Fuschl Conversations: Foundations of Information Science

Towards a New Foundation of Information-, Cognitive- and Communication-Science.

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Introduction

The practical goal of formulating foundations of a general theory of information, cognitive and communicative processes in nature and society is that we hope to be able to contribute to the designing of a conscious evolutionary process (Banathy 1996) that integrates technological and human aspects in a process that leads to the emergence of a new form of humanity.

Designing a participatory and co-operative society is in need of such an integrative theoretical framework that we aim to build. For solving the global problems we need to integrate nature, society, consciousness, and technology in a co-operative way. For doing this we need to theoretically understand the connections between the different realms of existence (matter, life, consciousness, society). The general unified theory of information and self-organization that we want to work out might accomplish this.

1. Formulation of the Problem

We want to construct a general theory that conceptualizes reality as the field containing meaningful human social interactions as well as technology and nature. It is a unifying framework that is not naturalistic, culturalistic or dualistic but praxeological as it views reality through human social and semiotic practice**.**

We need a **non-reductionistic, multidimensional and complex** approach in order to explain the complexity of human practice as Edgar Morin points out.

2. Basic Foundations of a General Theory of Reality

We view the basic aspects of human social semiotic practice as **cognitive, Communicative, and co-operative problem-solving processes** oriented towards:
1. Survival and procreation, 2.Social position/power, 3.Finding a meaningful life.

We see human social practice relating to **4 basic aspects of reality**:
1. **Nature**, 2. **Life** , 3.**Consciousness**, 4.**Meaning**. We have made a visual model of the basic ontological prerequisites we find as a minimum necessary to create a transdisciplinary framework for co-operation between the natural and social sciences as well at humanities and technological science such as computer science and informatics, in figure 1.

Our **praxeological** understanding of reality fits with approaches of scientists like Luhmann, Wittgenstein, American pragmatism (Peirce), Marx, Mead and Wittgenstein:

These scientists focus on practice from different views:

- Luhmann: communicative practice from a systemic and autopoietic view (Luhmann 1995)
- Marx: social production, problem-solving from a materialistic view (Marx 1844, 1867)
- Mead: symbolic interaction from a social constructivist view (Mead 1967)
- Peirce: semiotic practice from a pragmatic, triadic semiotic and evolutionary view (Peirce 1931-58)
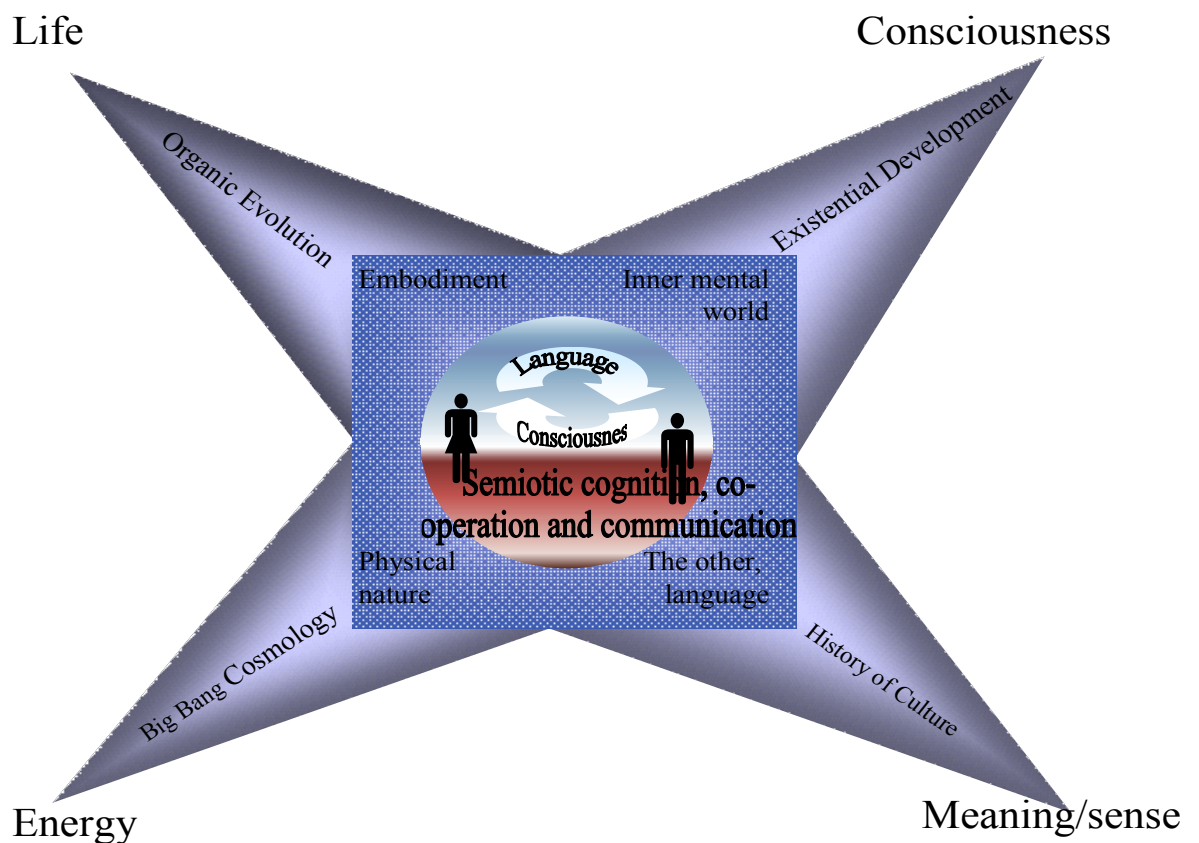- Wittgenstein: language games and life forms (Wittgenstein 1958)

Fig. 1: The epistemological dimensions of a general framework for approaching FIS that takes departure from human practice

We want to propose a **unifying, non-reductionistic theory** of information, cognition, communication and human embodied knowledge production as rationalistic reductionism as for instance seen in the information processing paradigm of cognitive science can't deal with the complexity of the information society and the problem of meaning and interpretation as well as of establishing a global culture.

A theory of human practice (praxeology) has three dimensions agreed upon in most philosophical approaches:

1. epistemology
2. ontology
3. axiology

The disagreement concerns the relationship of the three dimensions:
1. Independent Relationship
2. Interdependent Relationship: Hierarchic relationship or
                          Networked relationship

We agree on the interdependent character of the three dimensions of reality and a combination of hierarchical and networked relationship.

3. The Evolution of Systems

A complex praxeology needs a complex and dynamic ontology as we do not believe in the possibility and productivity of reducing reality to simple mathematical or rationalistic scheme or structures. We think we have to combine structural and processual approaches to avoid reduction to either pure structure or pure process as both need each other in causal explanations.

One way of doing this is an evolutionary systems stage model. Such a systems concept has been developed from Bertalanffy's General Systems Theory (GST, Bertalanffy 1968). Such an evolutionary systems stage model conceptualises the interaction between structure and process as the emergence of **metasystems** that result in the dominance of **supersystems** (Hofkirchner 2001).

A metasystem is a higher-order system that has emergent qualities that distinguish the metasystem from lower-order systems. Each system consists of subsystems and is itself subsystem of a supersystem. Metasystems refer to the **diachronic** aspect of evolution, supersystems to the **synchronous** aspect of evolution.

Evolutionary systems theories are not explanations of the creation of the world, but of its development and differentiation. The theory we want to work out is non-reductionistic and as such non-deterministic. An important aspect of explanation is that there is a temporal sequence of levels and systems. An explanation is not a deterministic time-causal explanation, but a search for the necessary preconditions of the present stage of the present world system we call a supersystem.
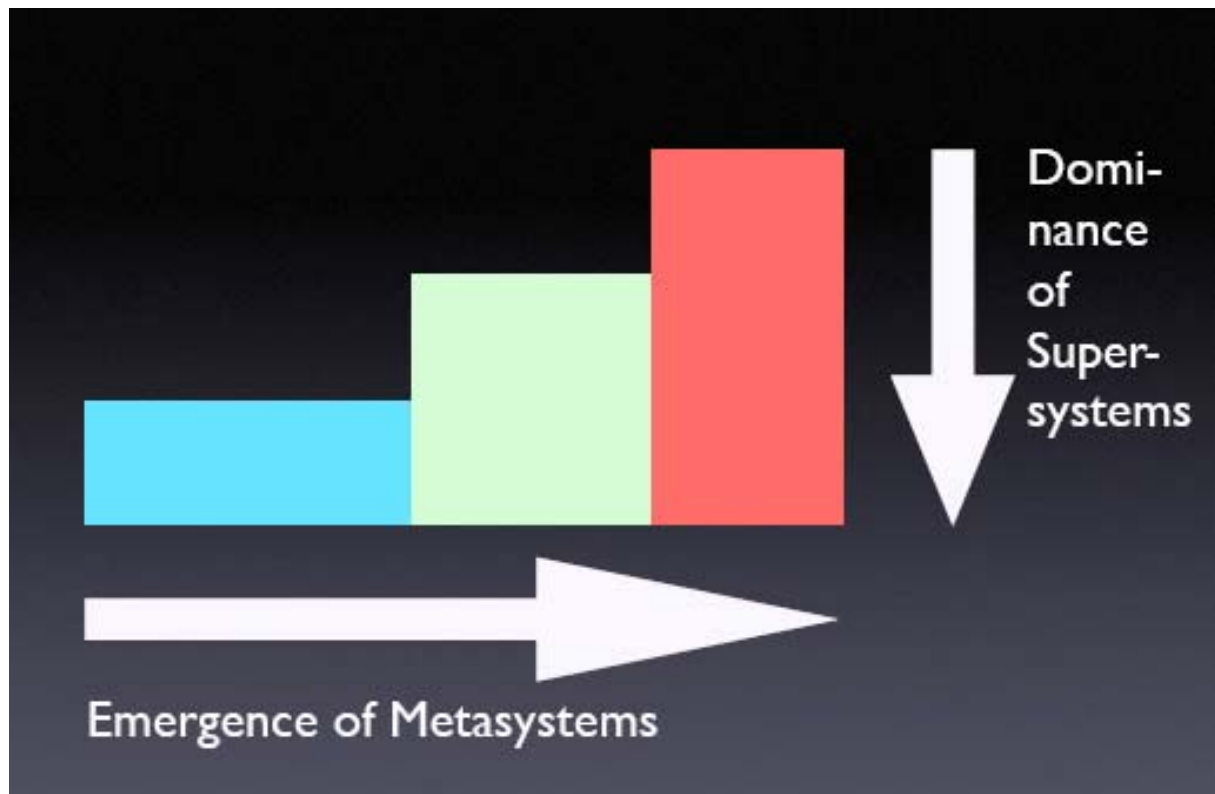
Fig. 2: The emergence of metasystems and supersystems in systemic evolution. Time is going from left to right. Complexity is going growing going up.
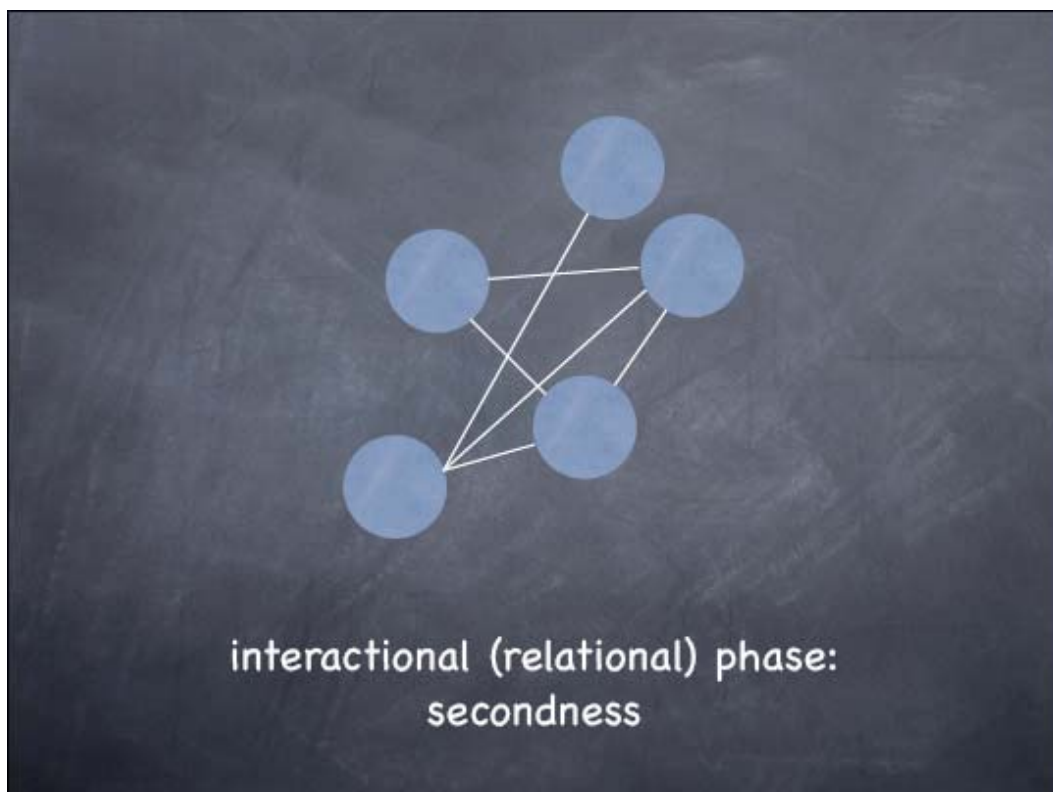
The concept of the metasystem transition allows us to reconcile GST, Peircian evolutionary semiotics, dialectical thinking, and systems thinking based on Spencer-Brown's logic of form (Heinz von Foerster 1984, Maturana and Varela 1980, 1986; Luhmann 1995).

Metasystem transitions: Firstness, Secondness and Thirdness

In a metasystem transition we have 1. an **Individual phase**, 2. an **interactional phase,** and 3. an **integrational phase** (Hofkichner 2002). The individual phase corresponds to C.S. Peirce's concepts of the basic categories of **Firstness** (potentialities, proto-elements), the interactional phase to **Secondness** (dualistic processes and relations manifested through constraints and forces), and the integrational phase to **Thirdness** (triadic systemic regularities and patterns). In visual figures it can be viewed like this:
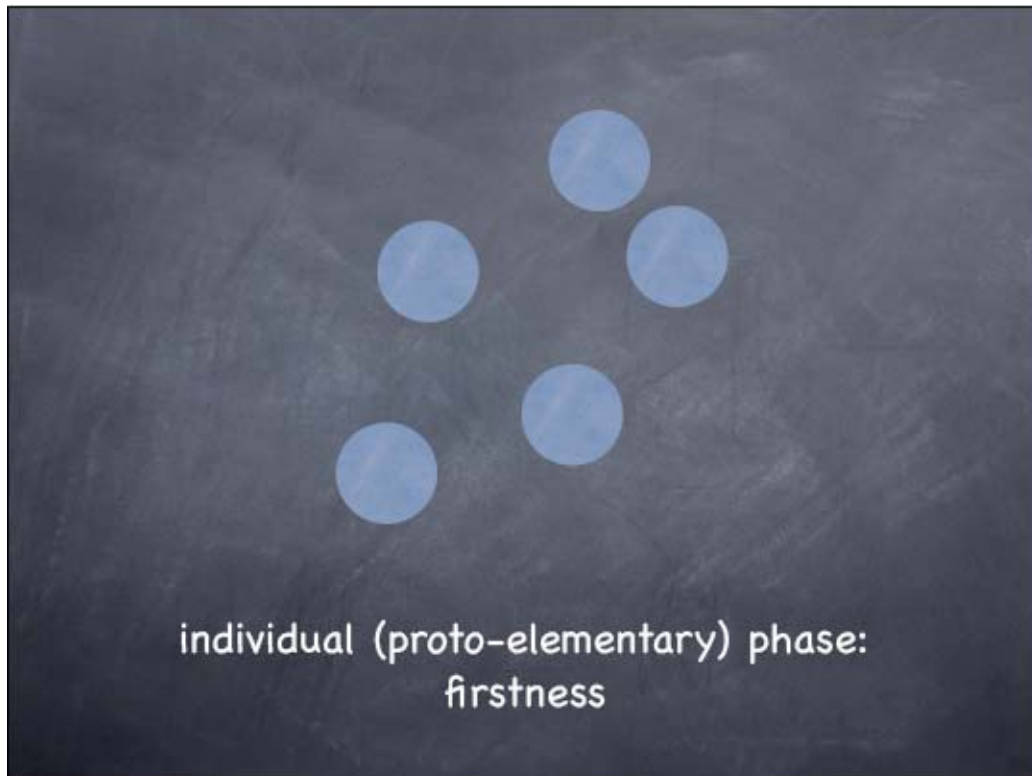
3. The first phase in metasystem transition starting with individual qualities or pro-elements in Firstness.

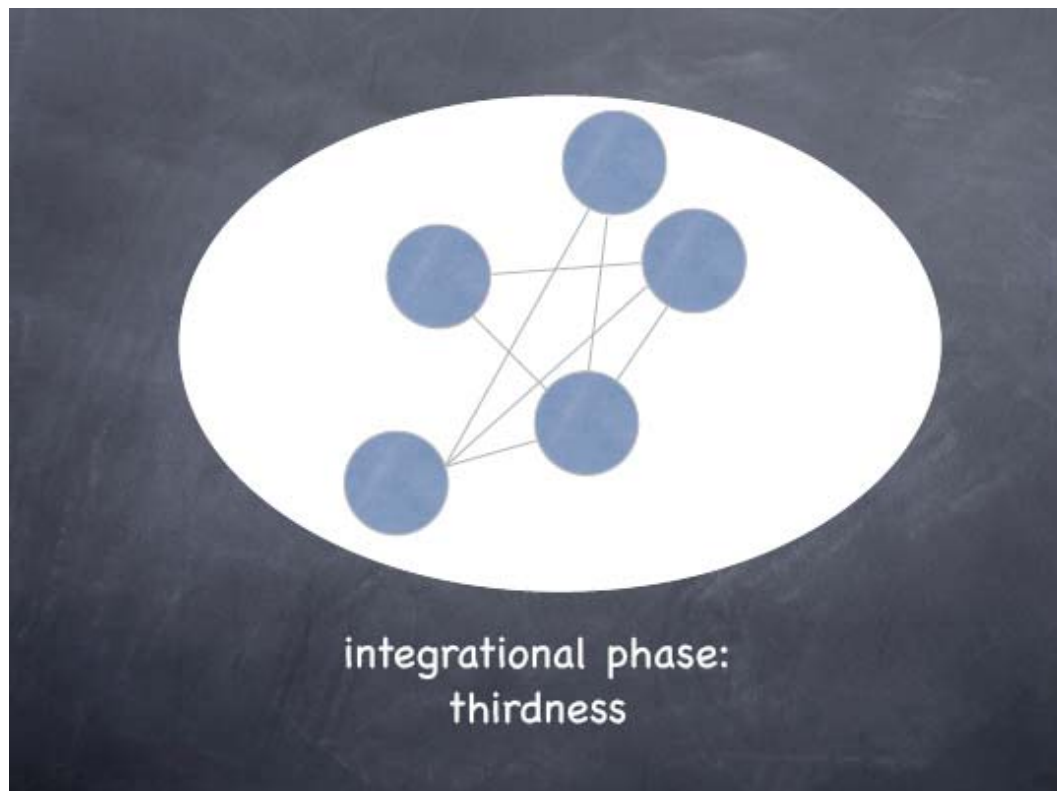*4. The interactional, relational phase of Secondness.*

Fig. 5: The third phases of metasystem transition is the integrational phase of Thirdness.

This model of the metasystem transition also corresponds to Hegel`s three phases of dialectical development (Fuchs 2003a, b): 1. **thing-in-itself** (identity), 2. **being-for-another** (negation), 3. **being-in-and-for-itself** (negation of the negation, higher-order identity). We are aware that there are some conceptual discrepancies between these approaches and some differences in the metaphysical frameworks, but we think that the similarities are so big that it will be more fruitful to should focus on the common aspects and thereby get the semiotic aspect of signification, interpretation and meaning integrated in the systemic and dialectical approaches.

We can make a further semiotic understanding of the metasystem transition: Firstness is a proto-element that has a potentiality to manifest into something such as a structure in the world. Secondness appears when two proto-elements make a dual relationship to each other (that can be of mental, material or social character). At this general level of theory it is not necessary to reduce the connection to any specific character. When the relation is specified and made more regular and stabilized, we enter the level of Thirdness. We can relate it to Peirce's triadic semiotics and dynamic semiotic web in the following way. See figure 6.
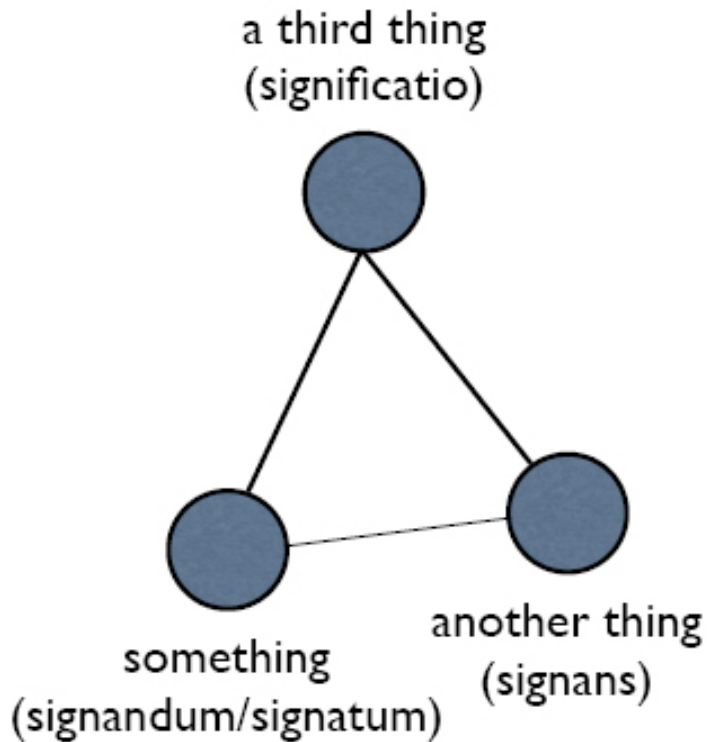
Fig. 6: A semiotic understanding of the metasystem transition where signandum is Peirce's representamen, signans is Peirce's object and significato is Peirce's Interpretant.

From a semiotic point of view here an interpretant emerges that connects the representamen with the object. From this triadic relation the sign emerges. From a systemic point of view it can be emphasized that the triadic sign emerges as a new quality of reality which is both structure and process. Semiosis means that there is an ongoing recursive relationship between the three elements that stabilizes itself in the form of a new systemic level through a kind of self-organization of meaning. We consider this triadic process and structure to constitute the most elementary system out of which all other systems are built in different kinds of emergent networks.

4. The Concept of Process-Substance

The most fundamental question of philosophy concerns the foundation and essence of all being. With a combined foundation of 2nd order cybernetics and systems thinking, semiotics, and dialectical thinking we believe one-sided concepts of reality can be avoided.

What we can say about basic reality is that it is a dynamical continuous field of vague spontaneous proto-elements that are in an ongoing recursive flux or process that can manifest into systems. Reality is a field of unmanifest protoelementary recursive processes. The foundation of reality is its process-structure, the concept of process-substance (Ernst Bloch, Bloch 1975, cf. also Fuchs 2003a) shows that the foundation of the world is its permanent dynamical change. This corresponds to saying that reality permanently organizes itself, it is a causa sui (Spinoza), it is its own reason, the essence of reality is that the only thing that doesn't change is that reality exists through permanent change, but as Peirce points out with a tendency to take habits.

Reality is characterised by hypercomplexity, i.e. it has an inbuilt dynamical and vague field complexity that is beyond measurement (like the Planck-scale limits, see e.g. Nielsen 1991 and 92), a chaotic Firstness as Peirce calls it, and there are no single centres of reality.

Multiple descriptions of reality will compete against each other, complete each other, and describe the other system from their own viewpoint. Thus we take a critical perspectivist and realistic view as the basis for a praxiological social construction of meaning in communication.

It is also important to underscore the evolutionary dimension that self-organizing systems are pro-active, anticipatory and become still more communication-depending (Luhmann 1995) more and more as we approach the social sphere. Self-organizing systems cannot not communicate (Watzlawick/Beavin/Jackson 1967)

5. Unity in Diversity

Realizing that there are no points of observation outside of society and the world, we want to make a transdisciplinary framework for unifying the polycentric dimensions of reality and explanations (cf. Lars Qvortrup's book "The Hypercomplex Society", Qvortrup 2003, 1993). In spite of the hypercomplex polycentrism of reality as seen from with in the world and within society and language, we do believe that there is some kind cohesion of unity in diversity in the world such as Peirce's 'tendency to take habits and produce signification and meaning.

 Although we believe in deep explanations of reality, in evolution and causality, we want to avoid the paradox of explaining first causes by using our dynamic triadic categories as minimum statements..

6. The four Aristotelian Causes

We believe in effective and final causes working at the same time when a system self-organizes and that the recursive process of self-organization is the basic process of evolution.

Self-organization is at the same time driven by effective and final causes, but not in a traditional mechanistic or religious sense. We believe there is a continuous field connecting effective, formal and final causes. In Peirce's theory this is called **Synechism**.

Synechism means that there can be punctuations, symmetry breaks, emergence of new qualities, but no unbridgeable gaps in evolution. (We don't consider this to be opposed to quantum physics, but there is a dialectic between continuity and discontinuity.)

The continuum represents the diachronic movement. When we talk about synchronous aspects in systems development they are as we described above. For the diachronic aspect we use Aristotle's two other causes, the material and the formative cause. The material cause can be ascribed to the bottom-up-forces (micro-level) and the formative cause to the top-down-forces (macro-level, downward causation) in the emergent evolution of systems. The top-down force is the formative force that the supersystem imposes upon the underlying system.

None of the four causes is able to fully determine the fate and the form of the system in its self-organizing development. They all co-operate and can at different times have different strengths of influence.

The rise of subjectivity Aristotelian forces in self-organizing systems
In the course of evolution there will be a shift of influence from the efficient and material causes to the final and formative causes as we move from natural systems to living and social systems. Let us demonstrate our thought in some visual models.
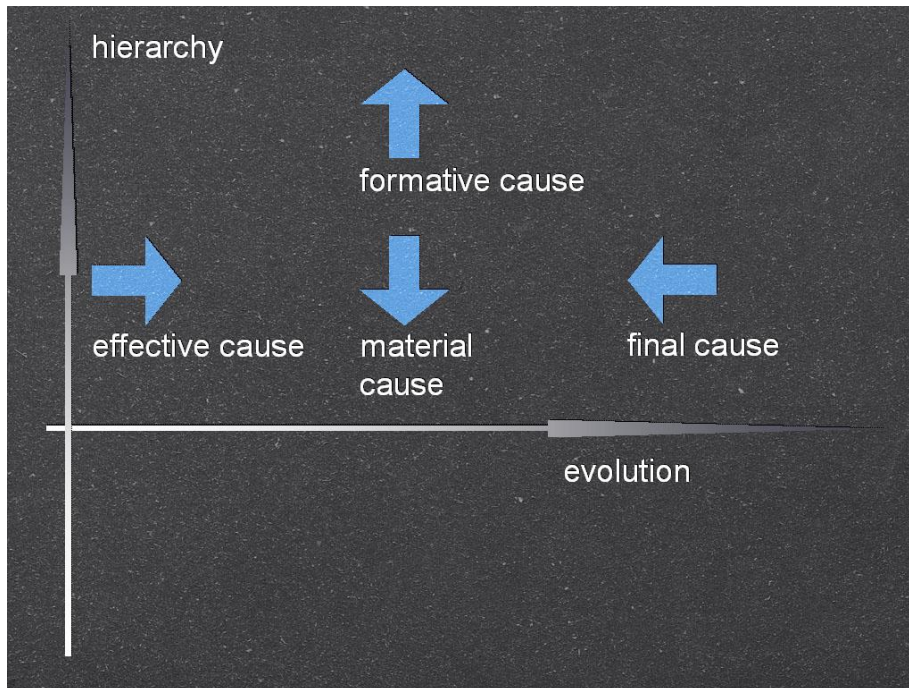

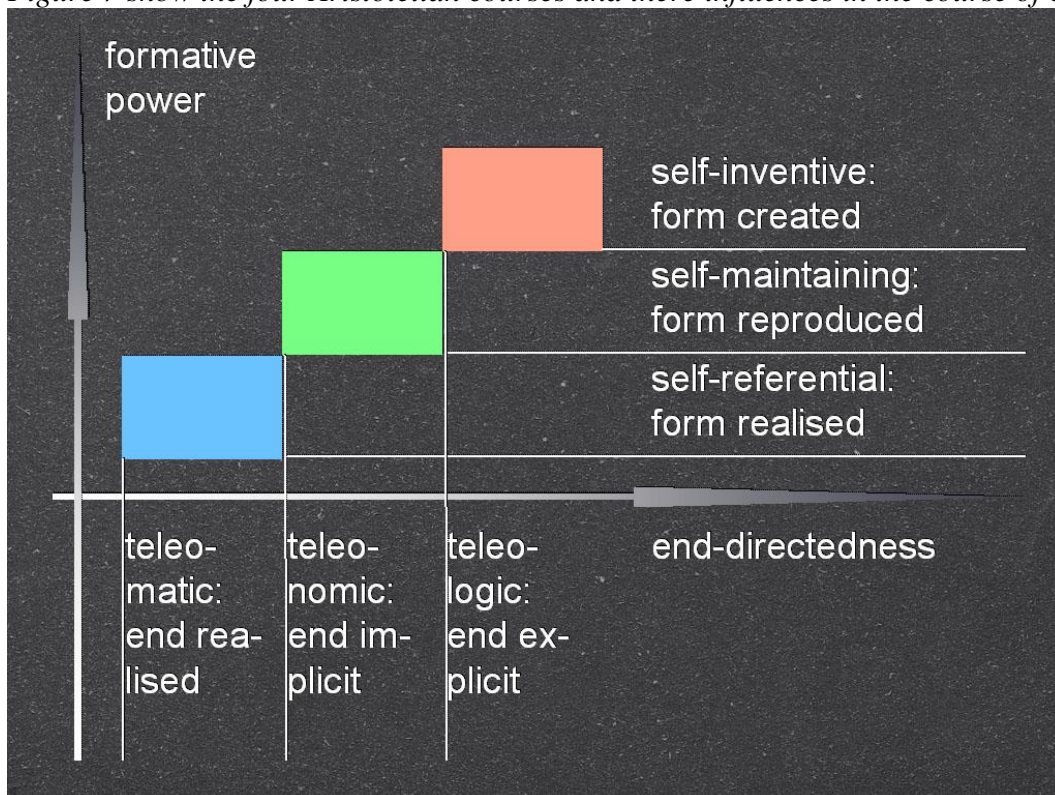*Figure 7 show the four Aristotelian courses and there influences in the course of evolution.*

Fig. 8: Aristotelian Causes and an evolutionary hierarchy of Self-Organizing Systems

This theory is compatible with Peirce's view of evolution. He works with three different kinds of evolution, where the teleological aspect gets developed more and more:

1. **Thycistic** (free or random variation).

2. **Anachastic** (dynamic dyadic interactions, a more mechanical necessity like Darwin's natural selection) and

3. **Agapistic** (combining the free variation with the dyadic interactions trough habit formation by the mediating ability of Thirdness).

Peirce's concept of **evolutionary love** is what we reformulate in a modern form as evolution by self-organization .His concepts of chaos as spontaneity, the continuum field theory (Synecism) and its habit-taking is the tendency of systems to self-organize through recursive processes and create new emergent phenomena.

Agapism corresponds to a synthesis of chance and necessity that can be called relative chance or **less-than-strict-determinism** or the self-organization drive in nature, which leads to habit-taking or new emergent phenomen.

Thus the theory is using modern terms for what Peirce called Thycism, Synecism and Agapism.

7. Foundations for cognition, communication, and co-operation: Structural couplings

As shown above then self-organizing systems are born proactive and semiotic, which makes them semiotic cognitive, communicative, and co-operative. Mechanical systems like for instance machines are produced from the self-organizing systems. Some natural systems have an evolutionary course that take them into near-mechanical states, such as rocks and fluids. Thus as Prigogine and Stengers (1984) show, then the mechanical systems are a special and limited form of systems that are not crucial to the understanding of emergent evolution of self-organizing systems. But dissipative systems with their self-organizing ability are. Self-organization needs energy flow and dissipation of entropy to build up order, information and semiosis.

But to make an evolutionary theory that encompasses the rise of the inner world of living systems with central nervous systems and the social co-ordinations coming through cognition and communication, we need a broader framework that the one based on matter, energy and objective information. This is why we also use Peirce, as his theory of Firstness has pure feeling and the tendency to form habit and thereby the ability through Thirdness to make interpretative semiotic relations that self-organize and develop through evolution.

Interpretation is an organization of the relation between perturbation (noise) and the system's embodied, pro-action and anticipative functions organizing an aspect of the environment in a meaningful way for the system's survival.

We claim that self-organizing systems are sign-producing systems at least when they become living systems. These self-organizing co-operative processes are semiotic and communicative processes as described by modern biosemiotics (Brier, Hoffmeyer, Emmeche).

Self-organizing systems are **operationally closed** (Luhmann 1995). To have a systematic relation to its environment, an operationally closed system has to establish a structural coupling which is a systematic change in the system's organization with the purpose of conserving the system's organization in the drift of evolution and history. A **structural**

coupling is a connection of two systems that takes place in such a way that one system perturbates changes in the structure of the other system, but doesn't determine these structural changes. This is done in such a way that pre-structured responses to the specific irritation and perturbation are created in the system and are thus making it proactive and anticipatory.

The structural coupling is what makes signification possible. The structural coupling is a simple and crude representation of selected aspects of the environment and its influence on the self-organizing system's organization. Structural couplings are made between self-organizing systems especially of the same type. We thus see the ability to make structural couplings as a prerequisite for the production of semiotic interpretants.

In the semiotic process (semiosis) we first find an unspecific or undetermined irritation of the self-organizing system. The structural coupling acts as a medium that allows the system to create an interpretant of the irritation that it is perturbated by. Thereby the system produces a meaningful representation of the environment. The meaningful representation of the environment is in Peirce`s semiotic terms the interpretant.

Systemically viewed this is an emergent phenomenon that structures the field of perception and cognition in a type of **downward causation** between the supersystem and the system. Thus a meaningful representation of the environment is created within the system and projected to the outside world producing a **signification sphere** (Brier 2001).

This is done by seeing the irritation as a representamen for outside objects. Hence the irritation becomes a sign of phenomena in an outside world that cause structural changes within the system and the emergence of new qualities such as understanding. In Luhmann's terms the system reduces the complexity of the environment through this strategy of meaningful interpretation. **The ability to make structural couplings is a prerequisite for cognition and therefore also for communication** (Brier 1995). This theoretical frame fits very well with Peirce's concept that cognition of non-intentional signs is **signification**.

Foundation of communication
Foundations of communication are: the ability to make structural couplings, the structural coupling of two systems, that each system can make a (however crude) model of the other system, and that each system has a certain degree of freedom that allows the active production of emergent qualities.

Communication is a mutual retrospective structural coupling of cognitive systems, system A produces a representamen of its environment with the help of system B and B produces a representamen of its environment with the help of A, communication is a common production process of representamens and interpretants. Such production processes are autopoietic.

Computers (such as in a network like the Internet) don't communicate with each other and human beings don't communicate with computers because computers don't have the ability to make structural couplings and representations of human beings, they are mechanistic passive systems without the pro-activity necessary for communication (Nöth 2002).

At the level of human communication the question concerning the relationship between the encoded meaning and the decoded meaning is important. There are theories that stress the genetic aspect of communication like Jean Baudrillard (1983), who says that we live in a world full of signs where the attribution of meaning is a casual process. But Luhmann (1995)

stresses that communication is contingent, uncertain and unlikely. Peirce defines a symbol as a sign where the relation between the representamen and the object is established through a cultural habit that has become fixed through contingent historical processes.

For Luhmann this contingency is the background for the emergence of **symbolic generalized media** such as love, power, money, truth that speed up communication by reducing social complexity and simplifying communication by making use of fixed binary codes (paid/unpaid, true/false, majority/minority). Each such medium relates to exactly one binary code. On the other hand there are theories like Critical Theory that focus on the reproduction of the communication process and of meaning in society. They stress that socially attributed meanings are transmitted in cultural processes. The synthesis of both approaches can be found in theories like Cultural Studies (Stuart Hall, Raymond Williams, Richard Hoggert, John Fiske, etc., for a more detailed discussion of cultural studies and the self-organization of culture see the paper of Christian Fuchs in this book, Fuchs 2005).

Stuart Hall (1999) has pointed out that a certain degree of determinism in the form of hegemonic meaning as well as a certain degree of indeterminism in the form of negotiated meaning and oppositional meaning is present in the cultural reception process. Dominant meaning means that "there exists a pattern of 'preferred readings'; and these both have the institutional/political/ideological order imprinted in them and have themselves become institutionalised" (Hall 1999: 513).

Negotiated meaning is decoding that "contains a mixture of adaptive and oppositional elements" (ibid.: 516), oppositional meaning means "to decode the message in a globally contrary way, […] within some alternative framework of reference" (ibid.: 517). The main achievement of Hall is that he has shown that there is no necessary correspondence between encoding and decoding. Different interpretations exist in parallel and even in opposition and antagonism to each other.

Meaning is not imposed, but is multidimensionally produced in contested social struggles, hence signification is not only a consumption process, but itself an active production process. Linking semiotics to society and culture shows that power has both a social and a semiotic dimension, signification both empowers and constrains people. There are forms of semiotic power in society (Fiske 1987). The struggle of alternative or opposing meanings in the cultural realm of modern society is a double movement. It is dialectics of containment and resistance (Hall 1981), homogenization and difference (Fiske 1987).

All of these theories contribute to the comprehension of communication as a self-organizing process where senders and receivers have to be seen as self-organizing living systems which produce their own sense that can't be reduced to a mechanical exchange of information.

Foundations of co-operation as practise
At the level of co-operation there is a praxis that connects to Firstness and its qualities. This comes close to what Habermas calls **life world** (Lebenswelt) (Habermas 1984). We view praxis as including the phenomenological existence of human feeling, experience, self-consciousness. Our understanding of practice also includes social phenomena such as production and communication. Co-operation is the production of livelihood in the human life world (Fuchs 2003c, Hofkirchner 2002). The communicative exchange of representamens is a prerequisite of co-operation. Human co-operation means that human beings find common understandings and meanings of certain aspects of the social world. These shared meanings are then objectified and represented in the form of objects of the social world that are part of

the shared social environment of the human subjects involved in the co-operation process (ibid.).

We don't confine co-operation processes to the human realm. In a general sense understood as interactions between self-organizing systems producing emergent qualities in a shared environment, it is a basic process in all self-organizing systems. In this sense also bacteria or cells co-operate.

Since all self-organizing systems establish closure even the simplest ones establishes an individuality, and since they are proactive in preserving their own organisation they develop a functional interest in survival in nature, in society and in meaning. They have what Spinoza calls conatus (a kind of vital force) they emerge as interpretation positions in reality that not only interpret the environment but also the behaviour of the other self-organizing systems and ultimately some kind of existential meaning.

We see first person experience and qualia as arising in the living systems as emergent phenomena as the biological structure and organisations become still more refined and specialized in the nervous system and finally brains. Peirce's pure feeling or the basic awareness is thus manifested or reflected more and more in the evolution of still more complex living systems that at the same time develop proactive interpretants and therefore also personal and social/cultural meaning. With human co-operation and self-awareness through language the field of personal and cultural existential meaning, ethics and aesthetics develops.

8. Arts as a Transdisciplinary Medium

The arts could function as a transdisciplinary mediator in science and society. Artworks are a social product that reflects the social relationships of a certain period of society. But the arts ever since the emergence of modern society has developed a special position as a relatively autonomous system, one can't deduce the dominant forms and contents of arts from the relations of production and power of a social formation. This is what Adorno has called the non-identity of arts (Adorno 1970). The aesthetical dimension of arts goes beyond the facticity of society (that which is), it can anticipate possible futures of a beautiful, fair, and just society.

Aesthetical forms go beyond the alienation of modern society and anticipate a happy and beautiful society. The arts can strengthen the creativity and imagination of human beings that are necessary for designing our systems in a co-operative and participatory manner. Art is a generalized medium that has the ability to reflect human endeavours and picture the latter in different ways. Although arts are primarily an aesthetical medium, it always carries a more or less explicit ethical dimension. So the aesthetics of arts can have an ethical dimension.

Contemporary art forms a mix of different styles and forms of human knowledge .The arts are the border where all spheres of human knowledge meet and it functions like a mediator between them, integrating their different codes. The arts do to have ability to build the meta-language of culture uniting all its forms. It may serve as a medium of unification of science and other forms of culture in the process of designing the future by integrating technological, ethical, aesthetical, political, economic, and ecological aspects of social systems, especially by reflecting the human existential and meaningful existence. An aspect that we have already systematically incorporated in our present approach is to show that the cognitive process also depends on the interpretative activity of the subject.

In this sense we could say that the art can implement a particular mission by formatting new ideas of the world and contributes to destroying old stereotypes because any art fulfils a common task: an artistic incarnation of the objective laws of life. Arts are an expression of the fact that in all forms of human knowledge the tendency of an overall picture of the world arises. And much more than that, the arts are able to collect the worldly knowledge of the different human cultures because in the art the possibility of the existence of many different points of views, values and opinions simultaneously is given. This creates a new level of reality that enables a dimension of freedom (Лотман 1992) that can display alternatives in a world that has problems of producing alternatives within its well-disciplined symbolically generalized media.

9. Conclusion

By unifying aspects of semiosis, cognition, communication, and co-operation in systems thinking we have attempted to create a transdisciplinary framework for understanding the information processes in the knowledge society in a way that unites the social, mental, biological, chemical and physical dimensions of reality.

We have been able to formulate a common framework with common primitives for thinking about the past, present, and future of society, nature, and technology. The design of technology must be oriented on human beings and human values.

General theories are necessary because they show that the self-organizing characteristics of nature, life, meaning and society are the foundation of existence.

Technology is part of our existence, but doesn't and can't form a foundation that controls reality. If technology dominates existence, it would tend to violate the laws of self-organization that are at the core of the evolution of nature and society (Nöth, 2001, 2002). It must be integrated into our personal, social and ecological reality in a meaningful and humane way so that it enhances our existence (Hofkirchner/Fuchs 2003 …).

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