiveness than linear consistency. If constructivism is radically considered, it is inevitable that a discussion takes on a meta-theoretical feature and returns its implication to itself.

Maturana who emphasizes the role of an observer admits that even the observer itself arises in the conversations of observers:

"The realization of autopoiesis, the living of the organism, as well as the observers themselves, all arise in the conversations of observers, so that all that there is, is languaging as coordinations of coordinations of consensual doings of observers that operate in language." (Maturana, 2002, p.32)

This is a good example to illustrate the meta-theoretical, recursive feature of the theory. We can recognize from this that the theory should not take the position to defend linear consistency but accept recursiveness of the theory itself.

Consequently, we have to claim such a theory, to borrow von Glasersfeld's phrase, "*to be no more than one possible model of thinking about the only world we can come to know, the world we construct as living subjects*" (von Glasersfeld, 1995, p.22). However, this is not to say that the discussion is arbitrary. What is important is that we can still examine its logical but recursive consistency and its experiential validity as a conceptual tool.

6. Conclusion

In this paper, we examined the relationship between systems theory and semiotics in order to discuss methodological issues related to a possible framework for a unified theory of information. Although we revealed that these two theories conflict with each other on their views on life, we also clarified that a way to overcome this contradiction can be found in systems theory itself. From this discussion, we derived three philosophical suppositions vital for a new information theory: epistemology rather than ontology, constructivism rather than metaphysics, meta-

theoretical recursiveness rather than linear consistency.

These three suppositions have some affinity to the features of second-order cybernetic systems theory. Likewise we can see similar features in certain aspects of semiotics, but we cannot say that modern semiotics is focusing on those aspects. Although there are a lot of practical analyses of meaning in semiotics, a careful examination of philosophical bases for them seems to have been left.

The same thing may be said of biosemiotics. Biosemioticians are analyzing various aspects of life, but it seems that little attention has been paid to their philosophical

bases. For example, the aporia of views on life, which was discussed in this paper, is considered remain hidden and unsolved at the core of all the biosemiotic questions.

Therefore, it seems reasonable to conclude that a mutually complementary relationship between systems theory and semiotics can be found based on the three suppositions. It can be developed well by systems theory and the actual analysis of meaning in semiotics. Apparently it calls for further investigations, but such investigations are expected to lead to the construction of a new information theory.

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