

Contextuality: System-Reframing for Self-Reference

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Joseph Ditterich, 1991

CONTEXTURALITY:

SYSTEM RE-FRAMING FOR SELF-REFERENCE

ABSTRACT. In the relationship between the concept of a system and the phenomenon of self-referentiality still dominates a conservative point of view with respect to logic. The system concept of contextuality, which was introduced by Gotthard Günther, is the result of a radical change in the logical foundations of systems. It should be shown how Günther's introduction of the philosophical theme of subjective self-reflection into his conception of a many-valued place-value logic, reverses the function of self-referentiality with respect to a system. As a contexture a system shows the structural conditions of a boundary for referentialities, a closure or a barrier for its own operations. Self-referentiality of a system in its minimal but unfolded organization is only possible if this system is involved with or surrounded by other systems or contextures. In classical two-valued logic there is no possibility for a conception of a multitude of elementary logical systems. The identification of a two-valued logic with an elementary contexture enforces the introduction of a polycontextural logic for an operational foundation of self-referential systems.

1. INTRODUCTION

Gotthard Günther introduced his theory of contextuality at the end of a long research process which started with a philosophical theory of reflection. Contextuality is a philosophical conception of system unity, which gives a new understanding of a systems complexity and self-referentiality. If we are to treat a system as a 'self' using this theory, then the structural precondition to re-frame the system is satisfied by its contextuality. The concept of the closure of a system is a first structural innovation by the concept of contextuality. This is the structural or organizational condition for a system-referentiality for hetero- and self-referential processes. At that time, when Günther was thinking in categories of reflection, he stated that a 'self' is generated by an 'iterated reflection'. The process of a 'reflection of reflection' leads only to a 'self', if the possibly infinite iteration of the process of reflection is stopped and an unity out of the double reflection is 'formed'. In this sense a system as a 'self' is generated by the process of self-reflection and the unity of this self-reflecting system is given by its closed organization, which characterizes the system as a 'self'. Such a complex self-reflecting system will be called a compound-contexture, but there is another mode of a 'self' in the scope of an elementary contexture, as will be shown.

Self-referentiality is looked at as a cybernetic problem, it is a phenomenon which is not separable from the organization of the system. A cybernetic system is defined by the organization of its operativity. This has the consequence that self-referentiality must be seen with respect to the organization of the system. With this cybernetic perspective, the focus moves towards an identification of the 'self' with the system. At this point the relation between logic and cybernetics comes into play. In the German Transcendental Philosophy (Hegel and others) the 'self' or 'subject' was introduced as a self-reflectional thinking process, which constitutes self-consciousness. Gotthard Günther starts his research with the aim of finding a formal extension of logic, which enables the introduction of the philosophical concept of subjectivity as a new theme into logic. The resulting philosophical *Theory of Polycontextuality*, which stands at the end of Günther's research, gives a very general theory for the organization of logical and arithmetical processes in complex systems. This will be shown by the demonstration of some steps going from an analysis of the classical two-valued logic to the development of logical system conceptions which were developed before the general *Theory of Polycontextuality*. An

argument for going back to the analysis of the philosophical meaning of the two-valued propositional logic is to show, that self-reference immediately performed in the space of the formal system of classical logic is not related to the system as an 'operator' or 'self' and therefore the demands of cybernetics cannot be fulfilled in principle. We will show that cybernetic needs a foundation in a new logic of self-referential systems and that therefore the notion of contextuality is essential.

It should be pointed out that results from 'second order cybernetics' concerning the relationship between a system and its environment show two aspects which give a new meaning to the phenomenon of self-referentiality of a system. The first is the realization that self-referentiality of a system is a phenomenon with respect to its environment: "...states that are generated purely within the animal, they are 'self-states' ... of the organism which permit it to refer each incoming signal to its own self, i.e., to establish self-reference with respect to the outside world." (von Foerster (1969):34). If the relationship system/environment is not established by an observer, but by the operativity of the system itself, a general system-referentiality is irreducibly implied. This was clearly stated.

The second aspect shows, that cognition as the basic realization of a system/environment relationship of a living system is characterized by the 'closure of operativity' of the cognitive system or its 'organizational closure'. (Maturana, Varela (1979)) Both aspects, the characterization as a closed system and its self-referentiality, cannot be modelled by the classical two-valued logic and the related type of self-reference. This was also stated by researchers of 'second order cybernetics' as von Foerster, Maturana, Pask, Varela and even earlier by McCulloch.

Also new considerations in AI-research had the consequence to look on self-referentiality as a mechanism of a system which is embedded in the world. Linguistic concepts like indexicality, context-relativity, circumstantial relativity, complementarity, local/global considerations ect. give the conceptual space for pragmatic formulations of self-referentiality. The system gets the role of the 'self', not just for its internal organization but also for its relation to the external world. Self-referentiality is no longer understood in the narrow meaning of self-referential propositions in the frame of a formal system without any organizational traits of a system's self-referentiality. It was stated, that different modes of self-referentiality have to be based on different concepts of a 'self': as a unity, as a complex system, as an independent agent or actor. (Smith (1986)) [¹]

In this situation it seems to be necessary to point out the problem, that the phenomenon of self-referentiality must be seen from the point of view of a possible choice with respect to different types of logic.

2. RECONSIDERATION OF SELF-REFERENCE

2.1. *Different Starting Points for Self-Reference with Respect to Logic*

Most important for the conception of self-reference in a polycontextural framework is the different starting point in comparison with the treatment of self-reference in the context of classical logic and formal languages. The latter systems are dominated by an intentional or referential point of view, as systems of representation, presentation or indication. In this context self-reference is subordinated to the general framework for dichotomic referentiality. In his lecture 'The Form of (Self) Reference' at the conference [²] L. Kauffman said, that self-reference is just a special kind of reference. The meaning of reference "to point to" is basic for self-reference too.

What this means can be seen through the fact, that in two-valued logic there is a coincidence of the reflectional and the intentional value-functions. (Günther (1979):151) Negation as an symmetrical exchange-relation between the positive and the negative value coincides with the

dichotomy of the designational / non-designational value-function, which defines the classical intentionality on being and object. It is the coincidence with the intentional aspect which produces the effect that the structure of objectivity is treated as being isomorphical to the structure of consciousness. The negation interpreted as the operation of a bipolar process of reflection is subordinated to or bounded by the intentional meaning of logic, which means that the two-valued reflection is interpreted as a hetero-referential process of thinking or cognition. This kind of hetero-referentiality has no ontological meaning with respect to the system which performs the processes of hetero-reference. (Günther (1979):254) In classical philosophical terms: the negative value as the index of subjectivity merely reflects or repeats the positive value, which stands for the object.

In this constellation the 'operator' of the process of reflection is not inscribed into the place of the logical system, but remains in the external position of the 'transcendental subjectivity'. Or as 'second order cybernetic' states, it remains in the position of the 'observer'. In the classical philosophical theory of thinking, the subject was the 'transcendental source' of thinking, until the following *Transzendentalphilosophie* introduced the self-reflection of subjectivity as a new problem. As long as this new theme is not taken over into logic it has the consequence, that the 'operator' of the philosophical conception of thinking and therefore of logic too, is transcendent with respect to that 'system'. In the ontological interpretation: 'subjectivity' is not part of the reality which is reflected by and a theme of logic. To define a two-valued system of logic as a closed reflectional system, it is required that negation is be freed from its subordinated function and that it takes the role of a process of a 'reflection in itself' (Hegel: *Reflexion in sich*).

The different aspects of referentiality ruled by the classical two valued logic, could now be enumerated:

- 1.'Auto-reference' (objects, 'being', one-valuedness, irreflexive identity).
- 2.'Hetero-reference' in the 'subjective mode' (cognition, thinking, two-valuedness).
- 3.'Self-reference' in the mode of partial or paradoxical self-reference. (Löfgren 1981, 1983) [³]

These three modes are variations of the basic 'auto-referentiality' of a system which has no environment, which means the same as a system without a boundary. Günther calls this type of hetero-referentiality the 'subjective mode of hetero-reference', because it includes no logical distinction between the system and its environment. A distinction by an observer is logically secondary, an autonomous system is defined by its self-distinction. (Varela (1991)) The function of two-valued logic at the background of this philosophical interpretation of hetero-referentiality as thinking the object or 'being', – which is a historical inheritance and cannot be ignored – has the following consequences:

1. Hetero-reference or cognition is guided by the claim to objectivity.
2. The subject or cognitive system is only involved as having the objective world as the content of its consciousness.
3. Consciousness and objectivity are isomorphical, the system has no environment or boundary.

Günther starts his research for a new logic of included subjectivity from the philosophical knowledge about the difference between hetero- and self-reflection in the frame of a general theory of reflection. He makes a philosophical analysis of logic as a vehicle of subjective reflection. His aim was to look for the possibility of a 'formal' logic, which does not only have, from a philosophical point of view, objectivity or 'being' as the theme or content of a process of reflection or thinking, but also has the process of reflection itself as a different logical theme. Both themes have to be parts of a new unity of logic. The classical two-valued logic was identified as the logic of the first theme, the second logical theme needs its own logical structure.

(Kaehr (1978), Kaehr et al. (1988), and Pfalzgraf (1991).

Günther realized the generalization and formalization of his philosophical foundations of a logic of self-referentiality by a many valued and multi-negational logic. This multi-negational logic – the known many-valued logics in mathematical logic (Lukasiewicz, Post) are not multi-negational, but have only one negation – functions as a place-value system of two-valued logical subsystems. The self-thematization of a process of reflection as a self-differentiation has its formalization in a logic composed of distributed basic logical subsystems. Each subsystem can be interpreted as a basic process of reflection and the place-value of a subsystem indicates the reflectional function of the respective process in the self-reflectional system unity. If this level of a logic of distributed systems is reached, the narrow interpretation as a logic of subjective reflection can be given up. But this will only be possible in a consequent manner only if the concept of contextuality is developed. For the relevance and necessity of further steps in Günther's research process, see (Ditterich, Kaehr (1979)).

2.2. *The Transjunctional Organization of Self-Referential Systems*

The whole project of a logic of a self-reflecting subjectivity turns in a very unexpected direction. Out of the problem that not all combinatorically possible value-sequences in a many-valued place-value logic have a philosophical interpretation, a new type of logical functions, the transjunctions and a new level of processuality in logic, the morphogrammatic level were discovered. (Günther (1976):215) Only if these operative innovations in a generalized place-value logic are given, it is possible to define a system of self-referentiality at the place of a basically two-valued logic system. It concerns the minimal structural situation of an operative autonomous system, which is embedded in the world. This situation is different from that kind of self-reflection which is organized as an internally distributed many-valued place-value system, which is irreducibly combined with a switch between subsystems or a detachment of one reflectional process from another.

What was still missing was the discovery of the operational meaning of the boundary (closure) of a reflectional system with respect to an environment. If self-referentiality is looked upon as an irreducible property of a system which is a consequence of its 'being in the world', a new conception for the interplay between open and closed states of a system is needed. In the first phase of the development of Günther's conception of a place-value logic, hetero-reflection was only logically distinguished from self-reflection as two different modes of thinking. But the system/environment problem has also to be seen in connection with the problem of the 'operator' of a system, as 'second order cybernetics' has shown. By the attribute of a 'self' for a system it is intended, that this system is its own 'operator'. The main problem for a model of a cognitive system from the standpoint of its operativity as a 'biological', autonomous system – is, to locate or inscribe the 'operator' into the place of the system. (Maturana, Varela (1979))

An decisive event in the operative development of place-value logic was the discovery that 'the morphogrammatic order of two-valued logic is incomplete'. (Günther (1976):218) The generalization of the place-value logic has its reason in the recognition that a two-valued subsystem of a place-value system cannot only have two but four different values, if the length or the number of places of a value sequence for binary functions is considered. See Figure 2. As long as negation was interpreted as the elementary process of reflection, there was no reason to look for a possible occurrence of more than two values in a subsystem.

That the two-valued logic is incomplete from a morphogrammatic point of view – only two different values are used in a pattern of four different places – characterizes it as a system that has no environment. The two logical values give the basic definition for the system, which is also the case for the systems which are parte of a place-value logic. But this is only the state of the system, as long as no phenomena are admitted which derive from a possible system

transcending functionality.

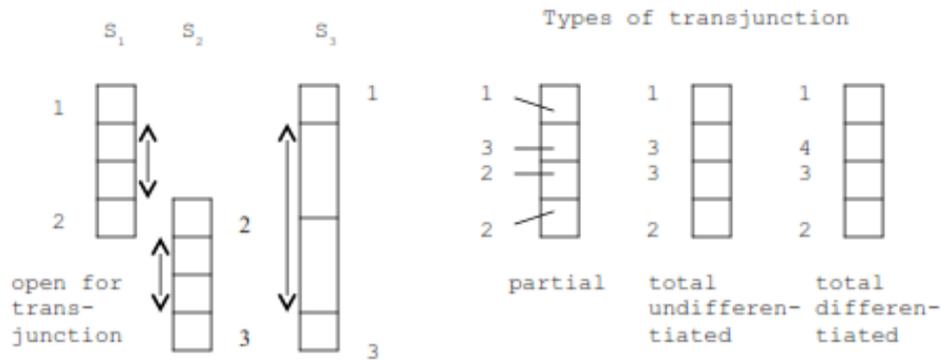


Figure 2. Transjunctions. Scheme of a three-valued place-value logic as a minimal structure for transjunctions and an illustration of different types of transjunctions with 3 or 4 values.

The possible appearance of two additional values, the rejection values in the place of a two-valued system – basically defined by its two values now called its acceptance values –, characterizes a new type of logical functions, the 'transjunctions'. "...transjunctions isolate a system (by rejecting it). In doing so, it produces the distinction between a closed system and its environment. ...For this purpose we require a value which transcends the scope of the system." (Günther (1976):318)

The rejection values, which come from outside of the respective two valued system into the scope of this system, are now interpreted by Günther as the index of subjectivity or reflection. In rejecting the alternative of the two system defining values as a whole, the relationship of this system to its environment is reflected in the inner organization of the system, which is expressed by one of the different types of transjunction. That the 'reflection of the system in itself' (Hegel) is realized by system transcending values means, that the self-reflection of a systems 'being in the world' has to go through its environment. As Figure 2. shows, transjunctions are differentiated with respect to the number and place of the rejectional values. The partial transjunction, which has only one rejection value in one of the two inner places which are open for rejection values in a value-sequence, has the meaning of a hetero-reflection in the sense of the reflection of an environment. But this transjunctional cognition, which is realized by a single rejection value, is at the same time a partial self-reflection, because the system thereby reflects structurally its relation to its environment. The environment separates itself from the system by rejection, as a process of hetero-distinction which is at the same time for the system a structurally co-realized process of closure. But the complete pattern of states of a self-reflectional system, the identity as a 'self' or subjectivity, is reached only by an 'iterated reflection', as was already stated in Section 2.1., as the criterion for the 'self' of an internally distributed system unity.

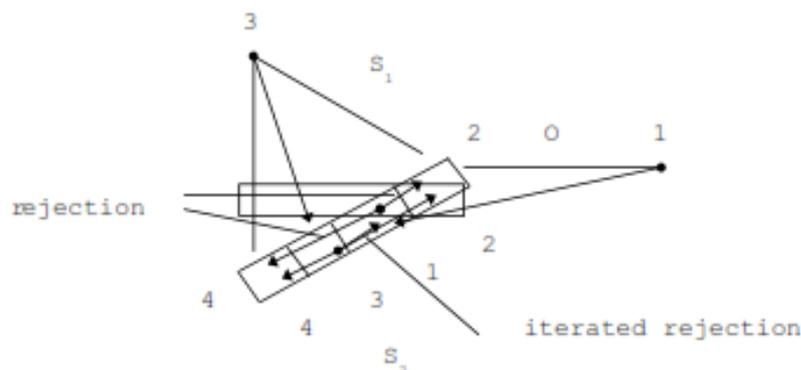


Figure 3. Illustration of a self-reflectional system S_2 . The process organization is given by the total differentiated transjunction in a four-valued situation.

The total differentiated transjunction shows the condition of the 'iterated reflection' by its 'iterated rejection'. But the two different rejection values presuppose the constellation of at least a four-valued logic. The second rejection value treats the first rejection value as an 'environment' for its own reflectional function. In this sense a system of self-reflection has two different environments. (Günther (1976):319) If the first rejection generates the hetero-distinction between the system and an outer environment, the second rejection separates the system from this state of the environment and generates a new state of 'being aware' about the first state. The total differentiated transjunction interpreted in terms of reflection is the functional expression for the self-reflectional identity of a system which is embedded in the world. It is the self-identity of such a system or the identity as a 'self', which is realized by a process of 'iterated rejection'.

Transjunctions are the basic logical operations for a system reframing for self-reference, they are the operations which realize a boundary of a system by the organization of its referentialities (auto-, hetero-, self-). In this irresolvable interconnection between boundary and organization, a genuine system referentiality is realizable. General formulated, transjunctions give the organizational conditions for self- and hetero-referentiality of a system in its basic and minimal form. They are the logical operations necessary for the understanding of the meaning of the concept of contextuality for a cybernetic theory of systems (Ditterich, Kaehr, and others (1985):76). But they are not sufficient conditions, as we will see in Section 3. An elementary contexture is a system which has already a boundary by its structural two-valuedness, which can be reflected and organized further by transjunctions. But the phenomenon of rejection does not appear only with respect to an elementary contexture but also to compound-contextures.

It can only be noted here, that the discovery and the operativity of transjunctions is combined with a displacement of the basic operativity of processes of reflection to a new level of logic, the morphogrammatical level. Morphograms are the basic four-place patterns, the empty structural schemes of the logical junctions and transjunctions without any use of logical values. The morphograms are the processual units, by which the 'operator' of a system changes the mode of reflexivity of the system and by which a system keeps itself open for different environments, respectively rejection values. The morphogram has now the role of the new operative unit of a process of reflection, instead of the negation. Morphograms are invariant for negations. Only the interplay between the morphogrammatical level and the level of value-systems (Günther (1976):297 and Kaehr (1978):112) provides the full operativity of the generalized place-value logic.

3. SELF-REFERENTIALITY AND CONTEXTUALITY

The difference between the classical function of two-valued logic and its function for a characterization of an elementary contexture is seen as the condition for the re-framing of a system. The role of the two-valued subsystem in a generalized place-value logic does not give the full scope of the organizational power of the concept of a contextuality. The next necessary but still insufficient condition for the characterization of an elementary contexture by a two-valued logic is, that its "limits are determined by an absolutely generalized TND (Tertium Non Datur)". (Günther (1979):286) The structure of a contexture, which is described by a two-valued logic is unlimited with respect to its content. Qua partial negations, an infinity of 'relative TND's' or points of views for definitions could be introduced, but the 'absolute TND' determines the limit or establishes the structural barrier of a contexture or contextuality (Günther (1979):188).

Any process which starts in a contexture "is confined to the contextuality in which it originates." (Günther (1979):287) A contexture as this domain or place of operations is structurally characterized as a finitude, a two-valued structure. This relation between infinity and finitude

is a total reversion of the viewpoint in the philosophical tradition (Günther (1975)) and is crucial for the reflectional functions of a contextuality. In the traditional meaning which is constitutive for the western ontology and logic since the philosophy of the Greeks, the finite is always subordinated to the infinite. In the case of a contextuality the finite structure of a contexture is the 'form' by which the processuality, generating all the possible contents of a contexture, is organized and through which it will also be possible, to organize the coupling of such process systems. These intra-contextural processes function in their place without any restriction and are dis-contextural to processes which take place in other systems. To be 'dis-contextural' means, to be excluded qua boundary (closure) and not qua distinction as an act of an observer (Günther (1972)). The finite structure of an elementary contexture is given by its one- or two-valuedness, for compound contextualities a definite number greater than two is the structural-number of the respective finitude.

The concept of contextuality as a finite structure, as an empty space for an unlimited intra-contextural processuality, formalizes a system with respect to its operational confines. For system processes, the place of the system causes a structural barrier with the consequence of an irreducible structural break up between different contextualities. The reflexivity-form of a contextuality is a unity 'reflected in itself' and is therefore the condition for a new type of a unity, from which a multitude of contextures can be derived. Classic two-valued logic is lacking this system quality as a unity, which can be seen in its singularity. Also the limits of formal logical systems with respect to completeness and decidability do not have the function of a boundary of a system. The limitations of formal systems are the results of a superposition of an external reflection into the basic system. The move and the coupling of this reflectional 'operator', which enables the classical type of self-reference, is not 'implemented', not formalized, as it is the case for self-reflectional processes in a place-valued logic. (Kaehr (1978):57)

Unity was at the early phase of the development of place-value logic – in the fifties – attached to the three-valued system as a whole. This interpretation of unity comes from the philosophical conception of self-consciousness. The logical designation of subjectivity had to maintain the principle of the 'unity of self-consciousness' by the corresponding 'unity of logic', for details see (Ditterich, Kaehr (1979)). The compound-contextuality is the generalized concept of a unity for complex systems in the *Theory of Polycontextuality*. A compound contextuality is a unity, which shows an inner differentiation as a compound of a respective concrete number of elementary contextures. It forms a unity out of its contextual parts or subsystems by realizing its 'compound-contextural closure' or 'compound-organizational closure'.

The general philosophical conception of a multitude of contextures or of the polycontextuality represents a new theory of reality and is no longer restricted to the theme of subjective thinking or reflection, as in the early phase of Günther's logical research. Reality is understood as a compound of contextures (Günther (1979):289), which are in different modes of relationship: intersection, overlapping, disjunction, parallelity ect. An elementary contexture in the *Theory of Polycontextuality* is not defined with respect to a homogenous background (universe) or an invariant reference-system (objective world), which would play the role of the medium in which a contexture is 'embedded'. There was an intensive discussion in physics and cybernetics, how a self-organizing system could evolve against or out of a physical background. The principles of 'order from disorder', 'order from order', 'order from noise' ect. Stand for this matter. (Ditterich (1990)) The function of a homogenous background is now moved to the inner space of an elementary contexture. But none of these contextures is preferred or functions as an invariant reference-system for the others. Each contexture can be a beginning, a starting system, but the concept of a contexture includes, that each contexture can change the position. A contextuality is a system which can in principle take any place in an order, but is related to other contextures by its 'ontological locus'. (Günther (1979):254) This is a kenogrammatic concept, which allows to relate contextures without the means of place-value logic. Kenograms

or kenogrammatic patterns (Günther (1967)), – from which contextures can emerge, if a transition to a structural level of logic, arithmetic, semiotic ect. is made –, are the irreducible basis for the reflexivity of systems and for the possible changes of a system between different modes of reflection. This possibilities are a question of the range of the kenogrammatic pattern (number of kenograms), in which a system is embedded with its activities and relationships.

The structural generalization of the morphogrammatical structure of place-value logic leads to the theory of kenogrammatic. A short characterization by Günther should be given here: "We ... introduce a new type of symbol which we shall call a "kenogram". ... the term "kenoma" in Gnostic philosophy ... means ultimate metaphysical emptiness. An individual kenogram is the symbol for a vacant place or ontological locus that, in conjunction with other kenograms, may form a pattern without regard to possible value-occupancy." (Günther (1967):400) The concept of a universal contexture comes out of the discovery that kenograms cannot only be occupied by logical values but also by numbers. A single kenogram can be the 'ontological locus' for a sequence of natural numbers (Günther (1975):25). A very detailed report about the discovery of the concept of contextuality is (Günther (1975)), where the philosophical problem of the interrelationship of 'Number and Logos' is developed. With respect to numbers, the concept of a contexture is defined as the place of a 'Peano sequence'. The counting process is confined to the place or space of its contexture. It is the analog characterization of the boundary of a contexture, as that of the principle of an 'absolute TND' in the case of logic. For both characterizations of a contexture it has the effect, that different kinds of operations can be confined to the place of a contexture, which is a condition for the polycontextural organization of distributed operativity. A contexture is a 'system of operativity', it gives the system its operative autonomy out of which different modes of coupling are possible.

The 'proemial relationship' can be seen as a 'complementary' operative determination of a contexture out of its relation to another contexture in the Theory of Polycontextuality,. The 'proemial relationship', introduced in (Günther (1971a)), shows the general mechanism of the interchangeability between the categories (operator, operand), if a dis-contextural transition from one contexture to another will be performed. Figure 1. shows the 'proemial relationship' between the four categories of the systems S_1 and S_2 . By the combination of the concept of contextuality and the 'proemial relationship' for dis-contextural transitions, the boundaries of two contextures with respect to their operativity are defined out of their mutual relationship. The 'proemial relationship' pre-organizes the boundary of the system operativity through the barrier, which is triggered by the exchangeability of the four categories of respective two systems. The 'proemial relationship' combines two intra-contextural order-relations between operator and operand with a discontextural exchange-relation between operator and operand or two exchange-relations with an order-relation. By this an operator is linked to the place of its system and can be 'mechanically' transformed to the category of an operand – or reverse, if a shift to another system is performed. It was already recognized in the case of subjective self-reflection, that an 'operator' can also change its 'identity', in order to become the 'operator' of another system or to become a 'self'. But this transition as the 'operator' of different systems is not an immediate exchange, as the 'proemial relationship' shows.

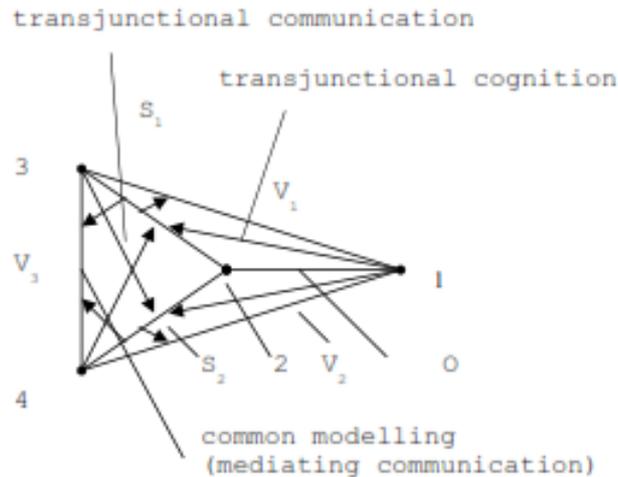


Figure 4. Scheme of the coupling of two cognitive systems (S_1 , S_2) in a common environment (O).

The openness of a contexture for trans-contextural phenomena can now be organized also by logical transjunctions. All achievements of the generalized place-value logic remain valid. Polycontextural systems as compound of many contextures give the structural possibility of an interplay of reflectional systems. As shown in an illustration in Figure 4., the coupling of the two cognitive systems S_1 and S_2 gives the possibility for several additional processes which arise out of the structure of a compound. Transjunctional cognition can be combined with transjunctional communication. The self-reflectional process of a basic system (S_1 or S_2) realized by the total differentiated transjunction, reflects the system with respect to its compound situation with the common environment O and the other cognitive system. The systems of mediation (V_1, V_2, V_3), which are consequences of the coupling of the basic contextures (S_1, S_2, O) give new possibilities for models, which are related to the different relations between the cognitive systems and their common environment. For further aspects see (Ditterich (1990)). The concept of contextuality opens new organizational possibilities for the parallelity and complexity of multi-operator systems. Recently transjunctions were used for the logical controlling of a three-robot system (Pfalzgraf et al.(1991):26).

We can summarize now: By the concept of contextuality a new concept for operative self-referential systems is obtained. In this concept of contextuality a lot of operative innovations and philosophical reflections are condensed or implied, and others are transformed. The concepts of dis- and trans-contextuality mediate the difference between hetero- and self-referentiality. The concept of a unity, which is given in its double meaning as an elementary contexture or a compound-contexture, the distinction is relative, leads to the structural innovations of a boundary and of a 'organizational closure' for the system operativity. Günther looked at his Theory of Polycontextuality with its coordinated systems of operativity as a new foundation of cybernetics.

(This paper is based on a presentation on the "3rd Mayor Symposium on Nature, Cognition, and System" with the theme "Perception, Information and/or Communication, and Self-reference", at the "8th International Congress of Cybernetics and Systems", 1990, New York, USA.)

Notes:

- 1) B. Smith (1986) developed the conception of "causally connected self-referentiality" for the inner organization of a system which is acting in its environment. The system should be able to produce a model of itself and to calculate investigations and deductions about itself within this model. The operations inside the model and inside the basic part of the system should work simultaneously and should be connected through a 'causal connection'. "A mechanism of connection that enables smooth shifting back and forth between direct think-

ing about, and acting in, the world, and detached reasoning about one's embedding situation." (Smith (1986): 28) The decisive point within this conception of 'causal connection' is to see self-referentiality not only in the sense of an intentional referentiality, but in the sense of distributed operativity, which forces a new dimension of time in a system organization. The modelling as a repeatable process as well as the performance or the interruption or the alteration of the direct process through reflections of the model, gives the connection a function for the organization of the system, concerning its behaviour in time. This represents a first abolition of the elimination of time through the classical shift of levels of control functions. The 'causal connection' should realize the time relation of the two parts of the system out of the structural conditions of the system 'being embedded in the world' (self-relativity) and its ability for self-referentiality. Such a switching function which realizes (qua 'causal connection') the organizational meaning of a system of distributed operational parts with respect to the relation of the system to its environment, places 'the central concept of cybernetics' (von Foerster), which is 'circularity', on a higher level of system organization. But in order to stop the structural dominance of the concept of the 'linearity of time' in its function for the inner organization of a system, the relationship of a system to its environment has to be understood as discontinuous or, in the terms of Günther, as 'dis-contextural'.

Seen from this structural condition, Smith's conception still remains within the classical paradigm (mono-contextural). The reasons are to be found in the 'deduction' of self-referentiality from the concept of self-relativity as the basic relationship of a system to its environment, which again is derived from a general relativity of circumstances. "The representation of circumstantial relativity requires, among other things, the representation of one's self, because that self is the source of the relativity." (Smith (1986): 26) This interconnectedness of the concepts of relativity and representation does not provide the basic structural break, which is indispensable for the operative autonomy of a system. 'Circumstantial relativity' is a condition for the definition of a system, it establishes a common domain for the system and its environment and therefore lacks the condition of dis-contextuality.

- 2) "8th International Congress of Cybernetics and Systems", 1990, New York.
- 3) *Löfgren's* concept of autology shows the limits of this type of self-referentiality for an operative modelling of autonomous systems. In the concept of autology or 'linguistic complementarity' self-referentiality is interpreted as self-application and through this perspective, it is distinguished into consistent and inconsistent self-referentiality. Through the perspective of self-application, the consistent mode of self-referentiality could be seen as an iteration of the application of a concept. The iteration is not performed out of the basic order between two categories (operator \rightarrow operand) or concepts but out of an application of the iterated category or concept to its non-iterated occurrence. This kind of self-reference or circularity can be unfolded in a metatheoretical modelling, as a "metalinguistic foundation for autonomies, or self-reference" (Löfgren (1983): 218). The other type of self-reference, which is not interpretable as an iterated application (iteration in the continuation of the order(\rightarrow)), is the inconsistent not unfoldable self-reference. The self-reference as the change from the function of one category to the function of another category has not just a meaning as reference to an application, but as a 'circularity' in the operative mode of the categories. What would be required from a biological point of view, is a self-referentiality in the basic operativity of a system, (Maturana, Varela, von Foerster). But from a logical and not only linguistic point of view, this forces another type of "unfoldment", which combines the change of the function of a category with the change of the system of operativity. The relational mechanism which shows this interconnection of categories and systems is called by Günther the 'proemial relationship'. (Günther (1971a) and (1979): 226)

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