Luhmann’s Relation to and Relevance for Constructivist Approaches

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The common denominators of constructivist approaches can be bodily, or the social realm. Constructivist approaches are considered to populate the rational-linguistic, the biological-constructivist approaches can be said to differ also with respect to whether invariants of inborn cognitive operators. Grouping of experiential complexes. Some regard perceived regularities as the structures of the real world can be compared with mental ones, or they constructed mental structures gradually adapt to the structures of the real world. How much influence they attribute to constructions. Some assume that cognition and perception are actively built by one’s mind rather than as cognition and perception are actively built by one’s mind rather than as cognition and perception are actively built by one’s mind rather than passive acquisition. However, constructivist approaches vary in function of how much influence they attribute to constructs. Some assume that constructed mental structures gradually adapt to the structures of the real world. Others seek to avoid this dualism. Either they skeptically reject that the structures of the real world can be compared with mental ones, or they embrace a phenomenological perspective that considers cognition as the grouping of experiential complexes. Some regard perceived regularities as invariants of inborn cognitive operators. Constructivist approaches can be said to differ also with respect to whether constructs are considered to populate the rational-linguistic, the biological-bodily, or the social realm. The common denominators of constructivist approaches can be summarized as follows. Constructivist approaches question the Cartesian separation between "objective world" and subjective experience.
Luhmann and the Sociological Turn in Constructivism

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Introduction

1984 marked a turning point in German sociology. In this year, Niklas Luhmann published his book Soziale System (Luhmann 1995) in which he started to base his thinking on concepts borrowed from scholars of radical constructivism (RC) and second-order cybernetics, most notably on Humberto Maturana and his theory of autopoiesis (1970) and on George Spencer Brown’s (1969) laws of form. Luhmann himself called his constructivist approach “operative constructivism” and brought about what Bernhard Poerksen called the “autopoietic turn in sociology” (Poerksen 2004: 78). Clearly, Luhmann was considered one of the major proponents of the constructivist movement in German-speaking countries in the 1980s.

However, Luhmann’s relationship to constructivist approaches is not free from doubts. Most prominently, Maturana himself rejected the idea that the concept of autopoiesis could be transposed to sociology:

“Thank you for having made me famous in Germany,” I said to Niklas Luhmann, “but I disagree with the way in which you are using my ideas.” (Maturana in Poerksen 2004: 78)

Maturana argued that it is incorrect to apply autopoiesis to social systems because in the original definition, autopoiesis refers to a network of self-reproducing molecules, i.e., a network of processes of production (transformation and destruction) of components that produces the components that: (i) through their interactions and transformations continuously re-generate the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in the space in which they (the components) exist by specifying the topological domain of its realizations as such a network.” (Maturana & Varela 1980: 79)

However, Luhmann’s fundamental entities were not molecules but rather communications such that a social system is essentially an autopoietic network of communications. This violates the original definition of autopoiesis because in contrast to molecules, which reproduce themselves without exogenous help, communications need human beings in order to be brought into existence:

[Biological] autopoiesis takes place in a domain in which the interactions of the elements constituting it bring forth elements of the same kind […] whereas communications can only produce communications with the help of human beings.” (Maturana in Poerksen 2004: 78)

Given the complexity of Luhmann’s work, it may be wrong to conclude that he was not constructivist in his thinking. In particular, Luhmann’s central concept of communication evades easy interpretations such that Maturana’s disapproval may seem rash. In an interview, Ernst von Glasersfeld admitted

“I have great difficulties with Luhmann… I have difficulties understanding specifically what he means by communication. His communication becomes such a basic term in his philosophy that I’m not sure what he means by it.”

To assess Luhmann’s relationship to constructivism in general and to RC in particular, we asked contributors to this special issue to reflect on various topic areas such as:

1 | Luhmann’s epistemological understanding in accordance with or in contrast to (radical) constructivism.
2 | Luhmann’s understanding of science (including understanding of truth) in accordance with or in contrast to (radical) constructivism.
3 | Luhmann’s use and development of typical constructivist concepts such as self-reference, self-organization, autonomy, autopoiesis, second-order cybernetics, observation, and second-order observation, etc. Their conceptual borrowing by Luhmann should be critically examined.
4 | What (radical) constructivism can learn from Luhmann.

In the remainder of the editorial, we provide an overview of the contributions that we received and attempt to find answers to these questions.

Contributions

In the course of our correspondence with potential contributors who were asked to shed light on these four questions we could not help noting a particular impression: while Luhmann is still highly respected in general sociology, his link with constructivist approaches seems to have weakened – at least when perceived from sociology. Out of the many scholars we encouraged to contribute to the special issue, we eventually accepted only seven authors who expatiated on the constructivist significance of Luhmann’s work. Is Luhmann just no longer discussed so much in constructivist circles? We decided to trigger a scientific discussion in advance of the publication of these articles and invited scholars to write Open Peer Commentaries (OPCs) on the main articles, focusing on a few aspects they could either criticize or support with additional arguments and evidence. All accepted OPCs were to be published together with the corresponding article and a response from the article’s author. To our great delight, so many people took up the challenge and provided commentaries exploring many additional aspects in Luhmann’s writings and in related authors that each main article is accompanied by two or three OPCs.

In the following, we summarize all the main articles, OPCs, and responses, ranging from epistemological to sociological to computational aspects.

The first paper in this collection introduces and elaborates the doubts regarding Luhmann’s status as a constructivist. In “Constructivism and Theory of Social Systems. Luhmann’s Ambivalent Epistemological Standpoint,” Armin Scholl analyzes the epistemological foundations of Luhmann’s theory, comparing it with the basic assumptions of radical constructivism. In particular, Scholl pursues the question of whether Luhmann’s theory is closer to realist or to constructivist approaches. He concludes that although there are differences, these differences should not be considered fundamental. This is because Luhmann is clearly closer to constructivism than to realism since he shares most of constructivism’s key concepts, such as self-referential logic, a strict relation between observer and observed, and the relativism of reality construction.

In her open peer commentary “Who Observes? An Appropriate Theory of Observation is in Demand,” Heike Egner focuses on one of these key concepts, i.e., the observer. According to Egner, Luhmann transcends the concept of observation by transferring it from the micro level of individuals to the macro level of society and by stating that all autopoietic and self-referential systems are capable of observing. Egner draws attention to the fact that in Luhmann’s work, the concept of observation is too abstract to be of value for the epistemology of constructivism.

In his OPC “What Exists between Realism and Constructivism?,” Armin Nasseri critically reviews the opposition of realism and constructivism. He argues that Luhmann’s epistemological standpoint cannot be classified within the categories of realism and (radical) constructivism and argues in favor of the concept of operation to escape the dispute between realism and constructivism.

Scholl responds to Egner that the very abstract concepts of observation and of communication must be redefined within the context of psychic or social system in order to work as useful concepts to characterize them. An over-abstract conception of both observation and communication would fail to solve this problem. In his response to Nasseri, Scholl emphasizes the importance of taking the core ideas of radical constructivism seriously and not trivializing them by reducing RC to any kind of idealism or anti-realism. He insists that Luhmann’s operative constructivism mainly follows a constructivist rather than a realist epistemology.

The second paper in this special issue delves into the historical influences in Luhmann’s thinking. Eva Buchinger’s “Luhmann and the Constructivist Heritage: A Critical Reflection” critically evaluates the innovativeness of Luhmann’s effort to replace the Kantian transcendental/empirical distinction with his system/environment distinction. Furthermore, it discusses the relationship of the respective philosophies of various scholars (Husserl, Piaget and von Glasersfeld, von Foerster, and Maturana & Varela) with Luhmann’s theory and terminology. Buchinger arrives at the conclusion that Luhmann’s contribution to constructivism – while original and inspiring – is innovative only in the context of his stringent theory architecture of autopoietic meaning-based systems.

In his commentary “A Circular Comment on Luhmann as a Question Generator,” Karl H. Möller shows that Luhmann can be viewed as a valuable question-generator whose heritage for radical constructivism lies in the original and inspiring effects these new and additional questions may produce. He argues that these effects are particularly relevant for those who look for innovative hypotheses in scientific disciplines such as linguistics, evolutionary theory, and sociology.

Bernard B. C. Scott’s “On Reading and Critiquing Luhmann” focuses on how Luhmann’s concept of meaning processing and his distinction between psychic systems and persons relate to other authors who emerged from the cybernetics movement, in particular to Gordon Pask’s elaborate body of work and to Scott’s own contributions in this field. Furthermore, he joins the circle of those who have concerns about Luhmann’s use of Maturana and Varela’s autopoiesis concept.

Randall Whitaker also voices his opposition to Luhmann. Drawing on a profound knowledge of Maturana and Varela’s work, he points out that Luhmann’s generalized concept of autopoiesis does not correspond with the original biological concept developed by Maturana and Varela, partly because Luhmann was not careful when distinguishing operational from organizational closure. While Whitaker admits that Luhmann managed to consolidate a “kaleidoscopic array of sources,” he has doubts as to whether the details were elaborated properly and thus urges a critical re-examination of the cybernetic roots of Luhmann’s work.

In her response, Buchinger concedes that there are some details in Luhmann’s theories, such as the notion of binary coding, that could be improved by, e.g., empirical investigation and application. She maintains, though, that Luhmann was successful in conceptually interlinking meaning, language, and information. Addressing the “autopoiesis” criticism, Buchinger downplays the actual importance of Luhmann’s borrowing for autopoiesis as for him it was a conceptual vehicle rather than a formal one (thus avoiding the need to examine it against the six criteria put forward by Varela, Maturana, and Uribe). In the end, what counts most for Buchinger is his fruitful theoretical framework rather than his “reckless” treatment of the scientific heritage.
Another central notion in Luhmann’s work (and in constructivism in general) is the concept of the environment. Hugo Fjelsted Alrøe and Egon Noe’s “Observing Environments” goes to great lengths to portray and compare the different nuances. The authors present a consistent treatment of the concept of the environment in Luhmann’s theory and in the work of Jakob von Uexküll and Maturana & Varela, and their respective relevance to problems of environmental sustainability. They argue that one needs to distinguish between inside and outside perspectives on the environment, and identify two very different and complementary logics of observation – the logic of distinction and the logic of representation.

Alrøe and Noe’s survey attracted three commentaries. In “The Construction of Embodied Agency: The Other Side of the System–Environment Coin,” Tom Ziemke addresses the notion of agency in constructivist theories. In particular, he is concerned with the requirements for artificial agency in robotic systems that interact with and adapt to their environments, i.e., with situated and embodied cognition. Ziemke remains skeptical as to whether Luhmann’s work is particularly helpful because he did not address biological details and thus had little to say about embodiment and ontogenetic adaptation.

In contrast to Ziemke, Karl-Heinz Simon considers Luhmann also important when it comes to discussing biological organisms. His commentary “Multiple Environments!!” emphasizes the importance of structural couplings. Simon considers them relevant for dissolving the apparent contradiction between autonomy and dependency of systems.

The third OPC is titled “The Complexity of Environment in Social Systems Theory” and is written by Bernhard Freyer and Rebecca Louise Paxton. It asks whether, in addition to the extensive nature of von Uexküll’s environmental terminology, other environments can be distinguished in Luhmann’s theory, and how malleable the system/environment distinction is to redefinition and interpretation from multiple perspectives. The commentators argue that the complexity yielded by an unpacking of the term “environment” sheds light on the difficulties in finding common understandings for solving wicked environmental problems.

In their response, Alrøe & Noe concede that Luhmann’s simple and rather conventional typology of systems is challenged by various problem cases studied by the authors and the commentators such as farming systems, scientific disciplines, and embodied cognition in robotics. Still, they stick to their recommendation that Luhmann’s theory of communicational social systems is a helpful perspective on the wicked problems. However, the details of how to apply it in conjunction with other perspectives such as embodiment are still in the making. (As editors we could not help but notice that the fact that the concept of self-organization is used differently in the response than by Maturana should be considered evidence that it is integrated differently in different encompassing theories – as exemplified by Luhmann’s idiosyncratic application of this concept to social systems.)

Yet another key concept of Luhmann’s theory, i.e., meaning, is at the focus of Raivo Palmaru’s contribution “Making Sense and Meaning: On the Role of Communication and Culture in the Reproduction of Social Systems.” He criticizes Luhmann’s concept of meaning as too weak to explain the autopoiesis of communication. Instead, he separates social sense and individual meaning and argues for the concept of culture as a link between both of them.

Tino Meitz’s OPC addresses the implications arising from socializing observer-dependent heuristics. He calls into question Palmaru’s terminology and argues that its conceptual deficiencies with regard to the relation between an observing system and its environments cause naturalistic fallacy.

“Why Culture?” asks Martin Zierold in his commentary and he argues that Luhmann might have had good reason to be hesitant to utilize the term. He worries that definitions of culture such as those Palmaru provides may either be too vague or in danger of becoming essentialist.

In his response, Palmaru insists on the concept of culture as a helpful and necessary missing link in Luhmann’s very abstract conception of communication. Palmaru justifies his conception of culture with the findings of his empirical research. Furthermore, he contrasts RC to Luhmann’s concept of communication because RC includes the individual’s sense making in the process of communication (as does, e.g., S. J. Schmidt).

In another sociologically oriented paper on “Radical Constructivism and Radical Constructedness,” Loet Leydesdorff examines “Luhmann’s Sociology of Semantics, Organizations, and Self-Organization.” He emphasizes the reflexivity of human agents and their interrelationships without ignoring or denying that communication is still an entity sui generis. However, communication itself is individually constructed and therefore mind-based, too. It is the evolutionary development of human languages that enables human beings to connect individual meaning and higher-ordered symbolic generalizations.

In her commentary, Kate Distin wonders whether “Symbolically Generalized Communication Media” is a category mistake. She argues that it is correct to emphasize the uncertainty of communications that require different media for communication within and across social boundaries, but it would be a mistake to confute the concepts of media and the symbolic communication codes that give them structure.

A very different perspective is embraced by Roger Harden, who focuses on the “uneasy relation of person/culture,” which, according to the commentator, must not be omitted from any serious discussion of Luhmann’s work. He pleads for a fuller consideration of Maturana’s work.

In his response to Harden, Leydesdorff points out that society consists of a continuous reconstruction of expectations, which can be considered counterfactual. With respect to Distin’s concern, he admits that Luhmann’s very abstract concept of symbolically generalized codes may be a reason for misnomers. Leydesdorff refines his elaborations to solve this problem of understanding.

The final paper, written by Manfred Füllsack, deals with the modeling of communication and interaction of self-referentially closed systems. The author shows how communication can emerge between agents as a byproduct of their own internal processes of selection together with interactions with the environment and with other agents as a stigmergy. He argues that computer models of this sort may give support to considering Luhmann’s constructivist conception of communication scientifically more reasonable than competing theories that draw on an irreducible quality of consensual communication.
The OPC of Loet Leydesdorff casts doubts on Füllsack’s claim. He wonders “Is Communication Emerging or Sui Generis?” and presents a plea for the latter. Also, the commentary of Thomas Kron and Pascal Berger is rather critical of the premises of Füllsack’s simulation model. They claim that his interpretation of the Luhmannian concept of double contingency contradicts the systems theoretical approach in fundamental ways. For them, Füllsack does not simulate a systems theoretical approach to double contingency but rather the reduction of the social to the individual psyches.

In his response to his critics, Füllsack aligns the “emergent or sui generis” question to the philosophical debate about emergence and downward causation. He remains convinced that with the help of digital computers it has become possible to show how unexpected macro-level properties can emerge from the interaction of lower-level components that do not show these properties. In the sense of Luhmann, such explanations oppose subject-philosophical explanations of communication.

Conclusion

Collecting and reviewing the articles and commentaries, we noticed a remarkable variety of suggestions to (a) embed Luhmann’s theory of social systems into constructivist epistemology (Scholl and Buchinger), (b) refine and complement it (Alrøe & Noe, Leydesdorff, and Palmaru), (c) use it for empirical research (Füllsack), or (d) criticize it for transferring key concepts borrowed from constructivism (some of the open peer commentaries to the articles). However, debating these suggestions (cf. open commentaries and responses) more often resulted in controversy rather than in consent. So was this variety of mutually opposing opinions able to shed light on the four starting questions?

In our opinion, Question 1 – the epistemological relationship between Luhmann and RC – remains a point of dispute. In particular, in those contributions in which RC is considered in a rather narrow sense, the differences between Luhmann and RC are emphasized. However, considering the broader context of philosophical heritage helps to clarify and evaluate the epistemological commonalities and differences. In addition to these theoretical aspects, the far-reaching practical consequences of the epistemological foundation for empirical research have only been addressed implicitly in the contributions but are certainly worth being pursued more intensively.

For Question 2 – Luhmann’s constructivist understanding of science – the contributions offer little evidence that could help to answer it. The exception was Müller’s OPC, in which he emphasized the role of Luhmann as “question generator” who can provide new impulses for a variety of disciplines that are also at the center of interest for constructivists.

Question 3 – Luhmann’s borrowing of constructivist concepts – was addressed in various contributions that explored the history of and differences between Luhmann and various proponents of (radical) constructivism or related theoretical approaches. Key concepts were used to show how far Luhmann worked constructivistically or, at least, agreed with constructivism. The suggestions for answering this question provoked major controversy reflecting the perspective of the authors and commentators. For scholars closely following Luhmann, the question is not whether the key concepts in Luhmann’s theory have been correctly transferred but whether the theoretical architecture is consistent. Constructivist scholars are concerned about Luhmann’s usage of constructivist key concepts because they are afraid that the strength of constructivist theory may be weakened. The question of whether Luhmann only vaguely and metaphorically refers to constructivist theoretical efforts and whether this concern is relevant at all remains undecided and probably must remain so because it depends on the very understanding of scientific theory-building in principle. Maybe this meta-interpretation of the authors’ and commentators’ ambitions at least hints at the way question 2 could be answered, although the contributors to this issue did not address it explicitly.

Finally, Question 4 has been answered in both directions: what (radical) constructivism can learn from Luhmann and how Luhmann’s theory can be extended or refined by constructivism. In their respective articles, Alrøe & Noe examine the concept of “environment,” Palmaru discusses the concept of “meaning,” Leydesdorff operationalizes the concepts of autopoiesis and structural coupling, and Füllsack implements computer simulations of Luhmannian concepts. Again, these suggestions have been the object of debates as to whether mutual applications (of Luhmann’s concepts for constructivist theory building and vice versa) are justified in terms of internal consistency or not. Such controversies show that it is worth relating Luhmann’s theory of social systems to constructivist approaches, although the right way to accomplish mutual applications has not yet been found. Perhaps building a consensus between both theories is not even possible because the concerns about abandoning internal consistency and argumentative strength prevail over the necessity for inter-theoretical development.

Our special issue on Luhmann’s relation to and relevance for constructivist approaches voices the contributors’ wish to explore the venture of theoretical bridge building. Although Luhmann’s theory of social systems appears to be a very complete endeavor, it is ambitious enough not only to conserve the achievements of the theory but also to develop it further to keep it flexible for solutions to new problems. In his obituary for Niklas Luhmann, Bernd Hornung (1999) wrote of the theoretical sociologist, who died the year before, that “beyond being a great theorist, he was a great person.” In the light of the contributions to this special issue, we believe the final answer to the question of whether he was a great constructivist too is still pending. However, this is not something to be concerned about as it is an incentive to further research and scholarly discussion, for which the present issue has laid the foundations.

References


Between Realism and Constructivism?  
Luhmann’s Ambivalent Epistemological Standpoint

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> Problem • Is Niklas Luhmann’s theory of social systems based on a constructivist or on a realist epistemology? Luhmann’s own elaborations seem to oscillate between both standpoints. > Method • The argumentation provided in this article starts with a detailed reconstruction of Luhmann’s epistemology and of Luhmann’s criticism towards radical constructivism and then examines the consequences for a comparison of systems theory and (radical) constructivism. > Results • Although Luhmann’s operative constructivism can be distinguished from radical constructivism, the differences are not considered fundamental. Luhmann’s epistemology is clearly nearer to constructivism than to realism and it shares most of constructivism’s key concepts, such as self-referential logic, a strict relation between observer and observed, and the relativism of reality construction. > Implications • Luhmann’s criticism of radical constructivism must be understood in the context of his sociological background. Most of his arguments against radical constructivism can be considered apprehensions of misleading interpretations of radical constructivism rather than of substantial criticism. They may help to clarify a radical constructivist epistemology. > Constructivist content • The paper attempts to check whether Luhmann’s theory of social theory is based on (radical) constructivist epistemology. > Key words • Systems theory, epistemology, radical constructivism, social systems.

1. Introduction

At the beginning of the 1980s Niklas Luhmann rebuilt his theory of social systems, going from a strictly functionalist theory towards an autopoietic theory. When the early Luhmann largely reorganized Talcott Parsons’ system theory from structural functionalism into functional equivalency, he did not address epistemological questions but rather questions about the relationship between functions (of social systems), which are rather stable over time, and structures (of social systems), which vary according to historic development or evolutionary differentiation. As different structures may fulfill certain societal functions, Luhmann avoided the structural conservatism Parsons was accused of.

When Luhmann turned towards the autopoietic shift of his theory, which was fully developed in his magnum opus Social Systems (1984, only translated into English more than ten years later in 1995), he borrowed many theoretical tools and concepts from radical constructivism, second-order cybernetics or from Gregory Bateson’s logic of distinction and from George Spencer Brown’s new algebra of distinction. Not only did this new theory of social systems show similarities to self-referential calculus (sensu Francisco Varela) or cybernetic logic (sensu Heinz von Foerster), but it also imported and applied the concepts of (biological) autopoiesis, autonomy, and self-organization (sensu Humberto Maturana). As a consequence, Luhmann’s sociological theory had to deal with epistemological and philosophical questions and problems deriving from the tools of cybernetics and observation theory. One should think that Luhmann incorporated radical constructivist epistemology, too, because radical constructivist discourse enabled Luhmann’s autopoietic turn in the first place. However, there are some statements within his outline of a new type of theory that do not support the impression that Luhmann examined all the possible consequences resulting from his autopoietic turn.

The following considerations assume that there are systems. Thus they do not begin with epistemological doubt. They also do not advocate a ‘purely analytical relevance’ for systems theory… Thus the concept of system refers to something that is in reality a system and thereby incurs the responsibility of testing its statements against reality. (Luhmann 1995: 12)

Furthermore, Luhmann criticized radical constructivism as a rhetorical fashion (Luhmann 1988a: 7). Has Luhmann ultimately not been consistent or even not been serious enough when rebuilding his theory towards an autopoietic systems theory?

The following article addresses Luhmann’s relationship with radical constructivism by reconstructing his argumentation on radical constructivism. I will try to find out whether Luhmann rejects the radical constructivist epistemology in total or is only skeptical about some very specific details of this epistemology. In particular, I will reconstruct Luhmann’s objections towards radical constructivism and his somewhat problematic reception of radical constructivism. The main aim is to neutralize and to eliminate the major differences without ignoring the minor inconsistencies. I will concentrate on epistemological questions only and leave aside moral implications or the idea of “man” behind Luhmann’s theory of social systems and radical constructivism.

This article is not the first attempt to clarify Luhmann’s epistemological standpoint in comparison to radical constructivism. Sociologist Armin Nassehi (1992: 43), a follower of Luhmann’s theory of social systems, already felt confused by Luhmann’s
programmatic and introductory statement quoted above. Nassihi’s approach was then to reconstruct radical constructivists’ criticism of Luhmann’s alleged essentialism and to check whether this criticism was justified or not. Unlike Nassihi, I will try to check the inherent consistency of Luhmann’s epistemology. For this purpose, the precise arguments of Nassihi are still very helpful.

Another attempt to reconstruct Luhmann’s epistemological standpoint was made by organization and management researcher Jac Chris tis. He locates Luhmann between metaphysical or dogmatic realism and skeptical idealism, relativism or solipsism (Chris tis 2001: 239). He consequently follows the criticism Luhmann passes on radical constructivism of being an excessive kind of idealism instead of expounding the problem of this position, and himself holds a position of what he calls grammatical realism (sensu Ludwig Wittgenstein). I have therefore chosen another way of argumentation, starting from radical constructivist epistemology and checking the accordance and discrepancy of Luhmann’s position with it.

However, I do not reconstruct the epistemological approach proposed by leading radical constructivists in order to contrast them to Luhmann’s epistemological efforts because I assume the readers of Constructivist Foundations are acquainted with radical constructivism. Additionally, I do not emphasize the differences between several radical constructivists (as does Proulx 2008). Rather, I will argue for and from a standpoint that I assume to be a common denominator among radical constructivists, although not all of them call themselves radical constructivists.

2. Luhmann’s epistemological standpoint

2.1 “Operative constructivism”

Luhmann does not hesitate to accept a constructivist foundation of epistemology (Luhmann 1988a: 9) and he largely adopts Maturana’s biological epistemology (Luhmann 1990a: 28ff, 131ff).

However, for “methodological” reasons Luhmann prefers to start with naive realism in order to reflect this starting point rather than to start with (radical) subjectivism, which he accuses of being naive in the same way as realism is (Luhmann 1988a: 53, footnote 9). I will address the criticism Luhmann makes of radical constructivism later on.

As Luhmann regards his very abstract theory to be empirically based and as empirical research is based most often on realistic epistemology, a realistic starting point seems to be more suitable than an idealistic or a skeptical epistemology. However, the following argumentation on epistemological problems, outlined by Luhmann, is constructivist in essence: environment only “exists” from the perspective of a system. And even systems do not exist in an ontological sense but only in a cognitive sense. “The difference between system and environment is itself an operation-guiding cognition” (Luhmann 1988a: 16, my translation). Moreover, systems “constitute and maintain themselves by creating and maintaining a difference from their environment, and they use their boundaries to regulate this difference.” (Luhmann 1995: 17) Apparently, there are two logical implications that opponents of constructivism impute to constructivists but that Luhmann strictly rejects:

1 | The environment does not exist.
2 | There is nothing except the observing system.
3 | There is no difference between first-order observation and second-order observation (and probably third-order observation, which enables one to distinguish between first-order and second-order observation).
4 | The difference between what is actually observed by an observer (manifest observations) and what cannot be observed by the same observer (latent observations and blind spots),
5 | The difference between the binary form of true and not true and of other forms of self-observation and the observation of others (Luhmann 1988a: 23).

Considering these differences, a psychological epistemology strictly should be distinguished from a sociological epistemology, as is intended by sociologist Luhmann (1988a: 24). His major concern here is to separate mental systems, memory, thoughts, etc. clearly from social systems, interactions, communications etc. Hence, he tries to avoid understanding concepts that are commonly used in the field of psychology, such as cognition, observation, etc., in a psychological sense by using them in a more abstract sense so that he can apply them to sociological categories as well (Luhmann 1990a: 522, Luhmann 1990b: 50). Luhmann’s macro-analytical and sociological approach may be considered one of the most striking differences with a more cognitive oriented constructivism, which indirectly affects the epistemological debate, too. I will address this sociological
2.2 Medium and form

There is another distinction Luhmann introduces to his theory, following psychologist Fritz Heider (2005): the distinction between medium and form, which can help solve epistemological problems. Reality can be conceived of as a medium, which can and will be formed by an observer or an observing system. Luhmann develops a hierarchical concept of the relationship between medium and form: cognition is not possible within an entirely arbitrary environment ("reality") but only within a suitable environment. However, it is up to the observer to make this environment suitable or to observe that the environment is suited to the observer's cognitions (Luhmann 1988a: 38ff). The premise of a given environment is only necessary for a specific difference between system and environment. There is no need to assume that there is an environment existing for itself or in itself (which can be labeled with the expression "world"). The environment only "exists" in relation to the system, which distinguishes itself from this (= its) environment. This system-related environment provides a medium for the system, which forms its environment by drawing distinctions with the help of the system's own operations. Reality as a whole or as itself remains unknown but it cannot be entirely entropic, unless it is conceived of as a medium of cognition. This seems to support a realistic view. However, even if reality had its own structure, as realists believe, it would be the system's own operations that would draw distinctions to fix real objects. It is a system's character to close itself with respect to its operations and not to represent or adopt an external reality – otherwise we would not observe it as a system (Luhmann 1988a: 41). This argument in turn supports a constructivist view.

Thus, reality is not conceived of as a world outside or of the object itself. Nor is it the recognizing subject. Both concepts only characterize half of the phenomenon or problem. According to Luhmann, reality is the difference between system and environment, hence environment as it differs from the system and system as it differs from its environment... The notion of reality in the context of systems theory indicates... the correlate of an observation of observation that makes use of the distinction between system and environment.\(^\text{(16)}\) (Luhmann 1990a: 318)

Following Luhmann's course of argumentation, he seems to hold an undetermined or oscillating position between constructivism and realism: as soon as he introduces a realist assumption, such as that the environment of a system cannot be arbitrarily structured and that it has discontinuities of its own, which are a necessary base for the system's operations at all, he retracts or withdraws this position by strictly relating the "real" environment to the system's observations. This argumentative technique reminds us the cybernetic loop (sensu von Foerster or Glanville), the concept of structural coupling between system and environment (sensu Maturana), the logic of re-entry (sensu Spencer Brown) or even the non-dualizing concept of the difference between object and (its) description (sensu Mitterer).

2.3 "Weak" ontology?

At this point we should not prematurely settle for the solution found so far. Although Luhmann's position cannot be definitely classified as constructivist or realist, we should search for some more hints that help to clarify this ambiguity.

Luhmann justifies his weak ontology or realism with the following argument:

Every unit functions as a unit by and for an observer. Even operations are units only for an observer, although indeed in a paradoxical manner such that the observer has to treat it as a condition that is independent from the observer because otherwise neither the observer himself nor his own operations can be subsumed under this concept.\(^\text{(19)}\) (Luhmann 1990a: 62)

It is the observer who assumes this pre-existing condition but it is a necessary assumption for observation at all. This pattern of argumentation sounds like a tribute to Immanuel Kant's transcendental ontology. Actually, Nassehi assists when he characterizes the non-distinctive concepts of "world,""reality," and "meaning" as "the [necessary] condition of the possibility to observe social and psychic processes as meaning-processing (Sinn verarbeitende) real systems within the world" (Nassehi 1992: 65, my translation). Luhmann seems to need such circular or even tautological statements within his theoretical building because they are inevitable and emerge automatically. "This relative absoluteness is an imperative of thinking, or better: an imperative of communication in order to describe social systems" (Nassehi 1992: 66, my translation). However, Nassehi's crucial argument to defend Luhmann against the criticism of falling back to traditional metaphysical philosophy is the following: Luhmann's "ontology" can be distinguished from metaphysical ontology, which claims that there is the a-priori transcendental condition of the possibility of existence (being), as it can be characterized as the a-posteriori empirical condition of the possibility of systems' existence. The existence of a system or its elements and their relations is not given before the system's operations start but it emerges during the process of the system's operations. As the system's elements permanently dissipate, the system's existence can only be observed after or traced back to the system's operations completed so far. Furthermore, the observation of the system's existence is not transcendently predetermined but emerges empirically with every new operation following other operations (Nassehi 1992: 67).
What Luhmann calls “ontology” is obviously not the same concept of a universal and metaphysical ontology that is legitimately criticized by radical constructivists. Rather, it is a byproduct produced and used by social systems to stabilize their operations and for reasons of self-determination. It is a system’s first-order observation, a monovalent meaning of reality, which does not reflect its negative counterpart but which is as it is. As soon as a second-order observation enters into the communication it is no longer a non-distinguished concept but it is related to an observer or an observation and loses its traditional ontological status. As radical constructivism relies on the logic of second-order-cybernetics, Luhmann credits constructivism for being able to reflect knowledge and reflection as (strictly) related to an observer or an observation and loses its traditional ontological status. Thus, the real performance of the operation of distinguishing and indicating produces a form, namely what actually happens in contrast to what does not happen... If this operation continues recursively, a system boundary emerges, which delimits what will be observed within the system." (Luhmann 1990a: 82, my translation)

Luhmann’s level of the operation, every observation is naive as it is non-critical with respect to its own reference (cf. Luhmann 1990a: 83).

3. Luhmann’s criticism of radical constructivism

As I mentioned above, Luhmann’s perspective is sociological and macro-analytical. This is why he argues strictly against any kind of subjectivism, solipsism or idealism. Although this sociological macro-analytical perspective seems to be responsible for the most relevant discrepancies between Luhmann’s theory of social systems and radical constructivists’ systemic approach, it affects Luhmann’s epistemological criticism of constructivism only indirectly. However, it seems to be the driving force for his criticism and should therefore be included in the following reconstruction of his arguments.

1. Against subjectivism

If the arguments so far can be accepted, Luhmann is in line with radical constructivist epistemology to a large extent. He even defends constructivism against popular counter arguments, such as the evidence that actually technology operates successfully. Luhmann replies to this argument the same way constructivists would: it is the system that checks whether its self-constructed expectations are fulfilled or not. Technology is a social artifact for observing objects that are constructed by observing them technologically (Luhmann 1990b: 34).

Why then is Luhmann skeptical about radical constructivist arguments?

Constructivist theories are put on the wrong track right from the start if they perceive themselves as radicalized idealistic, semiotic or subjectivist epistemologies. Such a radicalization is not possible without discounting the other side of a distinction (such as the distinctions between concept and reality, signifier and signified, subject and object) or by keeping the (self-constructed) idea or the sign (without reference) or the (self-reflecting) subject only. Each distinction collapses if one (or the other) side is left out. Without drawing a distinction, which implies a difference between its both sides, one cannot indicate an object anyway. (Luhmann 1994: 7, my translation)

What does "which implies a difference between its both sides" mean? Do both sides have to exist in a realistic perspective or does it only mean that an observer can imagine both sides? In accordance with the position I reconstructed in the previous paragraph, I prefer the second interpretation.

Luhmann does not argue against radical constructivism straightforwardly but in the form of conditional clauses, e.g., “In any case access to constructivism is obstructed if one assumes the old controversy of whether the knowing system is a subject or an object.” (Luhmann 1990b: 34, my translation). Thus Luhmann does not reproach constructivism for subjectivism, rather he advises constructivism against subjectivism. He appreciates the neurophysiological empirical research of Maturana, which is helpful for refreshing philosophical epistemology. As radical constructivists have started their epistemological arguments on the basis of empirical neurophysiological, psychological or linguistic research, they are indeed not anti-realistic, because their epistemological conclusions rely on their empirical research. Obviously, they are not skeptical with respect to these empirical results (Luhmann 1990b: 32).

Luhmann mainly criticizes certain expressions, such as “the subjective foundation of knowledge,” which may prompt misunderstandings. Unfortunately, he is not very exact in quoting specific refer-
ences but he obviously refers to Siegfried J. Schmidt’s book Diskurs des Radikalen Konstruktivismus, published in 1987. It is this one-sided subjectivism that exaggerates the de-ontologization of reality by denying the existence of reality at all. Luhmann’s counterargument sounds like this:

44 If a knowing system cannot get access to its outer world, we may deny the existence of this outer world; but just as well and even more plausibly, we may hold the position that the outer world is as it is. Both variants are unprovable. One cannot decide in favor of one of them. However, it is not the outer world that becomes questionable but only the even distinction between existence and inexistence, as is used by philosophical ontology. (Luhmann 1990b: 36, my translation)

31 In his book on the science of society, Luhmann approves of (radical) constructivism by using exactly the same argument: "The world is as it is. (Insofar) constructivism is right. However, constructivism can only justify itself via negation" (Luhmann 1990a: 527, my translation). Obviously, Luhmann and radical constructivism share the position of epistemological agnosticism.

32 Beyond this rather philosophical argument, Luhmann criticizes any kind of subjectivism from his sociological standpoint. He does not conceive of an observer as a subject. On the macro-level of society, communication is the basic element or unit of analysis. Observing systems consist of communications only. As a consequence, individuals, subjects or agents are not part of a social system but of a social system’s environment (cf. Luhmann 1995: 138, 177ff). This is why Luhmann may accept the epistemological consequences of (radical) constructivism even though he does not share the scientific approach of radical constructivists, which is individual cognition. Hence it is not possible to compare Luhmann’s theory of social systems with von Glasersfeld’s, Maturana’s or von Foerster’s approaches to social phenomena. In order to provide a fruitful comparison, it is necessary to abstract from the empirical level of observation (individual vs. social) to a general theory of observation, which is inherent in both Luhmann’s theory of social systems and radical constructivist epistemology.

3.2 Against solipsism

33 Furthermore, Luhmann worries that the metaphor of the system’s “blind operation” suggests that the system has no contact with its environment at all. This would be a false conclusion as we can only conclude from the system’s autonomous operations that the system has no cognitive access to the world (outside). Knowing is neither copying, nor reproducing nor representing the outside world (Luhmann 1990b: 38f). Referring to the reality of the outside world is made possible by the blind spot of the operation “knowledge”: “reality is what cannot be recognized (observed) when we recognize it.” (ibid: 47, my translation) The question arises of whether Luhmann’s argument itself includes a too far reaching conclusion. If the outside world is as it is, no observer can know whether his construction of the world represents it, distorts it or what kind of construction it is at all.

34 Luhmann also criticizes the radical constructivist distinction between irritation (or perturbation) from the outside (environment) of the system and self-determination on the inside of the system for only duplicating the difference between the inside and the outside of a system. Rather, the epistemological problem of subjective consciousness should be replaced with the recursivity of observing and knowing. Recursive processes permanently check the consistency and viability of the system’s observations to be able to continue further system-related operations. This criticism is very selective or even one-sided as Luhmann’s argument is entirely compatible with radical constructivism, which he indirectly admits when referring to and following von Foerster (Luhmann 1990b: 42). Again, it is not the constructivist argument itself that is questioned by Luhmann but an isolated formulation that can be misunderstood.

35 As can be observed with respect to subjectivism, Luhmann’s sociologism ensures that he avoids the problem of solipsism. Starting from a social perspective and from communication as the basic element of observation rather than starting with individuals or subjects or agents (cf. Luhmann 1995: 137ff) is the best way of defending his systems theory from the problem of solipsism that ontologizes the individual observer. However, I consider the macro-analytical, social, communication-based perspective a sufficient but not necessary argument against solipsism. The problem of solipsism can be solved by radical constructivists, too, who place the individual observer at the center of their argument, because and if they are epistemologically agnostic: as soon as the observer, be it an individual or a system, is not considered ontologically existing, there is no danger of solipsism or re-ontologization.

3.3 Epistemological agnosticism

36 Finally, I want to address Luhmann’s objection to the criterion of viability. He criticizes constructivist statements such as “reality is a construction that does not rely on a correspondence with the world outside” as imprecise and uninformative. Construction of reality is not the opposite of representation of the reality or correspondence with the reality (Luhmann 1990a: 518). The constructivist criterion of viability (as a substitute for the criterion of correspondence) leaves the question open of in what aspect is correspondence to the world outside impossible (ibid: 522). Of course both Luhmann and radical constructivists share the agnostic view that the world outside is as it is and that there is no contingency outside the system. But even this statement can only be used within a system or by an observer. That is why knowledge and reality do not correspond. The only thing that “exists” is the proof of cognition itself caused by the recursive formation of invariants; but this, too, is a construction of the system (ibid: 526f). Unfortunately, Luhmann again does not quote any specific author or statement but only speaks of “common formulations” (ibid: 518). Maybe Luhmann constructs a discrepancy between radical constructivist and his own epistemological standpoint. But this seems to vanish if one looks carefully at the argumentation provided by Ernst von Glasersfeld (1981; 1984). Since it would deviate too much from my line of argumentation, I cannot go into detail on whether Luhmann is right or wrong in his criticism of the concept of viability. However, this criticism should rather be used in a constructive manner than be understood as fundamental.

37 As a sociologist, Luhmann also observes the social factors enabling the emergence of (radical) constructivism in contemporary scientific discourses. From
this perspective he characterizes modern science with the help of relativism, conventionalism, and constructivism, which can be condensed to the loss of reference (to a world outside). His goal is to reintegrate epistemological theories of reflection into empirical research (“normal science”) in order to cope with the paradox that the philosophy of science observes the operations of science from an external viewpoint but within scientific argumentation (Luhmann 1990a: 715).

Hence, in the controversy between constructivism and realism, they cannot be regarded as incompatible positions or points of view (Luhmann 1990a: 706).

In sum, Luhmann (1990b: 47f) advises (radical) constructivism against the danger of taking the position of anti-realism, skepticism or idealism, which is simply the opposite of realism. Hence, he strictly tries to avoid reconstructing epistemology in such a way that idealism is a suitable possible ancestor of constructivism. He looks for a middle ground between solipsism and representationalism (Luhmann 1990a: 517).

De-ontologization does not work if epistemology only changes its position from one side (objectivism, realism) to the other side (subjectivism, idealism), because this shift of position would only ontologize the other side (subject, observer). Constructivism, be it operative or radical, should not be located at the same epistemological level as realism. Rather, it should discard this distinction and should incorporate realism by constructing another distinction, namely that of first-order realism (observation) and second-order observation. The distinction between different levels of observation itself is what constitutes constructivism.

4. Consequences for a constructivist foundation of systems theory

4.1 Same expressions — different contexts

The strategy of my argumentation was not to compare radical constructivists’ arguments with Luhmann’s arguments on epistemological questions or to oppose their epistemological standpoints but to find out whether both positions can or should be regarded as contrary at all. The clue of my argumentation is to interpret the use of common expressions or words, such as “reality,” not literally and in a way that is disconnected from their broader context, but within the context of the entire argumentation and approach. When constructivists use the word or expression “reality,” they are obviously referring to an ontological catch-all concept, which they refuse to accept as an epistemological base. Luhmann does not use “reality” in the same way. Quite the contrary, “reality” has no ontological implications within the context of his argumentation. Hence, Luhmann’s statement that the system’s contact with the environment is real does not meet a realist’s view on reality. I tried to show that and how both epistemologies converge by disentangling the confusion caused by different usage of the same words or expressions. Embedding words, expressions or notions in a meaningful context rather than disconnecting them from the context of argumentation should have shown that some or even most of the epistemological dissent between radical constructivism and the theory of social systems can be transformed into matching or even agreeing positions. The motivation of such an interpretative effort is to clarify the epistemological argumentation and to avoid “false” or irrelevant controversies. If this manoeuvre is considered successful, Luhmann’s theory of social systems should be clearly incorporated into constructivist approaches. The same strategy of argumentation can be used to avoid “false” controversies between (radical) constructivism and Josef Mitterer’s non-dualizing philosophy (Scholl 2008). All three, Luhmann’s systems theory, Mitterer’s non-dualizing philosophy, and radical constructivism, have more commonalities than they actually claim to have, and both Luhmann and Mitterer hold positions clearly in opposition to epistemological realism. Thus, the discrepancies left should not be overvalued as major incommensurateness or even contradictions, because the more fundamental epistemological controversies can be observed between (radical) constructivism and realism.

If I interpret Luhmann’s “realism” within a constructivist framework or at least as matching constructivism, this argumentative strategy should also work the other way round: Luhmann’s concern about radical constructivists’ hidden subjectivism, which Luhmann himself strictly tries to avoid in his theory by criticizing this subjectivism for being a classical fallacy, is no longer justified if constructivists’ use of the expression “subject” does not match the philosophy of idealism. Rather, it is an individual’s cognitive system. Thus, as well as Luhmann’s theory of social systems being necessarily based on a constructivist epistemology, radical constructivist epistemology necessarily should be understood within system theoretical logic (which by the way – and obviously – need not match Luhmann’s version of systems theory).

4.2 Avoiding negative ontology

Even so, we should not jump to this conclusion without trying to explain the differences detected. The reasons why Luhmann somewhat fluctuates or oscillates between constructivism and realism seems to be his scientific background. Luhmann’s concern is strictly sociological. Hence, he does not address epistemological questions from a directly philosophical perspective. Rather, he treats them radically in a sociological way. Therefore he advises against a negative ontology that merely denies reality (as opposed to ontologists, who account for reality). In Luhmann’s view, a constructivist perspective comes no closer to truth or reality (in an empirical sense) than a realist perspective does. Some radical constructivists actually justify their explanations of natural phenomena with empirical data gained from scientific experiments. This position is supposed to lead to a paradox argumentation, as constructivism is justified by its opposite, which is realism. However, we should not criticize this argumentation hastily. Rather, it is worth respecting the empirical results of Maturana’s or other scientific experiments as valuable hints (not proofs) for establishing a radical constructivist epistemology.

There is another “ontological” problem of radical constructivism: as realists assume that knowledge gained from the object is independent of the observer (although there is always some subjectivity in this process of course), constructivists probably ontologize the observer, as there has to be someone who generates knowledge.
Luhmann’s course of argumentation can be characterized by strictly avoiding such subject–object philosophy and by replacing the binary code of subject and object (of knowledge) with the binary code of system and environment. Of course, his minimal ontology then has to assume that there are systems (and any environment). The advantage of a systemic “ontology” compared to a subjectivist ontology is that the system has to construct itself and cannot be regarded as a given unity or object. A system theoretical approach allows the researcher to leave the option open as to which “object” is observed by which observer. The observer need not be a human being, a subject, an individual, etc. but can be any system that becomes a system by distinguishing itself from its environment. The system–environment schema is thus more abstract than a subjective-objective schema, which is too demanding and incorporates realism (by distinguishing between first-order and second-order observation). Unlike Mitterer, Luhmann includes first-order and second-order observation as oscillating forms of observations. This is why the impression emerges that Luhmann oscillates between realism and constructivism too. But contaminating observation with the virus of constructivist philosophy in the first place at all is already constructivism itself. We should not imagine constructivism and realism as opposite elements of the same (epistemological) form or as two epistemologies at eye level. Rather, radical constructivism both follows and has developed its own logic, which is different to the logic of realism and which includes and incorporates realism (by distinguishing between first-order and second-order observation). Realism is strictly connected to classical or modal logic, unlike (radical) constructivism, which operates with self-referential calculus and reflexive logic and which accepts that paradoxes occur within scientific (and everyday) knowledge.

4.3 Major consistencies – minor discrepancies

Although there are discrepancies between radical constructivist and social system theoretical positions, the pragmatic consequences seem to converge, especially when opposed to a strictly realist understanding of scientific knowledge. Constructivist and system theoretical research show preferences for ambiguity of knowledge over objective knowledge, non-linear process of scientific knowledge over approximation to reality, self-referential scientific obtaining of knowledge over correspondence with reality, solving of problems that are socially (contingently) constructed within society over solving problems that are subjectively (arbitrarily) chosen or objectively given (determined), etc. What social system theory and radical constructivism have in common, too, is the strictly relationist/relativist – i.e., observer-related – understanding of any knowledge (which of course includes scientific knowledge, too). There is no escape from the observer or from the observing system when obtaining knowledge. There is no such thing as knowledge without or independent from observation. Without observation (or cognition) there “is” no reality but whatever can or will be observed is “real” because or insofar as it has been observed. Observers cannot observe nothing, unless we use a negative ontology – but that again holds an ontological position. Considering observation as a real operation is itself an observational construction but one that is based on a (“real”) operation that only becomes real as an observed operation and so forth. The criteria for whether the observed reality is accepted as true or real reality (rather than as illusion or deception) depend on the observers themselves (as a community, as a system or whatever status the observer may hold). Reality, truth, and objectivity are thus problems of communication – and this is why social systems “exist” or emerge to solve them.

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http://www.univie.ac.at/constructivism/journal/8/1/005.scholl
5. Conclusion

All in all, I do not think that the argumentations between Luhmann and radical constructivism or between Mitterer and radical constructivism are mere mock attacks. Consequently, the convergent reconstruction of (radical) constructivism and systems theory does not aim to get rid of unpleasant differences between both approaches. Rather, the differences can be used to clear the standpoints of inherent inconsistencies, to strengthen their arguments, and to promote their continuous theoretical development (and hopefully improvement). Reading, e.g., Schmidt’s (2011) latest philosophical proposal to rewrite radical constructivism, the main criticism of constructivism made by Luhmann should have become clear. The remaining discrepancies I regard as fruitful pluralism within constructivist discourse.

Ernst von Glasersfeld (1993) once responded in a very elegant way to criticism of radical constructivism with the words “not converted but refined.” This should probably become a viable way for radical constructivists to cope with friendly criticism, as is made by Luhmann. Of course, not every criticism can or should be embraced in the way that I did in my argumentation – a harsh conflict will do better in some situations.
someone or at least some idea of consciousness involved, even if we think of social systems as being based on communication rather than on individuals. In this perspective, the quest for differences and similarities in the argumentation between (radical) constructivism and Luhmann’s understanding is reasonable and surely will promote the discourse of constructivism.

« 3 » But what about the first category of autopoietic and self-referential systems: living systems? Thinking of animals, the understanding of observation for psychic systems might be transferred and we might quite easily imagine an understanding of what this could mean (pet owners would probably deny any differences anyway). But Luhmann gives some examples, such as the following, to illustrate the difference between “observation” and “understanding” (this difference is of no further interest for us, but the example itself is of relevance):

« 4 » Going forward from this point, a further argument can be drawn (cf. Egner 2008: 62): living systems, such as the chemical, biological or physical systems of our body, can not only distinguish but can also describe and thus learn. This occurs, for instance, when the physical defense reaction against high-strength spirits (the hangover) gradually diminishes through regular use or when the efficacy of pharmaceuticals declines over time.

« 5 » How can an example like this be understood in terms of realism or constructivism? I, at least, cannot decide on this. I rather assume that we simply do not have an appropriate theory of observation available to include such phenomena. Surprisingly, this finding coincides with the considerations within quantum physics, a branch in physics that is also in need of an appropriate theory of observation to explain the paradoxical phenomena of their experiments. There, the materialization of quantum objects depends on whether they are observed and how they are observed, i.e., with what “theory” or “expectation” the result of the materialization is interpreted (in the case of light, for instance, whether it is considered as a “wave” or “particle”).

« 6 » Although these striking contributions were already made in the early 20th century in physics, their disturbing consequences and their irritations for our traditional epistemologies and the philosophy of science, for instance, are not yet well developed. The quantum physics experiments support neither realist nor (radical) constructivist positions (cf. Egner 2012) since they seem to be “new kind” of phenomena that violate our intuition and traditional understanding deeply. In this, they equal the stomach example above. So far, the experiments in quantum physics only show the central role of observation and the exposed position of the observer while the explanations for the paradox emergences are still open. Most recently, quantum physicists are in search of a theory of measuring and observation, mainly to reject the Copenhagen Interpretation of the experiments mentioned above (cf. Gell-Mann 1995: 212ff.; Schlosshauer 2007: 329ff.). They quite easily provoke the radical conclusion that the materialization of the world is a result of our observation and, thus, the world is a product of consciousness (cf. Schrödinger 1959, Zeilinger 1996).

« 7 » Furthermore, there is now evidence that the laws of quantum physics not only apply to the micro level but also to phenomena in the macro world (cf. Amsmann et al. 2009, Aspelmeyer 2010, Aerts et al. 2011 and Walther et al. 2006). Thus, the development of an appropriate theory of observation is required even more.

« 8 » Within physics, some researchers even assume that the concept of observation is not only applicable to autopoietic and self-referential systems, but indeed to all “complex adapting systems”: in short, most of the world. It is due to these systems that the world seems (or proves) to be solid even if there is no (human) observer to hold it stable and in its place by observation. Thus, Murray Gell-Mann and Jim Hartle see these systems as “actors” that can observe. They call them “Information Gathering and Utilizing Systems” (Gell-Mann 1995:155f., Gell-Mann & Hartle 2012). However, there is no consciousness whatsoever involved and this seems to me to be a crucial point in the argumentation of (radical) constructivism. Are there any concepts of constructivism without consciousness? As far as I know, no. Luhmann tried to expand the concept of observation to all autopoietic and self-referential systems, resulting in the discrepancies with (radical) constructivism Scholl so thoroughly describes.

« 9 » Scholl states that the notion of epistemological agnosticism (§30, 31), condensed in the quote “the world is as it is,” is a common ground for (radical) constructivism and Luhmann’s approach. Moreover, he states “there is no escape from the observer or from the observing system when obtaining knowledge” (§44). With this, I guess, quantum physicists would also agree. Taking this as common ground might be a good starting point for the further development of a theory of observation. For now, all we can state seems to be that “the world is as it is and the observer observes what she/he observes.” There is lot to be done to gain a deeper understanding of the “who” and “how” in observational processes.
> Upshot - I argue that the distinction between realism and constructivism is incompatible with Luhmann’s systems theory. An operative theory of (social and psychic) systems has certain ontological implications that cannot be seen from a radical constructivist perspective.

1. Is the distinction between realism and constructivism a practical one? Scholl’s argumentation affirms this distinction when he confronts Luhmann’s theory with radical constructivism. I do not wish to discuss the philosophical background of radical constructivism here. What I wish to emphasize is that what is called “radical constructivism” can only be so radical because it is a theory of subjectivism in terms of a theory of cognition in a rather traditional form. Ernst von Glasersfeld’s accomplishment lies in his radicalization of the Kantian idea of epistemological agnosticism. Strictly speaking, he offers an empirical version of Immanuel Kant’s transcendental philosophy, which at first sight seems to be a contradiction. Kant did not have any empirical perspectives. He was interested in the question about the conditions for the possibility of cognition. One of these conditions was, for Kant, the impossibility of direct contact between consciousness and the object of cognition. So Kant created the modern philosophical figure of a distinction between the world and its awareness. From a sociological point of view, this can be read as a reaction to the social experience of different perspectives on the world.

2. Radical constructivism has radicalized this theory by giving the distinction between cognition and the world an empirical form. (Radical) constructivism theorizes a radical perspective. In that sense, it can be interpreted as an heir to subject philosophy. Reality is then only a cognitive construction. And this implies that all realistic perspectives fall behind the achievements of a post-ontological theory.

3. As Armin Scholl aptly puts it (§2), Niklas Luhmann’s theory of social systems begins with such a relapse when Luhmann asserts that “there are systems.” However, Luhmann does not begin with an ontological definition but with a hypothesis; that is with a construction, a theoretical first sentence, with an asymmetric idea of ontology. Not to begin with an epistemological doubt is far from the naive realism that Scholl asserts (§9). In my reading, this refusal of a radical epistemological doubt indeed has ontological implications. But these implications are located on another level than Scholl supposes.

4. Scholl concludes that Luhmann’s alleged realism is due to his sociological perspective (§25). As a sociologist, he has to avoid any solipsistic or subjectivist perspective. So a little realism can be admitted. While this is a rather abbreviated reconstruction of Scholl’s argumentation, I think that this figure can lead us to the crucial point. The radicalism of radical constructivism stems from its delimitation of the cognitive operations of entities with a central nervous system to avoid speaking of subjects or agents. Such entities can be theorized as radically constructing entities because the world in which entities such as these occur cannot even be doubted. This outer world is no problem for the heirs of Kantian theory.

5. So radical constructivism can reconstruct individual constructions and epistemological forms of awareness. But it is not able to theorize the communication between ego and alter ego. In my reading, the most radical constructivism is Edmund Husserl’s phenomenological philosophy. Husserl has shown how the world can only become reconstructed as a result of a cognitive system that only can operate with its own capacities. His Phänomenologie des inneren Zeitbewussteins shows that the succession of cognitive events in unobservable presents (“Urimpressionen”) emerges in an operatively closed unit. The only contact of this unit with an outer world is self-awareness. By reconstructing Husserl this way, we can see that Husserl anticipated theoretical figures of cybernetics, constructivism, and systems theory in the language of traditional philosophy (cf. Nassehi 2012).

6. Radical constructivism, then, reconstructed in the language of Husserl, repeats Husserl’s grand collapse with the problem of intersubjectivity. The radicalism of radical constructivism is based on this grand collapse. When Scholl argues that Luhmann’s alleged realism stems from his sociological orientation (§25), he is right – but in another way than he suggests. Luhmann has overcome the problem of intersubjectivity by theorizing social systems as operating systems consisting of communications as basic elements. The radicalism of Luhmann is that he theorizes social systems in a similar way to that in which Husserl describes the operations of consciousness. Consciousness emerges by successive occurrences of conscious elements, operatively closed in and on its own operative basis. Psychic elements can only become connected by and with other psychic elements.

7. And the same is true for communication: social systems consist of communication, emerging by the occurrence of communicative elements, operatively closed by their own operative basis. Communicative elements can only become connected by and with other communications from the same system (cf. Luhmann 1995: 137–176).

8. Constructivism now means that the only reality in which different systems, both psychic and social, can operate is the reality that stems from their own operations. This sentence has two implications.

9. The first implication is compatible with what is called “radical constructivism” – with the difference that there now exists a theoretical possibility for solving the problem of intersubjectivity: by avoiding it. Psychic systems become structurally coupled to social systems. And the co-evolution of this special kind of system-environment relations is the basis of the emergence of a constructed reality in time. These construction processes happen on different levels and with different operational conditions – but they are radically bound to their own respective operative basis. This is more radical than radical constructivism because it replaces the distinction of construction and reality with the distinction of different system-environment relations. The Kantian heritage of the world outside is then no longer a radical problem.
The second implication is an ontological implication. I think that the radical refusal of ontological questions is somewhat naïve. Scholl seems to have anticipated this point when he writes about minimal ontology (§42). Traditional ontological distinctions use the difference of being/not-being. Scholl (§20) refers on my 1992 paper. In a comment on this paper, Luhmann argues that my criticism of the ontological implications of his theory might be based on terminological differences because systems theory is not based on this distinction of being/not-being (Luhmann 1992b: 381) – given that, Luhmann is right. But there is another ontological implication. Systems theory, especially Luhmann’s theory of temporalized social systems, is based upon the idea that systems consist of subsequent temporal elements. In a traditional Cartesian way I think we cannot doubt that systems operate when they do what they do. They operate in unobservable presences, which can only become observed afterwards. So the beginning of a system has always begun. This paradoxical figure can be unfolded in terms of time. We can then see that everything a system does is the result of its own operations, which occur somehow invisibly. So the system itself is both constructing and constructed, based on the operations of the system itself. It unfolds its basic paradox in time and by time (cf. Nassehi 2008: 210–231).

This is reminiscent of Jacques Derrida’s criticism of Husserl’s theory of time. Derrida argued that Husserl’s theory has metaphysical elements because the presence of operations cannot become theorized when consciousness is based on occurring presences (cf. Derrida 2010). But what we can learn from Derrida is not how to avoid metaphysical or ontological implications but how to come to terms with this problem. I think that Luhmann’s operative systems theory is able to solve this ontological problem. There are social systems: that means there is something operating. This has nothing to do with being or not being. This is not a metaphysical assumption. It is only an empirical observation, which presupposes observations. So the idea that there is something that operates is the proof of itself – it is important to be aware of this Cartesian meditation.

If we do not accept this paradoxical figure, we have to remain radical constructivists and to theorize about the distinction between constructivism and realism. My question is: What exists between realism and constructivism? My answer: operations. Do they exist? Not really (sic!). They operate.

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Author’s Response: What Constructivism Does not Say
Armin Scholl

> Upshot • Egner’s suggestion that a theory of observation should be developed towards a more abstract concept in order to apply it to any autopoietic system is plausible from the point of a general systems theory. However, this strategy of theorizing is not suited to solving epistemological problems in particular because such a broad concept fails to specify constructivism as a strictly observer-related philosophy. Nassehi’s search for a third way between constructivism and realism, in turn, presumes a too narrow and biased concept of constructivism and is therefore not suited to solving the epistemological problem for which constructivism has been developed.

Can constructivism do without the observer?

In her comment, Heike Egner touches a sore spot in Luhmann’s kind of theory building. Indeed, the abstract concept of observation provided by Luhmann’s theory of social systems seems to conflict with the claim to identify his or any constructivist foundation using a strict observer relation. If we conceive of observation in such an abstract sense that even a stomach can observe its environment, the process of observing and the relationship between an “observer” and an “observed” phenomenon or environment does not say much about epistemological questions that are left to human thinking and communicating (Egner §2). What would be the consequences? Either we would need to drop the strict relationship between the observer and the observed as a necessary and sufficient criterion for defining and characterizing radical constructivism, or we would need to confine the concept of observation to psychic and social systems. The first route might be problematic because the main difference between constructivism and realism is their conception of the observer’s role in gaining (scientific) knowledge. The second route seems to be problematic, too, because epistemology is typical for human beings only; but many animals have a mind and social relationships, too. From a consistent constructivist perspective, we cannot even know whether (some) animals address epistemological questions or not. When Egner refers to pet owners (§3), this is not intended to be an argument for fun! As human beings, we have the experience of inter-species communication. Obviously, any kind of limiting of the concept of observation is somewhat arbitrary. We have the same problem with communication. Communication is not necessarily limited to human social communities or societies. Dirk Baecker, a close follower of Luhmann’s system theory, argues in favor of
a more abstract concept of communication (Baecker 2012: 52). However, the degree of abstraction in a theory of social systems cannot be forced even more to the point where abstractions result in an empty category that is unable to specify and analyze social phenomena.

2 For this reason, I suggest a pragmatic “solution” to the problem of how abstract a theory should be. If we assume that only human psychic systems or human social systems address epistemological questions in human communication (as is the case for this special issue of Constructivist Foundations), then we can exclude any other living systems from the argumentation here. Within this reduced but specifically anthropological perspective, the need to ask and answer epistemological questions results from practical matters, such as the way we conduct empirical research or judge the quality of theories (see also Leydesdorff in this issue).

3 Egner’s concern about an “appropriate theory of observation” results from the intriguing findings of quantum physics. Although these findings “show the central role of observation and the exposed position of the observer” ($\S$6) for experimental research, Egner assumes that they support neither a realist nor a constructivist position. The decision to follow the consequence of her conclusion or not depends on the meaning of “support.” In a strict logical sense, empirical findings do not prove any epistemological standpoint; however, in a logically weaker sense they may suggest it or hint at it. In this logically weak sense Maturana, too, interpreted the results of his biological experiments in a constructivist way (cf. Maturana & Poerksen 2004: 54).

4 With respect to quantum physics, the argumentation could be as follows. If Heisenberg’s uncertainty principle holds (i.e., that the electron, when being observed with the help of quanta of light in order to localize it, alters its impulse discontinuously so that the localization becomes intangible or at least unspecific), then this implies that both the scientific observer and the measurement instrument together construct the object. In the social sciences, this phenomenon is known as “reactivity” (cf. Merten 2005), meaning that the method constitutes specifically the results of empirical experiments. Constructivist epistemology can explain this phenomenon easier than realist epistemology because the observer and the observing method cannot be considered neutral to or independent from the outcome of scientific experiments, resulting in the description of the object. From a realist perspective, the object under study — including its attributes (e.g., the localization of an electron) — is considered to exist independently from the observer. But is this independence of existence relevant for the scientist if the object’s attributes vary according to the method used to measure it? I do not suggest that this conception of construction should be understood as the arbitrary invention of the object — as anti-realists or idealists may argue — but as the active involvement of the physicist in the description and analysis of her object.

5 Can constructivism be considered simply the opposite of realism?

6 Let me then be more specific: Luhmann’s assumption that “there are systems” is not a hypothesis (i.e., the assertion that two or more variables are related in a systematic rather than random way) but as much a metaphysical and pragmatic presupposition as the metaphysical and pragmatic presumptions of realist philosophy, such as that there is a mind-independent reality. Within the context in which Luhmann introduces his theory of social systems, I do not see that he starts with a hypothesis but rather with an assumption or presupposition. I consider his presupposition merely strategic to deconstruct the realist claim that the observation of systems corresponds with something in the real world. Furthermore, “a little realism can be admitted” (Nassehi §4) only if realism and constructivism are opposed on the same level. Rather, I understand (radical) constructivism as a way to embrace realism and yet overcome it in the same vein by distinguishing first-order observation from second-order observation. First-order observation is characterized by realist assumptions: the observer — an individual or a social system — takes for granted that observed phenomena correspond to entities and events in the “real world.” Not until the observer observes other observers observing the world and not until the observer observes the differences of observational outcomes does constructivism come into play within the process of observation. The (potential) contingency of every observation then enforces the assumption of a strict relationship between the observer and the observed. From the perspective of realism, there is no difference in principle between first-order and second-order observation because in both cases it should be possible to approach reality by improving the methods of observation. For constructivists, too, second-order observation can be used to clarify what can be called a proper RC philosophy despite the fact that there are many authors calling themselves constructivists or called constructivists (against their own will). Were RC a direct heir of Kant’s philosophy, it would not provide us with innovative insights. Nassehi’s understanding of RC is too selective and narrow to see its strength in solving epistemological problems. He only sees the pitfall of idealism, which does not apply to RC in general.
is as much an observation as is first-order observation. Therefore, Luhmann's argument that the operation of observing is real in the sense that it is taken for granted by the observing system is important because it avoids that constructivism shifts towards idealism. I insist on the distinction between a realist and a constructivist epistemology because there are different consequences for theory-building and for empirical research deriving from each epistemological standpoint (cf. Scholl 2008).

«7» I agree with Nassehi (§5) that constructivists start their epistemological argument from the perspective of an individual whereas Luhmann (as sociologist) chooses the social system as starting point of argumentation (§§6–7). However, why should it not be possible to accept different approaches to addressing the same epistemological problem? Siegfried J. Schmidt (2011) argues from a radical constructivist, process-oriented, and de-ontologizing perspective, which he uses for theorizing about social systems as well. Radical constructivists such as Schmidt realized the danger of accidentally ontologizing the subject, the individual, the observer or the actor or agent, and thus drew consequences from it by strictly conceptualizing their theories as process-oriented theories. This comes pretty close to Luhmann's position.

«8» Luhmann himself characterizes his epistemological foundation as operative constructivism (and not as operative realism). Understanding constructivism and realism as different ways of thinking, of elaborating scientific theories, and of doing empirical research requires the researcher to decide whether one can distinguish between reality and observation or whether one has to deny the possibility as well as the necessity to make this distinction.

«9» Nassehi calls refusing any ontology naïve and elaborates the paradox of constructing and constructed systems. It is not clear for me why this apparent paradox implies a minimal ontology. So I have to assume that Nassehi and I have different concepts of ontology in mind for I cannot imagine different degrees of ontology. The same applies to Luhmann, who did not conceive of more or less autoepoiesis or more or less autonomy of a system. Working with a basic ontological assumption implies believing in the correspondence theory of scientific observation and believing in the existence of reality independent from and prior to observation. Refusing to accept any ontological commitment results exactly in the paradoxes Nassehi describes (§10). He seems to insinuate that constructivists deny the existence of any reality; however radical constructivism is actually strictly agnostic about this question. It assumes neither a pre-existing reality nor that everything we observe is mere imagination. So constructivism is neither realist nor idealist A third epistemology between realism and constructivism, which Nassehi sees in Luhmann's operative constructivism, is nothing other than radical constructivism proper. This is the reason why I fully agree with Nassehi's argument in §11, that it "is only an empirical observation, which presupposes observations." However, I do not follow the consequence drawn in §12 that operations "exist" (sic!) between constructivism and realism. Rather, I consider the radical constructivist epistemology to go beyond realism and idealism. Luhmann's merit consists of warning constructivists about the danger of confusing constructivism with idealism. However, this does not imply that Luhmann's operative constructivism is the only way to avoid idealistic elements within constructivism.

Conclusion

«10» The aim of my article was to point out that Luhmann sometimes runs the risk of coming too close to the epistemology of realism. However, I am confident that both Luhmann and Nassehi are much better off with the constructivist discourse than with the realists' attack on self-referential, autonomous, and autoepoietic social systems, which some of them (such as Esser 2002) even accuse of being scientific nonsense.
Luhmann and the Constructivist Heritage
A Critical Reflection

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> Context • Luhmann’s theory of autopoietic social systems is increasingly receiving attention in the scholarly dis-
•pute about constructivism. > Problem • The paper explores the transition from Kant’s “transcendental/empirical” to
Luhmann’s “system/environment” distinction to provide a deepened understanding of Luhmann’s constructiv-
ist approach. > Method • Luhmann’s construction of reality via the system/environment distinction is discussed
with respect to preceding concepts provided by philosophical and system/cybernetic scholars such as Kant, Hus-
sler, Piaget, von Glasersfeld, von Foerster, and Maturana & Varela. The innovativeness of Luhmann’s approach is
then critically evaluated. > Results • Luhmann’s contribution to constructivism is innovative only in the context of
his stringent theory architecture of autopoietic meaning-based systems. > Implications • The text is a contribu-
tion to the positioning of this approach as part of the philosophical and systems/cybernetics constructivist heritage.
> Key Words • Theory of social systems (TSS), observation, autopoiesis, self-reference & hetero-reference, meaning.

“Construction theory is about the reality of the system – whatever the contours of its own meaningful
observations might be – is the simultaneity of its operation with the conditions of reality that
sustain it.” (Luhmann 1990b: 70)

Introduction

1 | Although Kant used the term “system,”
Luhmann is right because Kant defined a system
as a unity of the manifold cognitions under one
idea and was concerned with its a priori deter-
nation and not with environmental relations
(Kant 1998: B860).

1 | “A reality that remains unknown”: this is part of the title of an article by Niklas Luhmann that deals with constructivism. In it he summarizes epistemological considera-
tions scattered in his voluminous work on social systems theory, which he developed over
three decades. His approach is not the denial of reality but a “de-ontologization” (Luhmann 1990b: 67) (ontology understood in the phil-
osophical meaning of dealing with whether or not a certain thing or entity exists).

2 | Unsurprisingly, for those who are familiar with his work, Luhmann sees his contri-
bution to constructivism in the elabo-
ration of the system/environment distinc-
tion. At least since the so-called autopoietic
turn (in which he re-conceptualized the idea of social systems by including notions such as
meaning and self-reproduction as constit-
tuting features), issues such as openness/clo-
sure, re-entry, and observation have become
pivotal. Thereby he aims at overcoming Im-
nmanuel Kant’s transcendental philosophy. That is, the transcendental/empirical dis-
tinction has to be replaced with the system/
environment distinction (Luhmann 1990b:
66). Luhmann argues that the concept of
evironment, as well as the correspond-
ing concept of system, was not available at
Kant’s time. Instead, the transcendental/
empirical distinction was developed to over-
come a self-referring circle in which every-
thing is the object of knowledge.1

3 | Kant’s work and his detailed episo-
temological mapping is an important start-
ing point in constructivism – not only for
Luhmann, but also for philosophers such as
Edmund Husserl and constructivists
such as Jean Piaget and Ernst von Glasers-
feld. Husserl, for example, criticizes Kant’s
conceptualization of the a priori, of under-
standing, and of reason (Husserl 2001a:
135), and aims at a “radical transcendental
subjectivism” (Husserl 1992a: 101). Piaget
argues against Kant’s concept that space and
time are pre-given (Piaget 1973: 70ff).

Instead, he shows on the basis of his inves-
tigations that space and time are concepts that evolve in the course of the develop-
ment of the child (Piaget 1954). Von Glasersfeld
likewise does not agree with Kant’s assump-
tion that there exists something beyond the
bounds of possible experience. But he is
nevertheless convinced that Kant’s transcen-
dental philosophy provides a model that is
in many ways fundamental to constructiv-
Kant’s work – together with the work of oth-
ers such as Plato, Descartes, Vico, Locke, Berkeley, and Wittgenstein – represents a
philosophical constructivist heritage that
allows “seeing further by standing on the
shoulders of giants” (Merton 1996: 237). Be-
side the philosophical heritage, there exists
a constructivist heritage including the sci-
entific community that emerged around the
Macy-Conferences and the BCL (Biolog-
ical Computer Laboratory) from the 1940s to
the 1970s (Müller & Müller 2007; Pias 2003)
and further proponents mentioned below.

4 | Luhmann is committed to the idea
of building on this scholarly heritage. He
observes that constructivism has very much profited from philosophy (from Descartes, via
Berkeley, Buffier, and Hume, to Kant)
(Luhmann 1990c: 495), from research “in
biology, neurophysiology, and psychology
Constructivist distinctions: From Kant to Luhmann

According to his own elaborations, referring to Kant means, for Luhmann, starting with basic distinctions of the "critique of pure reason" and replacing them with contemporary terms and concepts (Luhmann 1990b: 66). As mentioned in the introduction, this especially concerns Kant's distinction between "transcendental" and "empirical," whose replacement with the distinction between "system" and "environment" is suggested.

To provide a deeper understanding of the innovativeness of Luhmann's version of the system/environment distinction, the transcendental/empirical distinction will be explored first. This is followed by Husserl's, Piaget's, and von Glasersfeld's reference to Kant, and by von Foerster's and Maturana & Varela's conceptualization of system/environment and autopoiesis. The selection of these approaches represents only a few milestones on the road from transcendental/empirical to system/environment and neither neglects nor underestimates all the other relevant "giants" (in the meaning of Merton).

Kant's transcendental/empirical distinction

Kant applies both terms – "transcendental" as well as "empirical" – to cognition (Erkenntnis). Cognition is in his conceptualization quite a complex process. It is located in the mind (Gemüt) and can be described by the three faculties of sensibility (Sinnlichkeit), understanding (Verstand), and reason (Vernunft): "All our cognition starts from the senses, goes from there to the understanding, and ends with reason..." (Kant 1998: B355).

Although cognition starts with empirical experience (i.e., the awakening of the cognitive faculty through objects that stimulate our senses), Kant (1998: B1), these three faculties are bidirectionally interrelated. In one direction, the senses provide the raw material (i.e., data) for cognition that is processed in the understanding on the basis of integrating rules. The other direction is that the reason provides integrative principles as a basis for the use of the rules: "If the understanding may be a faculty of unity of appearances by means of rules, then reason is the faculty of the unity of the rules of understanding under principles." (Kant 1998: B359)

The reason therefore never applies directly to empirical experience. Instead, it applies to the understanding in order to give a priori principles to the understanding's manifold a priori rules. The well-known terms "a priori" and "a posteriori" are hereby defined as follows:

One calls [...] cognition independent of all experience and even of all impressions of the senses [...] cognitions a priori, and distinguishes them from empirical ones, which have their sources a posteriori, namely in experience." (Kant 1998: B2)

Kant's transcendental philosophy deals with a priori cognitions in reason and in understanding, which are mostly labeled "pure" in the elaboration of his "Critique of pure reason." He explores how "pure understanding" and "pure reason" make cognition possible in allowing for empirical experience (Kant 1998: B25). This includes quite sophisticated considerations and differentiations. One of them is the distinction between intuition and concept (see Figure 1), which gained prominence because of his postulate that space and time are pure intuitions.

Space and time belong to sensory intuition (sinnliche Anschauung) as its pure forms. That is, space and time guide as "pure intuitions" the subordinated "empirical intuitions." But note that the empirical intuitions are subordinated only from the perspective of transcendental philosophy – actual cognition starts with sensation: objects stimulate our senses and we have empirical intuitions and corresponding empirical concepts (e.g., an object is soft or hard).

Intuitions and concepts (i.e., empirical intuitus vel conceptus) as well as pure intuition and concepts (i.e., pure intuitus vel conceptus) are manifold and require organization. First, the senses allow for the synopsis of the manifold a priori. Second, the imagination (Einfühlungskraft) allows for the synthesis of this manifold (intuition-synthesis = synthesis speciosa, concept-synthesis = synthesis intellectuālis). Synthesis in accordance with concepts takes place as an action in understanding (as self-activity of the subject and not given through objects) whereby the pure concepts of understanding are called categories (i.e., quantity, quality, etc.). Third, the apperception (i.e. self-consciousness) allows for the unity of this synthesis. If it changes with the stream of inner appearances, it is called transcendental apperception. If it is unchanging (pure, original), it is called transcendental apperception. (Kant 1998: A78ff, B104ff, A95, A107, B130) But how can such an unchanging self-consciousness, such a transcendental apperception be maintained?
To complete the organization of the manifold, an ultimate containment is necessary. This is provided by the "subject." The manifold is related to the identity of the subject, which is possible because of the "transcendental unity of self-consciousness" (Kant 1998: B132–134). Whereas empirical consciousness that accompanies different representations is by itself dispersed and without relation to the identity of the subject, the transcendental unity of self-consciousness produces the representation "I think" as thoroughgoing identity.

Note for the sake of clarity that the transcendental/empirical distinction is different from the transcendent/immanent distinction. The latter is defined by Kant as follows (Kant 1998: B383): pure concepts of reason are always transcendent whereas pure concepts of understanding are always immanent, because understanding bridges to experience.

Kant’s conceptualization of cognition a priori has been extensively and controversially debated in epistemology. Jean Piaget’s investigations added a rich body of empirical evidence to this debate. He explains how space and time are constructed in the course of the development of intelligence in the child. Also, Kant does not argue that the a priori space and time are innate. Instead he uses the method of elimination in declaring that one can never imagine “that there is no space” and that an a priori representation is a condition of possibility that “grounds outer appearances” (Kant 1998: B38).

Luhmann’s claim to have overcome transcendental philosophy by the introduction of the system/environment
distinction is somewhat doubted. This is, for example, true for Luhmann’s conception of “reflection,” in which the logic of transcendental presuppositions is still detected (Merz-Benz 2000), or for his conception of system-rationality, in which metaphysical background convictions are replaced with metaboliological ones (Habermas 2007: 370ff).

It is altogether evident that Kant and Luhmann are addressing different issues and are therefore seeking solutions to different problems. Kant has “knowledge” as his object of investigation and Luhmann “society.” Whereas Kant aims in his critique of pure reason to establish/defend metaphysics as a science of knowledge/cognition, Luhmann aims to establish/defend systems theory as a science of society. According to Kant, this concerns the challenge that metaphysics had to find the “secure path of science” to overcome “a mere groping, and what is the worst, a groping among mere concepts” (Kant 1998: BXV). According to Luhmann, this deals with the explanation of world as “related to the system reference of social systems, that is, related to the difference between system and environment that is characteristic of social systems” (Luhmann 1995a: xlvi).

In this context, both elaborated quite complicated concepts of cognizing “subjects.” Kant’s transcendental unity of self-consciousness as an unchanging identical “I”/subject is replaced by Luhmann’s self-referentially closed psychic system/individual, which is distinct from, but nevertheless depends on, social systems. This is indeed a different perspective. But it is true that neither, as constructivists, denied a reality, and both insisted on a kind of fundamental independence in (re)constructing this reality by cognizing subjects/individuals (and also by cognizing social systems in the case of Luhmann; i.e., he claims no privileged “metaphysical,” subjective position for observation, description or knowledge/cognition).

Husserl on meaning

« 20 » Husserl feels himself generally close to Kant’s critique of pure reason. Nevertheless, he sees in it some “obscurities,” because from his point of view, Kant lacked the phenomenologically correct conceptualization of the a priori, of perception, of experience, and of understanding (Husserl 2001b: 318f, 2001a: 28f). Although Husserl concentrated later in his work on transcendental subjectivity/inter-subjectivity and aimed at a “radical transcendental subjectivism” (Husserl 1992c: 138ff, Husserl 1992a: 101), he did not appreciate what he called “Kant’s confusing, mythic concepts of understanding and reason” (Husserl 2001a: 135). Instead, Husserl elaborated his method of phenomenological analysis. It starts with psychic acts, by which subjects represent the object world within their consciousness.

« 21 » Psychic acts are meaning-processing entities in which expressions (words, sentences, etc.) are related to objects (concrete things perceptible by the senses or imagined, or facts, characteristics, categorical forms, etc.). This two-dimensionality – object and expression – requires the distinction between two basic psychic acts (Husserl 2001a: 192). On the one hand, there is the act of meaning-intention (bedeutungsverleihender Akt), such as the thinking of an expression. On the other hand, there is the act of meaning-fulfilment (bedeutungsverfallender Akt), which is a reference to a certain object. This distinction is crucial because of the ambiguity of the language. For example, two expressions can mean something different, but refer to the same thing: “the winner of Jena” and “the loser of Waterloo” both refer to Napoleon.

« 22 » Meaning-intention and meaning-fulfilment are congruent in a single act of experience of a limited duration. From this temporalization, it follows that consciousness is not a “thing” but a “stream” (stream of consciousness, stream of experience). From this, it also follows that consciousness does not need an extra ego-principle to come into existence (Husserl 2001b: 86), but is constituted by its continuous meaning-processing activities.

« 23 » It is clear that not every experience can be active in a stream, but that one experience is always active and surrounded by inactive ones. It is the nature of such a stream that the mode of its experiences is constantly changing. Active experiences become inactive, and one of the surroundings inactive ones becomes the next active one (Husserl 1992b: 73).

« 24 » All the possible different objects exist in one world (universal form of world) and this “given world” is the horizon of all meaningful acts, i.e., a meaning horizon (Husserl 1992a: 42, 49).

« 25 » Luhmann’s adoption of Husserl’s phenomenological analysis is crucial for the theory of social systems (TSS), since meaning is the pivotal moment in the TSS architecture (Luhmann 1990e, 1995a: 92ff, 2002: 221ff). Beyond that, Husserl provides a quite advanced concept of consciousness that anticipates cybernetic/systemic considerations (such as the referential structure of operations and subordination to the maintenance of its own organization, intention instead of input/output, independence of an observer, etc.). Husserl’s conception is above all adopted in TSS in the following aspects (Luhmann 1995a: 92ff, 138, 262, 1990e). First, Luhmann uses the idea of meaningful acts that constitute the stream of consciousness and specifies that meaning-processing elemental units constitute psychic and social systems. Second, he uses the notion of temporized reference and specifies that meaning appears as a surplus of references and therefore requires continuous selection. Third, he uses the metaphor of a given meaning horizon and specifies that selection brings something into the focal point (at the center of intention) and that everything else is indicated marginally as the horizon, thus guaranteeing the actuality of the world in the form of accessibility. In TSS, meaning becomes the ultimate form of the world and consequently overlaps the difference between system and environment; even the environment is given in the form of meaning.

Piaget on intelligence development and environment

« 26 » In his book The Construction of Reality in the Child (Piaget 1954) Piaget presents a six-stage model of the development of the object concept in connection with space, causality, and time on the basis of sensorimotor intelligence. Whereas in the
first two stages no special behavior related to vanished objects can be observed, this changes gradually and results in the representation of invisible displacements in the sixth stage. His investigations include the repeated (time) placement and displacement (space) of objects in front of children. Piaget concludes that the elaboration of the concepts of object, space, and causality goes together with the development of intelligence. It starts from a state in which accommodation to the environment is undifferentiated. Later on, the universe is built up into an aggregate of permanent objects connected by causal relations. This universe of connected objects is perceived as independent from the child and is placed in space and time. In Piaget's observations, an "a priori" such as space or time does not exist.

"27" The development of sensorimotor intelligence is conceptually captured with the terms "assimilation" and "accommodation" (Piaget 1954: 350ff). Assimilation tends to subordinate the environment to the organism whereas accommodation is the source of changes and bends the organism to the successive constraints of the environment. In the beginning, assimilation means the utilization of the external environment by the subject to nourish his/her hereditary or acquired schemata (sucking, sight, etc.). As the schemata are multiplied and differentiated in the course of the development, assimilation is differentiated from accommodation. The development progresses from an integral and unconsciousness egocentrism to an increasing solidification and objectification.

"28" Luhmann adopts Piaget's notion of assimilation/accommodation in the course of his elaboration of the structural coupling between psychic and social systems (Luhmann 1995b). In TSS, this structural coupling is provided by the form "person," which is constituted for the sake of ordering behavioral expectations. It helps the psychic system to develop adequate schemata/structures to accommodate various social situations or to interpret (assimilate) the behavior of other psychic systems according to his/her existing schemes/structures. Luhmann describes this as the transformation of irritations (disturbances, ambiguities, disappointments, inconsistencies, etc.) into workable forms.

**Von Glasersfeld on Kant, Piaget, and "principles of radical constructivism"**

"29" Although von Glasersfeld appreciates Kant's transcendental philosophy as a model that is in many ways fundamental to constructivist approaches, he judges Kant's "transcendental enterprise" as belonging to the realm of poetic metaphors and mysticism (Glasersfeld 1995: 39). For von Glasersfeld, it isrationally unconvincing that something that allows experience can be captured with concepts and language that were derived from experience.

"30" Piaget's constructivist theory of knowing is far more convincing for von Glasersfeld than approaches such as the transcendental conception of cognition. He observes in this context (Glasersfeld 1989a) that the theory of evolution was unfortunately not available for Kant, but that later authors already used it. For example, besides Piaget (assimilation/accommodation), Georg Simmel had dealt with the adaptive function of cognition. That is, cognition does not produce a "true" picture of a "real world," but rather aims to enhance an organism's management of experience. Also, authors such as Maturana, Varela, von Foerster, and Claude Shannon considered adaptation as important.

"31" Based on these and further approaches – see for an overview of "thirty years radical constructivism" (Glasersfeld 2005) – von Glasersfeld formulated his principles of radical constructivism (Glasersfeld 1989a):

- Knowledge is not passively received (neither through the senses nor through communication) but actively built up by the cognizing subject.
- The function of cognition is adaptive (towards fit or viability) and serves the subject's organization of the experiential world (not the discovery of an objective ontological reality).

"32" Luhmann discusses radical constructivism and especially considers the concept of "viability" together with the notions of adaptation and fitness (Luhmann 1990c: 521 and 555, Luhmann 2007: 236). But in distinction from radical constructivism, he does not opt for viability/adaptation/fitness. In TSS, meaning-based selection operations of psychic and social systems do not serve the "fit" between system and environment, but rather the maintenance of the system's reproduction (Luhmann 1990c: 576f).

**Von Foerster on system and environment**

"33" Von Foerster was already interested from early on in the question of the way in which a system and its environment are interrelated. In a paper published in 1969 (Foerster 2003a), he referred to Gordon Pask's network considerations as a basis for discussing a system's utilization of environmental order. This is done using the "order from noise" principle. No order is "fed" into the system; only those components of the noise are selected that increase the order in the system. Later on, von Foerster spoke of states that are generated purely internally (i.e., "self-states" or "eigenstates"), which permits each incoming signal to be referred to its own self. He describes this as the establishment of self-reference with respect to the outside world (Foerster 2003a: 110).

"34" Luhmann uses exactly this notion in his conception of resonance (Luhmann 1989: 15ff). In TSS, there is no direct input from the environment into the system. Instead, resonance occurs when the system is stimulated by its environment. The stimulation can be registered by the system if it possesses a corresponding capacity, i.e., if the stimulation becomes data (and not noise). This ability is because the data can be included in the system's own operations. The system distinguishes itself from the environment and establishes the system/environment difference to be able to observe the environment in respect to itself.

**Maturana & Varela on autoeiposis**

"35" According to Ludwig von Bertalanffy, an important question in classical systems theory was “how systems are realized at various levels of the world of observation” (Bertalanffy 1969: xxi). Neither von Bertalanffy nor other system theorists denied the existence of a real world. But it was argued that systems are entities either perceived in or inferred from observation, or conceptual systems such as logic, mathematics or music, which are symbolic constructs. Therefore, a system is not something presented to the observer, but recognized by
Autopoietic machines are autonomous in subordinating all changes to the maintenance of their own organization, whereas allopoietic machines are subordinated to the production of something different from themselves (e.g., cars).

- Autopoietic machines possess individuation because they maintain an identity through their continuous production independent of their interactions with an observer, whereas allopoietic machines have an identity that depends on an observer.
- Autopoietic machines are units only because of the operations that specify their own boundaries in the process of self-production, whereas the boundaries of allopoietic machines are defined by an observer.
- Autopoietic machines do not have inputs or outputs but can be perturbed by independent events and undergo internal structural changes to compensate for such perturbation. Interactions between two or more autopoietic entities will therefore result in reciprocal perturbations. If there is a history of recurrent interactions leading to the structural congruence between them, there will be a structural coupling.

Luhmann’s system/environment distinction

Luhmann values the system/environment distinction as the central paradigm of the system theory of his time (Luhmann 1995a: 178). Thereby, the concept of environment should not be seen as a residual category, but as twofoldly constitutive for the formation of a system. The autopoietic operation mode generally (see above Maturana & Varela) and the constitution of an identity specifically require the distinction between system and environment.

- The environment is always system-relative. It can be described as a negative correlate of the system and can remain more or less undetermined. "The environment is simply ‘everything else’" (Luhmann 1995a: 181). This "everything else" vis-à-vis the system constitutes the world. That is, "world" serves as a concept for the unity of the difference between system and environment. This can be described with the metaphor of a horizon (see above Husserl).

System/environment: operational closure and the construction of reality

- Meaning-based self-reference is a central notion in Luhmann’s theory and therefore in the explanation of the construction of reality as well (Luhmann 1990b, Luhmann 1990c, Luhmann 1983). It is the notion of meaning-based self-reference that provides the ground for the conception of operational closure and subsequently allows the internal reconstruction of the difference between system and environment. In the logic of Luhmann’s theory, only this enables the system’s continual reference to itself by distinguishing itself from the environment.

Figure 2: Categories of autopoietic systems (Luhmann 1990a: 2).
Meaning as a basic concept

In Luhmann’s conception of meaning, Husserl’s notions of a universal meaning horizon, object reference (intention), and inactivity/activity are linked with Maturana’s/Varela’s ideas of circularity, maintenance, and reproduction. This results in the notion of circular organized meaning, which has the following features (Luhmann 1995a: 37, 59, 263, 1990a: 12):

- Meaning refers to meaning and never to anything else. The only way to escape this circularity is negation. But negation, too, has meaning and meaning is, therefore, a non-negatable category.
- This tautology is solved on the level of the system by the possibility of “re-entry,” a concept adopted from George Spencer-Brown. That is, a meaning-based system is able to represent the difference of system and environment within the system (Spencer-Brown 1994: 72ff).
- Meaning is also defined as a referential structure in the form of a surplus of references (horizon). Something stands in the focal point, at the center of intention, and everything else is indicated as the horizon that guarantees the accessibility of the world.
- Meaning is further characterized by temporality. Meaning references always operate in the present and are, therefore, of only minimal duration.
- Because of temporalization, there is a continuous need for reference maintenance. Every reference must either be repeated (selected again) or, if not, other references must be selected. Meaning therefore exists only if meaningful references are made; otherwise it ceases.
- Luhmann indicates two categories of meaning-based systems: psychic systems and social systems (Figure 2). These two can be distinguished according to whether they use consciousness or communication as a mode of meaning-based reproduction. Luhmann defines psychic systems as constituted on the basis of a self-referential (unified) nexus of conscious states, and social systems as constituted on the basis of a self-referential (unified) nexus of communications (Luhmann 1995a: 59 and 271).
- Although psychic and social systems are different categories of systems, they are inherently connected; i.e., they have evolved together (Luhmann 1995a: 59). This co-evolution has led to a common achievement, namely meaning. In summary, it can be said that since both systems are ordered according to meaning, they are a necessary environment for each other to allow for the continuation of their autoopoiesis.

Modes of self-reference and operational closure

Psychic systems consist of “thought elements” and social systems of “communication elements” (Luhmann 1995a: 138 and 262). Both kinds of elements are defined as being themselves complex events. This is a conceptualization specifically following Whitehead’s elaborations that an event is a nexus of actual occasions (actual occasion = entity diverse from any entity in the “many” that it unifies) (Whitehead 1979: 21 and 80).

Therefore temporalization and complexity require the ongoing identification and establishment of the elemental unity. In the case of psychic/social systems, the elemental unity is constituted as an element in relation(s) (and not ontologically given). That is, elements acquire unity only when they are related, i.e., when they refer to other elements. The formation of the elemental units is explained as a “constitution from above” (and not an “emergence from below”) and is based on three interrelated levels of self-reference (Figure 3):

- First, in the course of basal self-reference, an element refers to itself (self = element of a certain category; distinction = element/relation). That is, thoughts refer to thoughts and communications refer to communications.
- Second, in the course of processual self-reference, an element refers to another element and forms a “chain of elements-in-relations” over the course of time (self = process; distinction = before/after). This is possible because of accompanying self-reference: i.e., a process is possible on the basis of accompanying meaning, which allows for the transition from event to event.
- Third, in the course of reflective self-reference, an element refers to the system because system-reference and self-reference coincide. This is possible because the system indicates itself — i.e., its own elements — in contrast to its environment (self = system; distinction is system/environment).

All openness is based on closure, and this is possible because self-referential operations do not absorb the full meaning, do not totalize but mer-
ly accompany; because they do not conclude, do not lead to an end, do not fulfill a telos, but rather open out.2

But conceptualized as reference within the theory the system and the environment is consistent used by Luhmann, is translated into English in various variants: “hetero-reference” (Luhmann 1995a: 447).

Openness to the environment is therefore not in contradiction of operational closure. Instead, openness is essential since systems are not occasionally, but structurally oriented towards their environment. Consequently, psychic as well as social systems are environment-sensitive and constantly scour their environment for impulses (Luhmann 1989: 118f).

Since the recognition of both the system and the environment is conceptualized as reference within the theory of social systems, self-reference has to be distinguished from hetero-reference. But this does not mean that hetero-reference is located outside the system. It is an internal operation, too, but refers to the environment and not to the system, a process or an element. This conceptualization is based on the assumption that there exists an external world, but that there is no direct contact with it (Luhmann 1990b: 64). The external world remains unknown but can nevertheless be treated within the system.

Luhmann claims that with this “intervention of systems theory,” a “de-ontologization of reality” is achieved (Luhmann 1990b: 67). Thereby, only the epistemological relevance of an ontological representation of reality is doubted. This is not an answer to the question of whether a world exists or not. Of course, if a system does not have an entry to its external world, it can be denied that such an external world exists. But this is not intended here. Equally well, it could be claimed that an external world exists. And the latter is preferred by Luhmann, although he sees no way of deciding in favor of the one or the other of these two options. What he suggests instead is the use of the system/environment distinction in the analysis of the problem.

Reflective self-reference, self-observation, and self-description

Not all systems achieve the level of reflective self-reference. For example, interaction systems (as one specific social system, see Figure 2) do not usually reflect their unity. They are constituted on the basis of the presence of individuals (criterion: presence/absence) and structured by centering along the theme(s) of communication. For other systems, such as psychic, organizational, and societal systems, reflective self-reference is common (Luhmann 1995a: 266ff, 456ff).


In the case of psychic systems, this can result in a self-description in the form of “person,” i.e., personal identity. The function of the “form person” is well-described in the psychology of Carl Gustav Jung and in the social psychology of Erving Goffman. In the ancient Greek theatre the “persona” was a mask, which nowadays can be seen as a compromise between individual and society: what someone should appear to be (Jung 1992: 158) or how an individual tries to control the impression he/she receives of the situation (Goffman 1959: 15).

Luhmann adopted these ideas and introduced the concept of the “form person” that navigates between the psychic and the social (Luhmann 1995b: 142). The form person includes the body because of the structural coupling between the psychic system and its physical basis and therefore gains duration beyond the psychic reproduction. It is not a system, but a social-psychological attribution with the function of reducing uncertainty in social interaction by representing individualized behavioral constraints.

In the case of social systems, a substitute for the body of the psychic system is required. This can be found in the form of texts that are either orally provided or written down (Luhmann 2000: 422). In the case of organizational systems, texts are documents such as organizational charts, internal rules (responsibilities, job descriptions, etc.), process/product descriptions, and annual reports. In the case of societal systems (i.e., functional systems such as an economy and a science), self-description is possible because of their specific codes and programs. On the level of coding, a system is differentiated by means of a binary scheme such as “pay/unable to pay” (economy) or “true/false” (science). Programs enable a “concretizing” or “operationalization” (Luhmann 1989: 45) of the requirements that a function system has to satisfy. On the program level, a system can change structures without losing its code-determined identity. For example, the economic system disposes of programs such as market oriented capi-
Innovativeness of Luhmann’s adoptions

60 Luhmann takes advantage of a great number of existing scientific approaches and integrates them into the strictly defined architecture of his theory of social systems. This is true for the absorption of smaller conceptual parts as well as of (more or less) complete approaches. An example of the first is the notion of assimilation/accommodation, which is part of Piaget’s theory of intelligence development. An example for the latter is the integration of Maturana & Varela’s neurobiological theory of autopoiesis, an undertaking that became so prominent that it has been labeled as the “autopoietic turn” of Luhmann’s theorizing.

61 Since Luhmann’s integration efforts are quite interdisciplinary, it is challenging to evaluate his scholarly position and the innovativeness of his approach. The related questions are: Are these integrations crude fittings into his sociological theory or do they result in significant theoretical advancements? Does Luhmann work out “new combinations” of existing concepts and provide therefore innovation, i.e., innovation in the meaning of Joseph Schumpeter? In an attempt to formulate answers to these questions, the conceptual adoptions that were identified and described in this text will be used. Table 1 provides an overview of them (a selection that is exemplary and not exhaustive and follows primarily Luhmann’s own evidence) by indicating the original concept as well as Luhmann’s adoption.

Table 1: Examples of Luhmann’s adoptions of existing concepts.

<table>
<thead>
<tr>
<th>Original concept</th>
<th>Luhmann’s adoption</th>
</tr>
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<tbody>
<tr>
<td>meaning</td>
<td>meaning processing systems</td>
</tr>
<tr>
<td>autopoeisis</td>
<td>autopoietic social/psychic systems</td>
</tr>
<tr>
<td>assimilation/accommodation</td>
<td>“person” as structural coupling</td>
</tr>
</tbody>
</table>

3 Innovation theory is still related to the name of Joseph Schumpeter, an economist who popularized the term innovation together with the notion of “creative destruction” in the first half of the 20th century. He defines innovation as any “New Combination,” e.g., in the form of new commodities, new forms of organization, newly opening-up markets, etc., but excludes those minor and day-to-day adaptations that are “part and parcel of the most ordinary run of economic routine within a given production function” (Schumpeter 1989: 62f).
The second answer to the above-mentioned questions is quite contrary to the first, because of the widening of the scope of the consideration. The innovativeness of Luhmann’s approach is given by the incorporation of these concepts in an overall framework. What appears “kaleidoscopic” as long as individual concept-adoptions are considered becomes “stringent” as soon as the complete architecture of the theory with its circular character is viewed. It is especially the intertwining of Husserl’s meaning and Maturana & Varela’s “autopoiesis” and their transformation into “autopoietic meaning based systems” that deserves the label innovation. This provides the basis for Luhmann’s distinction between psychic and social systems, which eventually indicates further concept-adoptions such as the “form person” and “resonance” as innovative.

As far as the system/environment distinction is concerned, the same is true for the evaluation of Luhmann’s contribution to constructivism. Dealing with system and environment and the overcoming of the notion of input/output relations is already state-of-the-art. Only the re-conceptualization of the system/environment distinction as a properly defined constituent of different forms of autopoietic meaning-processing systems (i.e., forms of self-reference, hetero-reference) should be called innovation.

Conclusion

Niklas Luhmann sees his contribution to constructivism in the exploration of the system/environment distinction, aiming at the replacement of the classical transcendental/empirical distinction. Thereby, he benefits from a rich body of philosophical and systems/cybernetic constructivist heritage that supports his differentiated and elaborated contribution. The resulting approach obtains its originality and innovativeness from the freedom of the adoption of the philosophical and system/cybernetic constructivist heritage, although exactly this makes it difficult to evaluate the explanatory power of his overall theory. Nonetheless, one can enormously profit from following Luhmann’s constructivist approach on the one hand, and from tracing back his conceptual adoptions to their respective sources on the other.

In conclusion, it can be said that Niklas Luhmann’s contribution to constructivism is doubtless original and quite inspiring. Although – or maybe because – it tends to raise more questions than answers, it has started to become a valuable ingredient in the scholarly dispute about constructivism and enriches it significantly.
tion to constructivism is doubtless original and quite inspiring although – or maybe because – it tends to raise more questions than answers” (§61). Since I share this general assessment, I would like to develop three specific contexts where Luhmann acted or acts as a question-generator, producing more new questions than solving old ones.

More questions for the inventors of constructivism

« 3 » The first context stresses the peculiar nature of the Luhmannian adaptations and accommodations of constructivist frameworks on the one hand and the reactions by the originators of these frameworks on the other hand. Looking at Table 1 in Buchinger’s article, one finds five major Luhmannian re-inventions of which four come originally from the group of radical constructivists. Given the adequacy of Buchinger’s transformation table, how the group of radical constructivists reacted to their ‘great transformation’ becomes an interesting issue. Maturana, for example, was still very explicit that the autopoietic framework should not be transferred outside the realm of biological cells, and should not be utilized for individuals or for the societal arena in general. The same holds for Varela. Von Foerster remained rather skeptical as to whether the Luhmannian notions of recursive closures or resonance were in line with his formalism for eigenforms. His talk for Luhmann’s 60th birthday culminated in the phrase “communication is recursion” (Foerster 2003b: 321) but it remains very questionable whether von Foerster and Luhmann shared the same semantic territories with respect to the concepts of communication and recursion. Bateson, like Piaget, died four years before the publication of Soziale Systeme in 1984, so they had no chance to react to Luhmann’s reconfiguration of their work. While everyone among the core group of radical constructivists might have agreed on the originality of Luhmann’s explorations after 1984, it would have been difficult to reach a consensus as to whether the Luhmannian approach would lead to a theoretical dead-end or to a vital radical constructivist research trajectory for societal analyses in general. Thus, for the radical-­constructivist group of first-­order inventors, Luhmann, with his second-­order inventions of first-­order radical constructivism, definitely created more new questions than answers.

More questions for constructivist interpreters

« 4 » The second context addresses the radical and counter-­intuitive organization and structure of the theoretical framework of TSS II and its many unintended consequences. Whenever one wants to take Luhmann’s definitions or explorations at face value, one ends up with a massive amount of new sets of questions.

« 5 » For example, as everyone in favor of Luhmannian systems theory knows, different systems operate on different binary codes such as payments/­non-­payments (economic system), truth/­falsity (science system), and the like. What looks appealing at first sight becomes rather complex and labyrinthine at second sight and a lost cause at third sight.

« 6 » Taking scientific communication as our starting point, probably the most important selective operations occur with respect to the choice of new data, hypotheses, theories, models, research-­programs, and the like. But where does the binary code for the science system lead us with respect to these crucial selections?

« 7 » Initially, we all are perfectly aware that much of the observable communication by scientists and researchers is situated beyond truth/­falsity-­claims. Gossiping, making jokes, telling anecdotes, asking questions, needing help with or making exchanges on everyday problems, messaging on social media, requesting more funds from a science administration, etc. clearly fall outside the realm of true or false scientific propositions or the search for true knowledge in general. But maybe science as a Luhmann-­communication system deals directly and only with truth and falsity claims and a Luhmann science system becomes, thus, highly selective with respect to its own communications. But restricting the science system to its true/­false communication only creates an immediate follow-­up problem because normative sciences such as mathematics, logic, statistics, ethics, welfare economics, and the like are not built on truth and falsity claims. Do these areas fall out of the realm of the science discourse? If not, can one still uphold a binary code for the science system in general or must one live by two binary codes, namely true/­false for the empirical sciences and valid/­invalid for the normative sciences? Luhmann suggests a differentiation between codes and programs so that one can build a general binary trueG/­falseG code on top and have a differentiation into a trueE/­falseE code for empirical and a validG/­invalidG program for normative science? But with a binary trueG/­falseG code on top and a special program or programs below, a host of new conceptual problems arises.

« 8 » Philosophers of science remind us again and again that truth issues turn out to be of minor or very marginal importance for the evolution of science or for actual decision procedures with respect to new theories, models, etc. New theoretical frameworks are hardly ever discussed on their truth merits, but on other criteria such as simplicity, generality, problem-­solving effectiveness, and the like. If, for example, problem-­solving effectiveness as a PSE program (Laudan 1977) or a variant of it, such as PSE*, becomes crucial for theory or model selection on historical or empirical grounds, then the following trilemma arises.

« 9 » First, one could develop a hierarchical between a binary true/­false code T/­F and a PSE program for program-­solving effectiveness. But then one is confronted with a general binary code with T/­F on top, which is almost irrelevant to accounting for the most important selections in its own domain. The necessary PSE selective program operates in complete independence from the top level binary code because it is based on a very different scale of varying degrees of problem-­solving effectiveness that, by themselves, are grounded in different dimensions of PSE.

« 10 » Second, one can develop a hierarchical ordering between a T/­F binary code and a program such as PSE, where code and program can be applied to common communicative domains. The problem here is not only that the binary code and the program will differ significantly in their selection results, but that the selections from the PSE program will dominate the potential selections from the binary coding. New theories, models, research programs
or research traditions have been and will be selected irrespective of the truth/falsity code allocations, but in line with the PSE-grounded results, which are based on different dimensions and degrees of problem solving effectiveness.

«11» Third, one can stick to a T/F binary code on top together with a program pool that contains, aside from PSE and other PSE variants, a suitable program for the binary true/false differentiation as well. In this case, the truth/falsity-program will select theories, models, research frameworks, research traditions, etc. according to its program rule set. But the program that relies on PSE problem-solving effectiveness or its variants will select specific theories, models, research programs or research traditions as well. As a consequence, an intra-systemic program competition scheme must be organized in order to select theories, models, research frameworks or research traditions. But the idea of such a competition scheme runs counter to the Luhmannian framework and undermines the initial idea of a binary code completely.

«12» In the end, one is left with a big bag of new questions once the journey along a particular line of systemic thought in the Luhmann tradition has been started. One could repeat this type of exploration with many other Luhmannian notions, which in the end provoke more questions than they are able to solve in the first place.

More questions for constructivist readers

«13» But there is also a third context where Luhmann raises more questions than answers. And the third context is populated by groups who look for interesting and fruitful hypotheses, trends, conjectures, aphorisms, and the like in the fields of language, evolution, society, etc. Furthermore, the third group will profit strongly from Luhmann’s work because they will usually find a particular aspect or an enlightened guess that is worth pursuing, producing many new and challenging questions for their future research. Why? Because Niklas Luhmann was an original and inspiring thinker and because it … can be generally stated that Luhmann was able to synthesize Parsonian systems theory … (and so ad infinitum)

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On Reading and Critiquing Luhmann

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> Upshot • I acknowledge the value of Buchinger’s contribution to my understanding of Luhmann’s theory of social systems and seek some clarification and elaboration concerning specific issues. In particular, I raise some questions about the concepts of meaning processing and of psychic systems and persons, with reference to related ideas developed by Gordon Pask and myself. I also question how Luhmann uses the term “autopoiesis.”

Introduction

«1» From what I have managed to understand of Niklas Luhmann thus far in my reading, I am persuaded that his social systems theory is a remarkable achievement. I am also persuaded that it has improvable flaws. Luhmann’s vision of what a “super-theory” (his term) of social systems should be is inspirational. I believe he is firmly on the right track in basing his theorising on the theory of self-referential systems, developed as part of what has become known as second-order cybernetics. Here, I can only indicate the few ways in which the theory could perhaps be better founded on or aligned with other work in cybernetics.

«2» First, I will briefly comment on Eva Buchinger’s article. I will then raise questions about some aspects of Luhmann’s theory that I find troublesome or contentious in the hope that this will lead to further debate and clarification. My questions concern (i) the concept of a meaning-processing system (ii) the concepts of psychic systems and person (iii) Luhmann’s use of the term “autopoiesis.” I conclude with some comments on the value of a super-theory such as Luhmann’s.

Buchinger’s achievement

«3» Luhmann describes his theory of social systems as “nonlinear” and with a design like a “labyrinth” (Luhmann 1995a: liii). I believe Buchinger has done a magnificent job of setting out before the reader major parts of the architecture – the skeleton as it were – of Luhmann’s theory, a theory she herself refers to as rigorous. She has also set out the chief components of the kaleidoscopic montage of sources that Luhmann draws on and shown how they have been transmuted and woven into his theory. I believe that, as set out in her intentions, she has made the case for the innovative nature of Luhmann’s theory of social systems.

«4» With respect to varieties of constructivism, Buchinger has usefully highlighted the contrast between a meaning system’s self-reproduction and Ernst von Glasersfeld’s concept of viability. Luhmann’s theory can more readily account for anomalies, such as the behaviour of the Shakers, whose beliefs (the meanings they found in the world) lead them to choose not to reproduce biologically.

Luhmann’s concept of meaning processing

«5» Buchinger has helped us see how Luhmann draws on Husserl in developing his central concept of meaning-processing systems. In §21, she cites Edmund Husserl thus: “Psychic acts are meaning-processing entities in which expressions (words, sentences, etc.) are related to objects (concrete things perceptible by the senses or imagined, or facts, characteristics, categorical forms, etc.).” However, I did not find this emphasis on the role of linguistic expressions in Luhmann. Without it, one could gain the impression that, as discussed in
ethology and biosemiotics, all organisms are meaning processors.1

My concern here is that whilst a phenomenological description is useful in helping us appreciate what the underlying mechanisms must account for, such an analysis does not (and cannot) specify the underlying mechanisms. Cognitive psychology is replete with experimental studies of reaction time, recognition and recall, selective attention directing, and many other cognitive activities. The studies are accompanied by models of the processes thought to account for the phenomena. Such explanation by mechanistic modelling is lacking in Luhmann's theory, much as he refers to "information processing" and "meaning processing." How these processes work is as opaque as Immanuel Kant's accounts of the workings of his "faculties." For guidance on this question of theoretical adequacy, I refer to cybernetics, in particular to Gordon Pask's definition: "Cybernetics is the science or the art of manipulating defensible metaphors" (Pask 1975a: 15). A metaphor is an abbreviated form of an analogy. In science, the analogy relations are between an abstraction, a model, and the aspects of the empirical world that it is intended to illuminate. For W. Ross Ashby, "Cybernetics takes as its subject matter the domain of 'all possible machines'" (Ashby 1956: 2). Ashby uses "machine" as a synonym for "system," where a machine is something that persists. He wants us to ask how something persists. What are the mechanisms? Thus, we can ask what are the mechanisms that account for a meaning system and its persistence? There is a more extended discussion of "cybernetic explanation" in Scott (2000), with particular reference to how one models the processes involved in child development (see my criticism in §8 below).

It is worth noting that the conception that organisms need objects to stimulate the senses for them to become active, mentioned by Buchinger (§9), is a major error in the thinking of Kant and many others before the 20th century. As discussed by Heinz von Foerster, Ashby; Stafford Beer, and Pask, organisms are self-organising systems. They are dynamic, active systems that eat variety. Pask goes so far as to say that humans have a need to learn (Pask 1968, 1996). These are the dynamics of awareness. We are aware of that about which we have some uncertainty. As that uncertainty is reduced by learning and problem-solving, we get bored and look for more novelty to process. Pask has developed detailed models of these processes, supported by a wealth of empirical studies (Pask 1975b, 2011). The closest that Luhmann comes to describing these phenomena is in his discussion of the instability of meaning, where, as noted by Buchinger (§51), he states that meaning-based systems "constantly scour their environment for impulses." I think this metaphor is conceptually confused, as this is part of a phenomenological description not a mechanistic explanation.2

On psychic systems and persons

Next, I wish to question the distinction Luhmann makes between psychic systems and persons. Luhmann acknowledges that psychic and social systems have co-evolved and discusses socialisation in terms of their "interpenetration." However, he pays little attention to the ontogenesis of psychic systems in child development and thus, I believe, fails to see that his psychic systems are constituted in person form from the outset, albeit with multiple forms that manifest in different contexts. This overlaps with how he uses the term "meaning processing." As Buchinger tells us, Husserlian meaning processing is about establishing correspondences between experience and a symbolic representation. The human capability to process meaning in this way develops in ontogeny as part and parcel of becoming a person. That personhood may differ in different contexts does not imply there are some generic processes that take on these personae. The accounts of ontogenesis provided by George Herbert Mead, Jean Piaget, Lev Vygotsky, and others are helpful here. In Scott (2007), I attempt a synthesis where I appeal to Pask's conversation theory (Pask 1975b) as a useful theoretical structure in which to capture the synthesis. In Scott & Shurville (2011), there is a more focussed account that addresses the question of how the "signs" in which we think emerge as shared significant symbols. Jung's (2007) theory of psychosocial systems also includes a genetic dimension.

For Pask, the dynamics of human cognition (Pask's term is "conceptualisation") are conversational in form. He makes an analytic distinction between conceptual systems, which he refers to as "psychological (P-) individuals," and "mechanical (M-) individuals (brains, bodies, and their augmentations) that embody them. It is the dynamics of the autopoesis of M-individuals that provide the mechanism for the on-going "symbolic evolution" (Pask's term) that constitutes human learning and problem-solving. He stresses that there is an interaction. (I see this as a case of what Luhmann refers to as the interpenetration of systems). What is being thought affects the brain that embodies that thought. Vice versa, structural changes to a brain affect what is being thought. Warren McCulloch (1965: 390) captures this complementarity, with a reference to Stoic logic, in an aphorism: "A thought in the head is like a fist in the hand" (my paraphrase).

A powerful aspect of Pask's analytical distinction between P- and M-individuals is that it frees us from the need to maintain a 1:1 correspondence. Thus a single M-individual may embody several interacting P-individuals; a single P-individual may be embodied by several M-individuals. A single P-individual may be considered to be a recursively nested set of interacting P-individuals. In this way, Pask provides a theoretically satisfying way of clarifying the distinction Luhmann makes between psychic systems and persons and of avoiding the distinction Luhmann makes between psychic and social systems and the complexities of accounting for their interpenetration. Luhmann's intention is to create a theory of social systems. For him, the distinction between psychic and social systems (in which to capture the synthesis. In Scott & Shurville (2011), there is a more focussed account that addresses the question of how the "signs" in which we think emerge as shared significant symbols. Jung's (2007) theory of psychosocial systems also includes a genetic dimension.

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1 | The relation between "cognition" and "language" is not a simple one, as shown when their interplay is explored in ontogenesis. I discuss this interplay in Scott (2011: Chapter 9).

2 | For a sophisticated account of "cybernetic phenomenology" and a discussion of relevant explanatory metaphors (organism, mind, machine, template), see Richard Jung (2007).

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social systems is a founding predication. He specifically states that by definition the internal conversation of a single human being is not an example of one of his “interaction systems” as it only involves one human being.

**Luhmann and autoopoiesis**

My reading is that Luhmann misrepresents Humberto Maturana and Francisco Varela’s concept of autoopoiesis. I am aware this has been proposed by many other commentators and is a contentious issue. Here I merely note my own disquiet. Maturana and Varela make the important distinction between “organisation” and “structure.” In an autoopoietic machine, a system’s organisation, whatever else it does with respect to its interactions with its environment and with itself (what it takes as input, what it produces as output) must reproduce itself. The system’s particular structure may change from instant to instant but the circularity or closure of its organisation must be conserved. Maturana and Varela also use the term “operational closure.” Here they are referring to a network of dynamic processes (operations) whose effects do not leave that network. They lead only to further operations within the network. In Maturana and Varela’s account, operational closure is exemplified by the operations of the nervous system. Operational closure as a process is not by itself autoopoietic. It requires the organisational closure of autoopoiesis. 5

Luhmann makes a central metaphorical use of the concept of operational closure to describe the closed nature of meaning-based systems (meanings lead to meanings; communications lead to communications) but does not refer to the concept of organisational closure. My conclusion is that in invoking the term “autoopoiesis,” Luhmann has carried out a partial metaphorical borrowing only. Inevitably this has lead to much confusion and debate. It would have been better, perhaps, if he had not used the term at all beyond its original biological context.

**Conclusion**

Finally, what is the value of Luhmann’s theory? For example, can it help us understand all that happens — or is required to happen — in the kind of critical circumstances that frequently face us now? In such circumstances institutionalised procedures have to be interpreted and followed in specific contexts, with humans learning and solving problems together in the autoopoietic activities of protecting, maintaining, and repairing the systems that support them? I believe, with some qualifications, that the answer is “yes.” The Paskian P-individual, in order to reproduce itself, must also reproduce the material fabric, the M-individual that embodies and supports it: brains, bodies, and extensions, such as dwelling places, computers, vehicles, and protective devices such as clothes and weapons. The more complex architecture of Luhmann’s supertheory may permit us to examine and analyse these activities and processes in more detail.

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**Luhmann’s Legacy: Illuminating Constructivism, or III-Luhmann-ized Constructs?**

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> Upshot • Buchinger’s review of Luhmann’s theoretical framework leads to a conclusion that Luhmann’s consolidation of a kaleidoscopic array of sources represents his primary innovation. However, this conclusion bypasses the question of whether Luhmann’s admirably fused result actually reflects viable — or even valid — applications of those sources he purports to integrate. I shall illustrate grounds for doubt on this question with specific regard to the construct Luhmann most centrally adopted — autoopoiesis.

**Introduction**

Let me begin by congratulating Eva Buchinger on a notably rich and informative review of Niklas Luhmann’s work in a limited space. Her characterization of his bases as kaleidoscopic (§4, §63) is apt, insofar as they are numerous and drawn from a variety of scholarly fields. Similarly apt is her conclusion that Luhmann’s most innovative contribution relates to consolidating his selected inspirations into a coherent framework (§63), whereas his adoption and translations of the concepts he selected for incorporation were less clearly innovative (§62).

However, a kaleidoscope is a mere divertissement intended to bedazzle the viewer. As Buchinger notes (§4), Luhmann’s work is a challenge to evaluate owing to his wide-ranging interdisciplinarity and assimilation of concepts for which he offered little detailed exposition. Scholars unprepared to critically analyze Luhmann’s choices of, modifications to, and interconnections among those borrowed concepts may have little choice but to remain simply bedazzled or admire his overall theoretical edifice by default. How many among Luhmann’s original target audience (sociologists) are knowledgeable in the systems/cybernetics topics he invoked as key components of his framework, as contrasted with the relatively many who should be familiar with the philosophical and sociological topics by which he laid out his thematic settings and objectives?

Buchinger addresses these settings and objectives at the outset, and she concludes with a cautiously positive evaluation of Luhmann’s composite result in terms of its being innovative. The one reservation I have is that this exposition moves from problem statements to evaluation of Luhmann’s product without addressing something more important than how innovative Luhmann may have been — i.e., the extent to which his treatment of precedent sources was viable or even valid. I do not fault Buchinger for bypassing this topic — such discussion might well require an entire book.

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5 | Whitaker’s *Encyclopedia Autopoietica* at http://www.enolagaia.com/EA.htm provides useful commentaries on these different kinds of closure in the theory of autoopoietic systems, with quotations from key sources.
“4” Nonetheless, absent such discussion, Buchinger is on thin ice in claiming a “...systems/cybernetics constructivist heritage that supports [Luhmann’s] differentiated and elaborated contribution” (§65). In the remainder of this commentary I shall attempt to illustrate how thin that ice may be (and, hence, how important it is that the bypassed discussion be seriously undertaken) via some selected points regarding the concept Luhmann most famously and most centrally exploited to his own ends, i.e., autopoiesis.

Examples: Problems with Luhmann’s treatment of autopoiesis

“5” Luhmann (e.g., 1986) characterizes autopoiesis as a construct (a) originating in biology; (b) initially defined with peculiar regard to biological systems; and therefore (c) requiring generalization beyond a strictly biological context to serve his purposes.

“6” The first point is sound; the latter two are unsupportable. Varela, Maturana & Uribe (1974) seminally defined the construct quite generally and without biological specificity in terms of abstract “autopoietic machines,” of which living systems are a specific instance. This supra-biological abstraction is reflected in both Luhmann’s (1986) quotation of Maturana’s definition and his own cursory explanation of its implications. Nonetheless, Luhmann amplifies upon this bio-specific fiction to argue,

“8” Varela, Maturana & Uribe (1974) lay out a clear procedure for determining whether a system exhibits autopoiesis. What prevented Luhmann from demonstrating autopoiesis in psychic and social systems using this procedure? He admits an inability to do so because

“9” Even though Luhmann proceeded to define communications (on his terms) as the relevant components in a social system, he never deigned to go back and demonstrate their autopoiesis via the prescribed procedure. As such, there is no clear basis for concluding either (a) Luhmann assimilated anything beyond the concept’s label or (b) his own connotations for that label necessarily correlated with its seminal specification.

“10” Even at this very general and initial stage in engaging Luhmann’s theorizing, we confront questions of viability and validity. Are self-serving misrepresented, superficial inference, and avoidance of correlating one’s work with the precedents allegedly employed “in the range of standard scientific reasoning and progress?” (§62)

“11” Such issues are not confined to this very general level of reference. Having misrepresented autopoiesis, Luhmann proceeded to exploit the construct in little more than name alone. I concur with Bernard Scott’s OPC (this issue) that Luhmann only partially adopted the canonical autopoiesis construct. However, I would go farther and indict Luhmann for distorting both (a) those elements he selectively used and (b) the degree to which his theorizing innovatively applied them. Let me illustrate the grounds for these claims with some selected examples.

“12” Luhmann’s grasp of canonical autopoiesis is so questionable that he demonstrably misunderstands where it applies, even in its original biological application. His attribution of autopoietic status to brains is clearly mistaken (Luhmann 1986, Figure 1). The brain – indeed the entire nervous system – is an operationally closed subsystem within an autopoietic organism. It is not itself autopoietic, even though its constituent neurons are individually autopoietic and its operations participate in integrating the autopoiesis of the overall organism (cf. Maturana 1975; Maturana & Varela 1980a). This error may explain Luhmann’s similarly mistaken correlation of autopoiesis and operational closure (see below).

“13” Luhmann recasts autopoiesis with primary regard to a sense of closure that clearly reprises Maturana and Varela’s operational closure, absent acknowledgement that he is simply repeating them. Operational closure connotes that the operational effects of interest are manifest wholly within the bounds of the system/unity to which they are attributed. Maturana and Varela applied this construct to the nervous system alone, to illustrate that its internal operations (e.g., electro-chemical transactions) pertain only within the nervous system itself. Operational closure has no requisite relationship with autopoiesis nor with Varela’s autonomy, of which autopoiesis is a subset (cf. Varela 1979). The form of closure definitive of autonomous (and hence autopoietic) systems is organizational – not operational – closure. Invoking this solely appropriative form of closure would have obligated Luhmann to address the key distinction between organization and structure (in Maturana’s terms) and attend to the defining issues specified in Varela, Maturana & Uribe (1974) – both of which he evaded.

“14” Luhmann repackaged multiple points made by Maturana and Varela, sometimes using new labels justified by (at best) minor glosses. For example, his “resonance” (cf. §§41, 57) is a straightforward reprise of structural determination (cf. Maturana & Varela 1980a), given the appearance of novelty by redirected allusion to von Foerster (Table 1 in Buchinger’s article). Similarly, it is unclear whether or how Luhmann’s “irritation” differs from Maturana and Varela’s “perturbation.” Buchinger notes (§48) that for psychic and social systems, “...the elemental unity is constituted as an element in relation(s) (and not ontologically given).” Maturana originally characterized an ob-

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server’s operations as being conducted solely in terms of “pure relations” (Maturana 1970). Maturana’s explanations for linguaging (and hence social) behaviors are explicitly relational in this same sense (as coordinations of coordinations … of behaviors; cf. Maturana 1988).

Luhmann’s stated intention was to generalize the original autopoiesis construct. He encrusted the construct with additional specifications (e.g., connections to meaning) that narrow rather than broaden its applicability. It was also methodologically anomalous to have allegedly generalized a construct without any mention of its extant generalization in the original literature (Varela’s 1979 contextualization of autopoietic systems as a subset of autonomous systems). Luhmann did not generalize the original concept of “autopoiesis”; he narrowed it and invented two variants tailored to fit the psychic and social contexts his agenda dictated.

**Conclusion**

Buchinger’s review of Luhmann’s work (on Luhmann’s own terms) is an admirable synopsis given the available space. Within that expository scope I generally concur with her conclusions regarding how innovative he may have been. Still, Buchinger’s contribution should not be viewed as a capstone, but rather an entry point into a long-overdue discussion of how viable, or even valid, Luhmann’s applications of his selected systems/cybernetics bases may be.

I therefore recommend the constructivist community should not embrace Luhmann’s work without the critical scrutiny that would derive from the discussion heretofore bypassed. Among Luhmann’s originally targeted audience (e.g., sociologists), his kaleidoscopic contribution is seen as stimulating or even revelatory. However, among those knowledgeable in the pre-eminents he exploited, Luhmann’s legacy includes confusion and discord. One example concerns Maturana and Varela’s work, for which Luhmann’s arbitrarily piecemeal and demonstrably distorted treatment of (e.g.) autopoiesis is “ill-Luhmann-izing” rather than illuminating. Let us not be content with bedazzlement at Luhmann’s kaleidoscope; let us move on to the critical analyses our scholarly roles recommend.

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**Author’s Response: Adoption Strategies and Applicability of Luhmann’s Approach**

**Eva Buchinger**

> **Upshot** - The three OPCs are instructive and inspiring, in particular for their pursuing of the question-generating function of Luhmann’s approach. Whereas Müller elaborates three broad perspectives (inventors, interpreters, and readers of constructivism), Scott concentrates on three specific socio-psychological issues (meaning, person, autopoiesis) and Whitaker addresses especially autopoiesis. In the response I first deal with specific issues and then with Müller’s three perspectives.

**Questions about “meaning,” “person” and “autopoiesis”**

1. Bernard Scott’s questions concerning meaning aim at its dependence on linguistic expressions (§5), the modeling of information in meaning processing (§6), and the stability/instability of meaning systems (§7). He doubts the adequacy of Luhmann’s approach in this respect. I share only some aspects of these doubts; for example those that lead to the suggestion that an enrichment of Luhmann’s theorizing on the basis of empirical investigations would be beneficial. Generally, I think that Luhmann was successful in interlinking meaning, language, and information in his theorizing. First, although language is not absolutely necessary in Luhmann’s conceptualization of meaning-based communication (i.e., nonverbal interaction may be sufficient in certain situations and meaning is defined pre-linguistically as referential context), it is valued as a “secondary specialization of the communication process” (Luhmann 1990e: 32), which is a precondition of all higher evolution of meaning and allows for a more or less unlimited number of types of behavior that can be used in interaction. Second, only the internal meaning-processing stability of systems allows for their openness to the environment. Third, the “production” of information in this context is “modeled” as a specific selection; i.e., as part of communication as a three-part unity (whereby utterance/corporeality, thematic centering, and expectational nexuses play an important role). In an interdisciplinary approach, I collaborated with physicists in elaborating a mathematical model to explore some of these “mechanics” in Luhmann’s theorizing (Barber et al. 2006).

2. Next, Scott questions Luhmann’s conceptualization of “psychic systems” as distinguished from “the form person” (§§8–10). Here I agree completely with Scott’s remark that Gordon Pask provides an enlightening theoretical framework with the P-individual/M-individual scheme. Especially, the potential of M-individuals for embodying and supporting the processes of P-individuation (Scott 2009: 153) deserves attention.

3. Third, Randall Whitaker (§§5–15) and Scott (§§11–12) criticize Luhmann’s adoption of the biological concept of autopoiesis (and especially the notion of operational closure). This is a widely disputed issue whose relevance is not least confirmed by the originators’ discomfort with this.
adoption. My understanding is that the dominating labeling of Luhmann’s theorizing with the term “autopoiesis” is overdrawn. Of course it is clear that Luhmann himself provided for this domination by prominently and repeatedly using the term “autopoiesis.” But he also repeatedly insisted on the difference between living and psychic/social systems and claimed much more than an adoption, namely a paradigm change. As far as I can judge, autopoiesis was, for Luhmann, a conceptual vehicle like other conceptual vehicles. In the introduction to his well-known Social Systems, he chose a different setting of priorities. It is general systems theory that should be tested in an encounter with sociological material and in this way concepts from other disciplines (including the concept of autopoiesis) could be made useable in sociological research:

“...One of the most important results of this encounter, from which I hope both sides will profit, resides in the radical temporalization of the concept of element. The theory of self-producing, autopoietic systems can be transferred to the domain of action systems only if one begins with the fact that the elements composing the system can have no duration, and thus must be constantly reproduced by the system these elements comprise.”

— (Luhmann 1995a: 11)

“4” In this conceptualization, systems would cease if they could not equip their temporalized elements with a capacity for connection that allows reproduction. Here, the capacity for connection is provided by meaning; i.e. meaning structures withstand the dynamics of the immediate (and not merely gradual, entropic) dissolution of the elements.

“5” In my understanding, the cornerstones of Luhmann’s theorizing are “temporalization” and “meaning.” In this respect, he benefited mostly from the work of Edmund Husserl (I elaborated this viewpoint earlier in Buchinger (2006) and repeated and complemented it in my main text). In accordance with this, I do not object the critique of Whitaker and Scott, although I do not believe that Luhmann’s work should be characterized as a phantasmagoria. I can follow their observation that Luhmann repackaged several of Maturana & Varela’s notions under new labels whereby he only partially adopted them, and that this might turn out as misinterpretation from the perspective of the originators. Therefore I will not insist here on the justification of the adoptions (I would be happy to able to contribute to such a discussion in the future). Instead I would like to draw attention to another area of critique that seems even more fruitful, namely Luhmann’s appropriation of the philosophy of the subject. Jürgen Habermas— an experienced observer and critic of Luhmann’s developments over decades — started a discussion about this issue in the 1980s (Habermas 2007). He remarks that Luhmann’s system theory presents itself as the successor to an abandoned philosophy (whereby I disagree, i.e. that the philosophy of the subject from Kant to Husserl is abandoned), and that Luhmann’s conceptualization of system relations is modeled after that of the subject (whereby I agree). In this context I find Habermas’ critique of Luhmann’s adoption of Husserl’s concept of meaning as indicatory for the ongoing discussion.

Questions concerning “inventors,” “interpreters” and “readers” of constructivism

“6” Karl Müller chooses a different starting point from Scott and Whitaker but comes to a similar conclusion as far as the inventors of constructivism are concerned (§3). He refers to Maturana & Varela’s reservation that their biological concept of autopoiesis could be used in other disciplines as well as to von Foerster’s skepticism that Luhmann’s notions of recursive closure/resonance could be an adequate adoption of his notion of Eigenform. I share his guess that for these and for other proponents of constructivism, such as Gregory Bateson or Jean Piaget, it would have been difficult to reach a consensus about whether Luhmann’s work would lead to a dead-end or to a vital research trajectory: as long as this issue is unsettled, Luhmann’s theory of social systems functions perfectly as question-generator.

“7” Concerning the interpretation of constructivism, Müller questions the relevance of Luhmann’s approach for users (§§4–12). He especially scrutinizes the binary coding and the respective programs of societal systems (i.e., function systems). This is indeed a challenging point for those who aim at the practical application of the theory of social systems. In my understanding, Luhmann’s elaboration of the complex “codes & criteria & programs” on the level of societal systems is somewhat sketchy and I agree that the theoretical elegance of the notion of binary coding does not accordingly result in empirical applicability. I would say that Luhmann progressed in this issue on the level of organization systems. In his book on organization and decision (Luhmann 2006), he distinguishes between premises of decisions (Entscheidungsprämissen) and programs of decisions (Entscheidungsprogramme). Whereas decision premises provide for general orientation (a functional equivalent at the level of organizational systems to codes at the level of societal systems), decision programs guide specific decisions (if–then decision programs, purposive decision programs). This conceptualization on the level of organizations could possibly inspire the further elaboration of the “codes & criteria & program” complex on the level of societal systems.

“8” Concerning the readers of constructivism (§13), Müller expresses his conviction that they will benefit from fruitful hypotheses, trends, conjectures, etc. This is a conviction that is definitely congruent with my own point of view.

Conclusion

“9” It seems to be generally agreed that Luhmann’s theory of social systems is challenging as well as inspiring. The complex theory architecture and the partial recklessness in the treatment of the scientific heritage have to be accepted because they go together with the provision of a fruitful theoretical framework.

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Combined References


OF RELATED INTEREST

THE CYBERNETICS OF SELF-ORGANISATION, LEARNING AND EVOLUTION

This book is a collection of Gordon Pask’s papers between 1960 and 1972, selected and introduced by Bernard Scott. Gordon Pask (1928–1996) left an extraordinary body of work and a study (room) that those who knew him recognised as both his archive and a map of his brain and person. For Pask, the study of human learning was also the study of himself. Pask’s groundbreaking work has laid foundations for the development of a more humane understanding of human action, and an intelligent interaction between humans and computers. Pask’s Conversation Theory, and the later Interaction of Actors Theory, are thoroughly constructivist theories, concerned with the (necessarily) personal generation of understandings of the world which are uniquely of each participant in any conversation.

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Observing Environments

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1 Introduction

- Environments are pivotal to modern societies. As Niklas Luhmann wrote in *Ecological communication:* “Contemporary society feels itself affected in many different ways by the changes that it has produced in its own environment” (Luhmann 1989: 1), referring to consumption of non-replaceable resources, biodiversity loss, pathogen resistance, pollution, and over-population (and today we would add climate change to that list). Modern society not only changes its own environment – it compromises the quality of human life and undermines the conditions for its own continued existence. Since Gro Harlem Brundtland (1987), this problematic has been high on the political and scientific agenda. It is generally discussed within the framework of environmental sustainability, based on ideas such as sustainable yield in forestry, ecosystem carrying capacity in ecology, and natural capital in economics, generalised to the consideration of global life support systems (Goodland 1995).

- The problems of environmental sustainability are “wicked problems” in the sense of Horst Rittel & Melvin Webber (1973). Wicked problems are complex, unique, dynamic problems that are never really solved. Different individuals and organisations disagree on what the problem is because they have different values and interests with regard to it and different perspectives on it. They therefore frame and formulate the problem differently. Bryan Norton emphasises:

> For those frustrated with the lack of progress in many areas of environmental protection, Rittel & Webber's work suggested a powerful explanatory hypothesis: Complex environmental problems cannot be comprehended within any of the accepted disciplinary models available in academy or in discourses on public interest and policy. This failure is not a matter of inadequate practice, but a matter of principle. 44 (Norton 2012: 449)

- With respect to wicked problems, we face an analytic void, Norton continues, and future analyses of complex environmental problems must be highly contextual.

- In other words, complex environmental problems are inherently multiperspectival. Each scientific and stakeholder perspective constructs its own immediate problem, which is but one aspect of the “really efficient” dynamic problem. Such complex problems therefore require transdisciplinary research cooperation that incorporates the dependence on context and perspective into an explicitly constructivist and perspectivist framework (cf. Alrøe & Noe 2011).

- However, the issue we want to address here is not on the level of different perspectives on environmental problems, but on the deeper foundational level of how “environment” is construed in different approaches to such problems. More specifically, we are interested in the construction of “the environment” in different constructivist approaches.

- The basic tenet of constructivism is the essential observer-dependency of observations and knowledge (as evident in Humberto Maturana’s statement that “anything said is said by an observer” and Heinz von Foerster’s basic idea that observers are necessarily involved in their observations and not neutral or outside, cf. Schmidt 2010). All constructivist approaches therefore share the intricate problem of the relation between observer and world – or system and environment. And any universal constructivist approach (sensu Luhmann 1995: 15) must be able to observe itself and its construction of “the environment.”

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The three theories in focus are all constructivist in the sense that they take observer-dependency as a basic precondition. However, we have been elaborating a constructivist and perspectivist framework for research in complex agroecological systems and problems of environmental sustainability, based on these and related theories, and through this work it has become clear to us that they contradict each other in important and quite fundamental ways. In particular, they have, as we shall see in the following, different conceptions of “environment,” which are related to their conceptions of “observation” and “system.”

The aim of the paper is thus two-fold: to clarify the concepts of environment in different constructivist approaches, and thereby to assist the sciences of complex systems and complex environmental problems.

To meet this aim, we shall first describe how we go about observing environments, keeping track of different terminologies and perspectives, and give an overview of the concepts of environment (and related concepts) in von Uexküll, Maturana & Varela, and Luhmann, based on their own descriptions. On this basis, we then discuss the possible deeper conceptual differences in their conceptions of environment, focusing on differences that are important in relation to the foundation of constructivism and perspectivism. Finally, we draw some conclusions with regard to the application of constructivist theories on complex environmental problems.

2. Observing “the environment” in von Uexküll, Maturana & Varela, and Luhmann

2.1. How to observe environments

In this section, we will give an overview of the concepts of environment and related concepts in von Uexküll, Maturana & Varela, and Luhmann, based on their own descriptions. But first we shall give a brief description of how we go about observing these environments.

If you accept observer-dependency as a built-in precondition for scientific cognition and communication, you will be prepared for certain difficulties in observing the concepts of “environment” in different scientific approaches. The methodological challenge has three layers:

1 | the problems of different terminology (that the different approaches use different terms for “environment” and hold different meanings of the same terms),
2 | the connection of the terminological differences to deeper differences in perspective, and
3 | our need to clarify our own analytical perspective and make clear what concepts of observation and environment are used in the analyses and comparisons in order to discuss these differences.

These methodological problems are no different from those encountered in other interdisciplinary work, but with the added twist that the research object is (also) the very concept of “a research object,” since this (the research object) is a key aspect of the environment of a scientific system.

As we have indicated, we will address this convoluted issue of observing environments by way of a perspectivist approach (cf. Alrøe and Noe 2011). This means that we will not only be looking at terminology in the form of different terms for “environment” and different meanings of the same terms, but also at the deeper differences in perspective that the terminological differences are connected to. We look at the differences in perspective in terms of elements such as domain and interests, type of examples, type of logic and model, and concepts and theories. With regard to our own analytical perspective, it builds on the very constructivist approaches that are scrutinized here, as well as other sources. In particular, our approach builds on Charles Sanders Peirce's theory of semiotics, and we shall utilize this comprehensive theory of meaning and representation in the critical analysis of the three constructivist approaches. This work will thus also have the added bonus that it will enable us to take a critical look at the perspectivist approach itself and the concepts of “observation,” “system,” and “environment” that are employed here.

In accordance with this background, we will look first at von Uexküll’s conception of environment, which was strongly influenced by the prominent Kantian philosophy of understanding that also influenced Peirce’s semiotics. This philosophy, with its Copernican turn from “our cognition must conform to the objects” to “the objects must conform to our cognition” (Kant 1998: B xvi), is in many ways fundamental to constructivism (Glaserfeld 1995: 39) and an important root of perspectivism (Palmquist 1993). Von Uexküll’s concept of environment, Umwelt, is now being widely used and debated, and this will help us elaborate a firm basis for the analyses. Furthermore, von Uexküll’s work predates that of Maturana & Varela and Luhmann, and by proceeding in chronological order we will be better able to discuss how the approaches compare and differ.

2.2. von Uexküll’s Umwelt

Von Uexküll considered himself Kantian in orientation, and he explicitly referred to Kant as a starting point for his work in biology. All reality is subjective appearance, he states, describing the solid ground that Kant prepared to support the edifice of the natural sciences. Kant placed the subject called man in opposition to its objects, and outlined the basic principles according to which objects are formed in our mind.
"The task of biology is to expand the result of Kant's research along two lines: (1) To consider the role of our body, particularly our perceptual organs and the central nervous system and (2) to study the relationship of other subjects (animals) to their objects." (Uexküll 1973: 9f; translation from Thure von Uexküll 1992: 287)

"17" Uexküll elaborated on this task for the better part of his life, developing a theory of signs and meaning for the study of animal behaviour: "Behaviors are not mere movements or tropisms, but they consist of perception (Merken) and operation (Wirken); they are not mechanically regulated, but meaningfully organized." (Uexküll 1982: 26). In the course of this work he made important independent contributions, especially to the fields of (bio)semiotics and ethology, and also had some influence in philosophy, especially on theories of epistemology (e.g., Kull 1999, 2001; Harré 1990; Buchanan 2008; Stjernfelt 2011).

"18" From 1909, with the publication of Umwelt und Innenwelt der Tiere, through to the end of his life in 1944, von Uexküll focused his research on attempting to discern and give expression to what he called the Umwelten of animals, and which he alternately described as "phenomenal worlds," "self-worlds," and "subjective universes" (Buchanan 2008: 18).

"19" "Each Umwelt forms a closed unit in itself, which is governed, in all its parts, by the meaning it has for the subject" (Uexküll 1982: 30) and "there are as many worlds as there are subjects" (Uexküll 1973: 70). For example, the stem of a blooming meadow flower can be a foot path to food in the Umwelt of an ant, an extraction point for watery sap to feed on and construct a protective cell in the Umwelt of a cicada larva, a morsel of fodder in the Umwelt of a cow, and a means of bodily ornamentation in a girff's Umwelt (Uexküll 1982: 29f).

"20" Von Uexküll uses different metaphors to convey how he understands these diverse animal (and human) environments. For instance, to glimpse the environments of the dwellers of a meadow, he envisages how we can blow, in fancy, a soap bubble around each creature to represent its own world, filled with the perceptions that it alone knows:

"21" There are two important aspects of the concept of Umwelten here: that they are phenomenal worlds and that they are meaningful. Every animal, von Uexküll claims, is surrounded by a world in which the environment is perceived and known to this animal alone, and that may very well be invisible to other animals or humans. The soap bubble constitutes the limit of the animal’s world, inside which things are significant and meaningful, and what lies beyond is hidden (Buchanan 2008: 23). Therefore we cannot easily understand the environment of other living organisms, be they animal or human. Von Uexküll presents the striking example of the female tick (Ixodes ricinus), which is blind and deaf. It has a very simple Umwelt consisting of sunrays, directing her up to the tip of a twig by the photosensitivity of her skin; the odour of butyric acid from mammal skin glands, which signals her to drop down; and a fine sense of temperature that leads her to the skin of the warm-blooded animal where she burrows deep in. "The external world (Welt) is as good as nonexistent, as are the general surroundings (Umgebung) of the organism. Both are theoretical references to contrast with the meaningful world of the Umwelt." (Buchanan 2008: 24)

"22" The precondition for there being limits for an organism to go beyond its own phenomenal world and enter into the Umwelten of other living organisms, is thus that the Umwelt is meaningful to the organism itself. Behaviour is not a mechanical process and animals are not "mere machines" [bloße Objekte], but subjects whose essential activity consists of perceiving and acting:

"23" In accordance with this, von Uexküll characterised his own approach to biology as “The theory of meaning” (Uexküll 1982), and came to be considered the founding father of biosemiotics (Sebeok 2001). Another pervasive metaphor that von Uexküll uses to express his theory of meaning is music: “The musical reference … is crucial to understanding how he interprets organisms as “tones” that resonate and harmonize with other things, both living and non-living.” (Buchanan 2008: 8). For instance, he describes how an object can have different tones or qualities because an object in relation to a subject is a “meaning-carrier,” and the object has different meanings in different contexts (Uexküll 1982: 27).

2.3. Maturana & Varela’s autopoietic living systems

"25" Maturana & Varela’s work can be characterised as “biology of cognition,” and they are most widely known for their theory of autopoiesis as a fundamental characteristic of living systems. They define an autopoietic unity as

"26" a network of processes of production, transformation and destruction of components that produces the components which: (i) through their interactions and transformations regenerate and realize the network of processes (relations) that produced them, and (ii) constitute it as a concrete unity in the space in which they (the components) exist." (Maturana & Varela 1980: 79)
In other words,

"one way to spotlight the specificity of autopoiesis is to think of it self-referentially as that organization which maintains the very organization itself as an invariant." (Varela 1991: 84)

« 26 » The focus on the autopoiesis and cognition of living systems in Maturana & Varela means that their concepts of environment are not as prominent and elaborated as von Uexküll's. They are, however, in many ways congruent with von Uexküll. In describing how their strand of biology of cognition is different from other strands, they "propose a way of seeing cognition not as a representation of the world 'out there,' but rather as an ongoing bringing forth of a world through the process of living itself" (Maturana & Varela 1998: 11). A key point, which is in line with von Uexküll, is the connection between action and experience: "this inseparability between a particular way of being and the way the world appears to us, tells us that every act of knowing brings forth a world." (ibid: 26).

« 27 » The paradoxicality of autopoiesis is that the living system must distinguish itself from its environment while at the same time maintaining its coupling, since it is this very environment that the organism arises from (Varela 1991: 85). In defining what it is as a unity, the organism at the same time defines what remains exterior to it, that is, its surrounding environment:

"… this exteriorization can only be understood, so to speak, from the 'inside': the autopoietic unity creates a perspective from which the exterior is one which cannot be confused with the physical surroundings as they appear to us as observers." (Varela 1991: 85)

« 28 » The recognition of the importance of interpretation and significance as seen from the point of view of the living system is similar to von Uexküll's theory of meaning (though Maturana & Varela apparently did not know of his work). And it leads to a clearly perspectivist distinction that is stated as a key point that may seem obvious, but that has deep ramifications:

I mean the important distinction between the environment of the living system as it appears to an observer and without reference to the autonomous unity – which we shall call hereafter simply the environment – and the environment for the system which is defined in the same movement that gave rise to its identity and that only exists in that mutual definition – hereinafter the system's world. (Varela 1991: 85)

« 29 » In other words, the situatedness of a cognitive entity means that it has – by definition – a perspective, and that it relates to its environment in relation to the perspective established by the agent itself (Varela 1991: 99).

« 30 » The concept of environment is discussed by Maturana & Varela in relation to the two-way fit between organism and environment. This is what they refer to as a structural congruence between organism and environment, which is the result of structural coupling:

In these interactions, the structure of the environment only triggers structural changes in the autopoietic unities (it does not specify or direct them), and vice versa for the environment. The result will be a history of mutually congruent structural changes as long as the autopoietic unity and its containing environment do not disintegrate: there will be a structural coupling. (Maturana & Varela 1998: 74f)

« 31 » This also means that two or more autopoietic units can undergo coupled structural changes when their interactions take on a recurrent or more stable nature, without losing their internal organization.

« 32 » In a separate publication, Maturana makes a more elaborate distinction between medium, niche, and environment from the viewpoint of an outside observer:

The basic operation that an observer performs in the praxis of living is the operation of distinction. In the operation of distinction an observer brings forth a unity (an entity, a whole) as well as the medium in which it is distinguished. (Maturana 1988: 6, viii)

« 33 » The medium of a unity is the containing background of distinctions with respect to which an observer distinguishes it. The medium includes both what Maturana calls the environment of a unity – that part of the background that is distinguished by the observer as surrounding the unity – and what he calls the niche of a unity – that part of the background that the observer conceives as interacting with the unity, and to which it is structurally coupled: "… a unity continuously realizes and specifies its niche by actually operating in its domain of perturbations while conserving adaptation in the medium." (Maturana 1988: 6, xiii)

« 34 » In other words, the niche does not exist independently of the unity, and it changes as the domain of interactions of the unity changes.

« 35 » That is to say, for an observer, the unity is distinguished from its medium, which can be separated into its niche, with which it interacts and couples, and its environment, which (merely) surrounds it.

2.4. Luhmann’s autopoietic social systems

« 36 » Luhmann devoted his life to building a unified theory of modern society based on systems theory and the German tradition of social philosophy from Kant onwards. As for von Uexküll, the concept of meaning was central for Luhmann, who drew especially on the phenomenology of Edmund Husserl,

and he considered meaning the basic concept of the social sciences (Luhmann 2006, 1990: 21ff).

« 37 » Luhmann distinguished four types of systems: machines, organisms, social systems, and psychic systems, of which only the latter two are characterised by their use of meaning (Luhmann 1995: 2–3). This is in sharp contrast to von Uexküll, for whom meaning was a key biological concept. Consequently Luhmann considers only psychic and, predominantly, social systems. These have evolved together, and at any time the

3] It would be interesting and relevant to take a deeper look at Luhmann’s Husserlian perception of phenomenological method, and how this relates to the concept of environment, but that would take us too far astray for this paper. Here we will only note that Peirce regarded Husserl's (early) work as psychologistic in character in spite of Husserl's claim to the contrary; yet Peirce considered his own early work on categories a foundational work in phenomenology (Ransdell 1997). See also Søren Brier (2009) on the relation between Husserlian and Peircean phenomenology and constructivism.
one is the necessary environment for the other (Luhmann 1995: 59). For psychic and social systems, meaning becomes the form of the world and consequently overlaps the difference between system and environment:

"Even the environment is given to them in the form of meaning, and their boundaries with the environment are boundaries constituted in meaning, thus referring within as well as without." (Luhmann 1995: 61)

Society is not composed of human beings, but persons cannot exist without social systems, nor social systems without persons.

"The basic aspect of social systems for Luhmann is communication. Social systems are communicative systems, and Luhmann took the fundamental process of Maturana & Varela's autopoiesis – the system's reproduction of its basic elements to preserve its own organisation – and applied it to social systems in the form of self-production of the communicative elements. Therefore, ecosystems are not systems according to Luhmann. Luhmann states that the usage of the concept of system in this way, as in the normal use of "ecosystem," produces considerable confusion. Based on the theory of social systems, not every interconnection is a system. A system exists only when an interconnection distinguishes itself from an environment. In this systems theoretical sense, the environment is not a system in itself, but something that is constituted by social systems that differentiate and define their own boundaries: "The 'unity' of the environment is nothing more than a correlate of the unity of the system since everything that is a unity for the system is defined by it as a unity" (Luhmann 1989: 6).

"The consequences of this interpretation can be reduced to two points: (1) Society as a system is not seen as a smaller unit within a larger one (the world), but as the difference of the system of society and environment (cf. Luhmann 1989: 6), (2) The idea of system elements must be changed from substances or individuals to self-referential operations of communication that can be produced only within the system and with the help of a network of the same operations (autopoiesis).

"If these two points are accepted then 'society' signifies the all-encompassing social system of mutually referring communications. It originates through communicative acts alone and differentiates itself from an environment of other kinds of systems through the continual reproduction of communication by communication. In this way complexity is constituted through evolution." (Luhmann 1989: 7)

"According to Luhmann, there is no environment in itself. It exists only in relation to something else, like a system as seen by an outside observer or from an observing system that distinguishes itself from its environment (Krause 2005: 250).

"All observation of the environment presumes the distinction of self-reference and other-reference, which can only be made in the system itself (where else?)" (Luhmann 1997: 92, own translation)4

3. Perspectives on the environment

3.1. Fields of observation

"It seems clear from the above observations of the "environments" of von Uexküll, Maturana & Varela, and Luhmann, that they are different in several ways. In this section we will summarize how they are different and analyse what is behind the observed differences.

"As described above, an important (though rather banal) difference between these three approaches is that they are not concerned with the same thing, their focus or field of observation is quite different. Von Uexküll focuses on behavioral biology and how behaviour is linked to the sense and effector organs of the organism. Maturana & Varela share the focus on biology, living organisms, and their cognition. But their emphasis is on neurophysiology and not ethology. To understand the importance of this difference, it is telling that whereas von Uexküll founded the "Institut für Umweltforschung" (at the University of Hamburg), Maturana, for most of his life, ran a research centre on the "Biology of Knowledge" (at the University of Chile). In other words, von Uexküll looked mainly at animal worlds, how they differ, and how they are constructed, while Maturana & Varela looked at the organism itself, the nature of life, and the biology of cognition.

"Luhmann, in contrast to the two others, focuses almost entirely on social systems, as one form of autopoietic system, which he distinguishes from the living systems of Maturana & Varela and from psychic systems of consciousness and thought. For Luhmann, social systems are strictly communicative systems, defining communication as the unity of the selection of information, message, and understanding.

"These differences in domain are important in understanding the deeper differences, and we will return to them in the following analyses.

3.2. Terminology of the environment

"Before we can analyse any deeper conceptual differences, however, we need to look at the immediate terminological differences. The three theories treated in this paper use different terms for the environment, though they, and their commentators, are not always entirely consistent in their usage. Some of the terms are also used in general language, but often in different senses, and there are also difficulties in translating the terms.

"In this section, we will try to clarify the terminology in order to make the deeper conceptual similarities and differences clearer. We shall briefly discuss what might be better and worse terms – realizing that the usage of terms is something that is decided in the community of scholars and stakeholders – and determine the terminology to be used in the remainder of the paper. Since von Uexküll’s concepts are the most elaborate and debated, we will, again, start here.

"The terms "phenomenal world," "self-world," "subjective universe," "subjective world," and "semiotic world" have all been suggested as translations of von Uexküll’s concept of Umwelt (Sutrop 2001). Others prefer "environmental world" or simply "environment" (Buchanan 2008).
In the context of the subjective-objective distinction, which can be misleading because the Umwelt, as a Kantian and semiotic concept, transcends that very distinction. To underline this point, the opposite term "objective world" is in fact used by Deely (2001) and others as a translation for von Uexküll's Umwelt, and this term will be even more prone to misunderstanding. Drawing on von Uexküll's soap bubble metaphor for Umwelt, we could still use his concepts in German (and Danish), Umwelt (om- verden) and Umgebung (omgivelser). The problem with that is that, at least in German, the term Umwelt is today used generally in connections with environmental problems, etc., whereas the more philosophical phenomenological understanding of the term in the tradition of von Uexküll is obsolete, according to Sutrop (2001) (but note Luhmann's use of Umwelt). In Danish, the general term used in connection with environmental problems is "miljø," corresponding to the French "milieu," and "omverden" is used von Uexküll's sense, but also in other sens-

3.3. Point of view on the environment

Having looked at the differences in terms of their field of observation and the terms used to describe the environment, we will now go into some deeper differences related to how they construe their perspectives on environment in terms of the point of view, or observational position, from where the environment is observed.

The constructivist postulate is that "the environment as we perceive it is our invention" (Foerster 2003: 212). As we have seen above, Maturana & Varela very clearly distinguish between the phenomenal world, the environment for the living system, and the environment of the living system as it appears to an observer. They consider the shifting between inside and outside perspectives a cornerstone of biology and the awareness of these shifts a key to understanding the nature of the relationship between autopoietic autonomous entities and their environment (Varela 1991: 85). Von Uexküll also worked with the system of signs of the human observer in opposition to the system of signs of the organism under observation (Uexküll T. 1992).

We consider this distinction between inside and outside perspectives to be a basic premise of perspectivism (Alrøe & Nøe 2011; Alrøe 2000). A similar distinction has been widely used in anthropology and other fields (where the distinction is pivotal to adequate understanding) under the somewhat odd names "emic" (inside) and "etic" (outside) viewpoints, from the linguistic distinction between phonemic and phonetic (Headland et al. 1990).

Luhmann also very clearly operates with a perspectivist approach (though he does not call it that), laying out premises of observation of observation following Maturana & Varela and von Foerster's (1980,

5 | Of course ticks and other animals do not speak of their world, so the inside perspective of animals is that envisaged by an observer.
second-order cybernetics. In a striking formulation, he says that “... a system can only see what it can see. It cannot see what it cannot. Moreover, it cannot see that it cannot see this” (Luhmann 1989: 23).

He describes the environment as a horizon, as the system-internal correlate of all references that extend beyond the system, and that can be pushed back by system operations. As an internal premise, the system’s environment has no boundaries nor needs any:

“The horizon always recedes when it is approached, but only in accordance with the system’s own operations. It can never be pushed through or transcended, because it is not a boundary.” (Luhmann 1989: 22)

But when the system is observed by another system, this observing system can also observe the constraints that the observed system enforces on itself through its own mode of operation. It can observe the horizons of the observed system so that what they exclude becomes evident. Following Maturana, Luhmann calls this “second-order observation.” This clarifies the mode of operation of the system/environment-relations in a kind of “second-order cybernetics”:

“However, Luhmann never attached different terms to those two concepts of environment.5 Maybe the reason for this is that since Luhmann deals strictly with communicative systems, he does not face the strong dual context of living systems, whereas the biologist constantly switches between the (outside) perspective of physico-chemical principles and properties and the (inside) perspective of interpretation and significance. In any case, compared to von Uexküll and Maturana & Varela, this seems to lead to some lack of clarity in Luhmann’s use of the term “environment.”

“65 We follow Maturana & Varela in making a clear distinction between the environment seen from within and without, and maintain that this is a key point in any explicit constructivist and perspectivist theory. Lack of clarity on this distinction leads to contradictions. According to von Uexküll, the complexity of the environment (Umwelt in the sense of phenomenological world) is conditioned on the complexity of the system – more complex organisms have more complex environments and the environment is always less complex than the system. Luhmann, on the other hand, often states that the environment is always more complex than the system (e.g., Luhmann 1995: 182, Krause 2005: 10).

“67 He argues that society is composed merely of communications and that the highly complex arrangement of individual macromolecules, individual cells, individual nervous systems, and individual psychic systems belongs to its environment. No society can bring about the “requisite variety” or corresponding degree of complexity for such an environment:

“However complex its linguistic possibilities and however subtle the structure of its themes, society can never make possible communication about everything that occurs in its environment on all levels of system formation for all systems.”

(Luhmann 1995: 182)

However, as we noted above, Luhmann uses one and the same term, Umwelt/environment, for both inside and outside perspectives on environment. Of course, any “outside perspective” by an observer of the system is also an inside perspective for that observer. But still, if we do not distinguish between the environment seen from within and the environment as seen from some other perspective, we have a meaningful difference that we are not able to communicate. Luhmann was also, or became, aware of this need, perhaps through reading von Uexküll. At least he refers to von Uexküll (1928, 1934), and mentions that in biology he showed an early awareness of the fact that the environment of an animal is not that which we would describe as its surroundings or milieu, and that we can see more (or perhaps fewer) and other things than those an animal can perceive and process:

“This also means that one deals with a different environment depending on whether one has in mind an environment as defined by a system – that is, the external reference of a particular system – or whether one assumes the existence of an external observer whose environment includes the system as well as its environment. It is entirely possible that the external observer can see many more and quite different things that are not necessarily accessible to the system itself... Hence, two concepts of environment must be distinguished.” (Luhmann 2006: 50–51)

6 The quote above is from a lecture held in 1991. In his large, later book on society we can find no indication that Luhmann followed his own call to distinguish between the environment as defined by the system itself and the environment of the system for an external observer (e.g., 1997: 60ff, 128ff, 1025).

7 We agree with Nöth (2011) that while Peircean semiotics cannot be considered a precursor of constructivism as such, it is concerned with some of the same key questions as (radical) constructivism and provides a framework that

http://www.univie.ac.at/constructivism/journal/8/i/039.alroe
According to Kant and Peirce, the phenomena or immediate objects that we experience refer to something beyond the horizon of the phenomenal world, to what Kant calls noumena or transcendent objects, the thing in itself, and Peirce calls dynamical or "really efficient" objects (Palmquist 1993: App. VIII, Alrøe & Noe 2011, Nöth 2011).

"We have to distinguish the Immediate object, which is the object as the Sign itself represents it, and whose Being is thus dependent upon the Representation of it in the Sign, from the Dynamical object, which is the Reality which by some means contrives to determine the Sign to its Representation."

(Peirce CP 4.536)

Phenomena are immediately accessible to us, whereas dynamical objects can only be referred to. A consequence of this is the basic insight that in any first order perspective, we only have access to the environment in the form of our phenomenal world. In none of the three theories have we found concepts corresponding to these more advanced, we believe, constructivist and perspectivist approaches.

Table 1: Concepts of environment from different points of view, showing the terms used by von Uexküll, Maturana & Varela, and Luhmann, and placing the concepts of Kant and Peirce in relation to them. Note: The terms used by Uexküll have not been translated here because there are so many alternative translations. However, the column headings can be considered translations of Uexküll’s terms.

<table>
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<th>Concepts of environment in perspective</th>
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4. The observation of environments

4.1. Observation as distinction or representation

Having looked at different points of view or observational positions on the environment in relation to the three theories, we now turn to the deeper differences in how they observe the environment. As we will show here, there are two very different logics of observation involved, which we characterize as distinction and representation.

Luhmann takes a genuinely radical constructivist approach to cognition: cognition is only possible because it has no access to realities outside itself – because it can advance constructivist and perspectivist approaches.

8 | See Ransdell (2007) for an account of the difference between Kant’s thing in itself and Peirce’s dynamical object.

9 | “Die Realität ist das, was man nicht erkennt, wenn man sie erkennt.”
is operationally closed – and the premise of a common world is replaced with a theory of observation of observing systems (Luhmann 1998: 164ff). In his theory of social systems, the system is defined as the difference between system and environment, and observation is basically an act of distinction (Luhmann 1995: 36, 1998: 167ff). Based on the logic of distinction developed by George Spencer-Brown (2009) in his Laws of form, he formulates a general conception of observation as indication by means of distinction: “Observation is the unity of the difference between distinction and indication” (Krause 2005: 88, own translation). In this he builds on the biological autopoietic theory, which also operates with Spencer-Brown’s logic of distinction (Maturana & Varela 1998: 40), as elaborated in particular by Varela (1979).

10 | Luhmann has stated that if he were to define an undeniable core in systems theory without which the whole system would disintegrate, it would consist of his thoughts on and sociological application of Spencer-Brown’s calculus of form and theory about observation as operation (Andersen 2003).

11 | “Beobachtung is die Einheit der Differenz von Unterscheidung und Bezeichnung.”

12 | Note that the Peircean notion of representation is very complex, general, and dynamic, and cannot be equated with the simplistic AI idea of representation as a direct mapping between internal symbols and external objects (Nöth 1997). The anti-representationalist views of cognition (e.g., Varela 1991) are thus directed against a restricted and simplistic view of representation and not the semiotic and triadic model of representation (Emmeche 2001).

13 | They do note, however, that Varela et al. (Thompson & Rosch 1991) formulation of an enactive cognitive science is to a large extent compatible with an interactive view of representation. Therefore, they conclude, many cognitive scientists, and certainly many researchers in semiotics, will probably prefer the theoretical framework of Uexküll, whose theories emphasize the central role of sign processes in all aspects of life.

14 | Spencer-Brown himself showed that his “calculus of indications” was equivalent to Boolean algebra (Spencer-Brown 2009: 90ff).

15 | Roughly, an index works by pointing at its object, an icon by resembling its object, and a symbol by way of a purely conventional rule or habit.

16 | Along the same lines, Brier writes that even though the epistemological theory of Maturana & Varela is a kind of constructivism, it is based on phenomenological mechanism and not a theory of how signification is created: “Cybernetic and autopoietic theories fail to elucidate the phenomenological reality of perception and cognition – especially that of animals” (Brier 2008: 326).

17 | By building on the very general concept of observation defined as indication by means of a distinction, Luhmann’s theory is confined to a form of binary logic. In contrast, the (bio-)semiotic concept of observation from Peirce and von Uexküll (1982) is based on a richer conception of meaning and reference (where “indication” is just one of three basic types of sign: icons, indexes, and symbols) and the genuinely triadic form of representation as the relation of sign, object, and interpretant, which cannot be reduced to binary logic (Peirce CP 3.483).

18 | Luhmann (2006) himself acknowledged the difference between the binary form of distinction and the triadic semiotics of Peirce. He suggested that semiotics could be “redrawn” in the form of distinction, where the sign is the difference between signer and signified (Luhmann 2006: 45). We think (in line with Brier 2001) that this is not at all sufficient to replace the conceptually much richer Peircean conception of observation as representation. First of all it misses out the key concept of the interpretant, and second it does not capture the distinction between immediate and dynamical objects.

19 | On the other hand, one of the strengths of observation as distinction is the
4.2. Observation and interaction

Observations can only influence observations, can only transform distinctions into other distinctions, can, in other words, only process information; but not touch things in the environment – with the important, but very small exception of all that which involves structural couplings. Also for observing systems, there is on the level of their operations no contact with the environment. (Luhmann 1997: 92; translation by the authors)\(^\text{16}\)

\(^{16}\) “Beobachtungen können nur auf Beobachtungen einwirken, können nur Unterscheidungen in andere Unterscheidungen transformieren, können, mit anderen werten, nur Information verarbeiten; aber nicht Ding der Umwelt berühren – mit der wichtigen, aber sehr schmalen Ausnahme all dessen, was über strukturelle Kopplungen involviert ist. Auch für beobachtende Systeme gibt es auf der Ebene ihres Operierens keinen Umweltkontakt.” (Emphasis in original quote.)

Although Luhmann uses biological autopoiesis theory as a main point of departure for his general systems theory, he does not adopt the conception of cognition originally connected with the theory (Alroè 2000). Maturana & Varela (1998: 44–45) characterise cognition as effective action, an action that allows a living being to sustain its existence in a certain environment as it reproduces its world – no more, no less.

In the biosemiotic tradition following von Uexküll, there is also a close connection between representation and interaction (Alroè & Nøe 2011). This is strongly expressed in his conception of the Umwelt as consisting of both Merkwelt and Wirkwelt (Uexküll 1992).

In contrast to Maturana & Varela, Luhmann does not have a connection between cognition and action. For him, social systems are strictly communicative systems, and autopoiesis and cognition is the same kind of process.

The consequence, at least for social systems, is that autopoietic reproduction and the operations of self-description and self-observation that use the system/environment difference within the system cannot be separated. (Luhmann 1995: 167)

There is only one kind of operation: communication based on observations as distinctions. The problem with Luhmann’s radical abstraction is that it does not support the important aspects of our lives that are based on the connection between cognition and action, or between representation and interaction, such as learning and meaning.

The tendency in cognitive science to abstraction, i.e., for factoring out situated perception and motor skills, misses the essence of cognitive intelligence which resides only in its embodiment. (Varela 1991: 96)

Much communication is closely connected to a practice and a practical function in society (trade, punishment, consumption, construction, production, transport, sport, war, health, sex, food, science, etc.). If society is a social system and social systems are only communicative, then society has no body. This goes against the insight from Maturana & Varela and others that cognition is embodied. And if society has no body, it does not have a (non-communicative) environment either, consisting of ecosystems, climate, etc., which are key elements in today’s wicked environmental problems.

As we have shown, meaning is a key concept in von Uexküll, and representation entails meaning or significance for the organism:

…every action… that consists of perception and operation imprints its meaning on the meaningless object and thereby makes it into a subject-related meaning-carrier in the respective Umwelt. (Uexküll 1982: 31)

The concept of meaning is very different in Luhmann. According to Brier (2001: 799), Luhmann does not really work with signification, since he, like Maturana & Varela, assumes meaning as granted. He does not work with a theoretical foundation of meaning from a phenomenological point of view other than that it is a surplus of interpretive possibilities and that he wants to leave behind all idea of a transcendental subject. Therefore Luhmann misses an important point in Uexküll’s work and phenomenological theory, and he fails to see how important the biological level is for a theory of meaning.

For Luhmann, meaning is the unity of the difference between the actual and the possible. In a “phenomenological description,” he says that “meaning equips an actual experience or action with redundant possibilities.” (Luhmann 1995: 60). He also says (somewhat vaguely!) that “it is better to avoid references to anything specific, since they always exclude something, and to introduce the concept of meaning as a concept ‘devoid of difference’ and intending itself along with” (Luhmann 1995: 59f), in the sense that: “meaning always refers to meaning and never reaches out of itself for something else” (Luhmann 1995: 62).

In his article Meaning as sociology’s basic concept, he states that “Meaning … overtaxes the potential of actual experience by including and presenting what is not directly experienced.” (Luhmann 1990: 30). But this occurs only within an individual life of consciousness. Here the contents that are
actualized in perception or thought change ceaselessly from moment to moment, and meaning functions as a selection rule to select from other possibilities, and not – or only secondarily – as an actual content appearing in consciousness. In his little article *Complexity and meaning*, he further argues that “meaning is nothing but a way to experience and to handle enforced selectivity” (Luhmann 1990: 82).

96 Luhmann says little about experiential learning, except on a rather abstract level: for example, “expectations that are willing to learn are stylized as cognitions. One is ready to change them if reality reveals other, unanticipated aspects” (Luhmann 1995: 320). But he does not describe how reality reveals. However, the concept of expectation (or habit, in Peirce’s terms – belief is a habit of action) is important in understanding the differences in how learning and adaptation are perceived in the different perspectives.

97 Luhmann considers science as a functional subsystem (among other subsystems) of a differentiated society. He states that the code of scientific truth and falsity is directed specifically toward a communicative processing of experience, i.e., of selections that are not attributed to the communicators themselves (Luhmann 1989: 77-78). However, this seems only to capture the communicational aspect of science that has to do with peer criticism – the cognitive aspect of science as experiential learning is left out (cf. Alrøe 2000).

98 We believe that the notion of embodied learning is a key concept in understanding the relation between system and environment, both in science and in a more general context.**

**Within this emerging framework, learning is conceived and acted out as an organic, embodied process based on the ‘inseparability between a particular way of being and the way the world appears to us’, so that ‘every act of knowing brings forth a world’.** (Horn & Wilburn 2005: 747, referring to Maturana & Varela 1998: 26)

99 In the previous section we highlighted some strengths and weaknesses of Luhmann’s theory compared to Maturana & Varela and von Uexküll. Now we return to our starting point, the prospects for applying different constructivist theories to the wickedness of complex environmental problems. From our point of view, the strictly communicational structure of Luhmann’s social systems theory and the logic of observation as distinction is a key weakness when observing complex environments. For instance, it seems to us that it counteracts the budding acknowledgement in economics that there is a need for alternatives to the dominating neo-classical economics, such as ecological economics, which set ecological boundaries to social and economic systems, and which in this way treat human societies more like organisms that depend on their environment.

100 In this section we will, however, briefly underline some of the particular strengths that social systems theory brings to the bouquet of constructivist theories when it comes to addressing complex environmental problems, and illustrate this with some concrete examples from our own work.

101 First of all, Luhmann treats social systems (including the systems of science) in a way that the two other theories are not capable of. And we do need theories of social systems to observe and handle the relations between complex systems and their complex environments – theories that are able to handle aspects such as self-reference, autopoiesis, and operational closure.

102 In our own work, we have used Luhmann’s theory in connection with complementary semiotic theories to observe and analyse the relation between systems and their environment for heterogeneous systems such as farming systems, which are technological and biological but also social systems (e.g., Noe & Alrøe 2006, 2012). The semiotic theories (Peirce, biosemiotics, actor-network theory) are strong in their ability to handle the heterogeneity of such systems, but lack the strong concepts of self-organization and operational closure that Luhmann’s theory offers to handle these aspects, which are evidently there in our empirical investigations.

103 Secondly, Luhmann (1989: 15ff) uses the concept of resonance to explain the basic condition for there being (autonomous) systems that would not exist as systems if they did not screen themselves off from environmental influences. They resonate with the environment only on the basis of their own frequencies (with an analogy from physics), and they only produce very selective interconnections in the form of couplings. Resonance with the environment is not something to be expected; on the contrary, it is improbable according to systems theory:

**“From the evolutionary point of view one can even say that sociocultural evolution is based on the premise that society does not have to react to its environment and that it would not have taken us where it has if it had proceeded differently.”** Luhmann (1989: 16)

104 The concept of resonance assumes second-order cybernetics; it presupposes a reality that triggers no resonance at all within the system, and shows the inherent constraints on any observational effort (Luhmann 1989: 25). The observed system constructs the reality of its world through a recursive calculation of its calculations, and since this is the case on the level of living, neurophysiological, and conscious systems, Luhmann argues, it cannot be different for social systems either. It can draw no other conclusion than that this applies to its own observation too, but at the same time it can still see that what cannot be seen cannot be seen.

105 In our own work, this is a key insight into the nature of communication in the social systems of food and science, which we have to deal with when making complex assessments of the effects of food systems on their environment,** and which forms an important basis for the development of a genuinely perspectivist methodology (e.g., Alrøe & Noe 2011).

106 Third, there is the extensive theory of differentiation in social systems theory, **18 Reduction of complexity in the communication of assessments of effects of food systems on their environment, for instance through trust and visualisation, is one of three key challenges for the MultiTrust project.**
which seems pivotal in addressing complex environmental problems:

“...complex systems like societies are differentiated into subsystems that treat other social domains as their (socially internal) environment, i.e., differentiate themselves within the society, for example, as a legally ordered political system that can treat the economy, science, etc. as environment and thereby relieve itself of direct political responsibility for their operations. This differentiation theorem has far-reaching consequences.” (Luhmann 1989: 19)

“107 It is just as suggestive as it is misleading to assume that “the” system reacts to “the” environment, even if this is only to “its” own idea of “the” environment, as Luhmann puts it. The idea of “the” environment of society is suddenly obviously dubious.

“108 In our work, we have used the theory of functional differentiation and structural couplets to analyse how decoupling due to the increasing differentiation of agriculture and food networks creates problems of sustainability, and as a new approach to look at sustainability solutions by way of recoupling and new forms of coupling (e.g., Noe & Alrøe 2012).

“109 Fourth, and equally important, is the notion of second-order observation applied to the social and scientific perspectives that are applied to solve complex problems. To analyse the problem of the exposure to ecological dangers with the necessary exactness, second-order cybernetics must be taken as the starting-point. In contrast to a naïve faith in science, second-order observation together with its theoretical apparatus is not “objectively better” knowledge but only a different knowledge that takes itself for better (Luhmann 1989: 25).

“110 If the starting-point was an “objectively” given reality that was still full of surprises and unknown qualities then the only issue would be to improve science so that it could know the reality better. But there are many different systems in society, and since any “objective” approach would by definition be a singular perspective, the relations of the other systems to their environment would not be grasped sufficiently. Even science with its “better knowledge” often finds no resonance within society; because its “better” knowledge has no value in the environment of other systems or is at best a scientific theory for them (Luhmann 1989: 26).

“111 Any first-order observation of the environment is not in a position to grasp the problem of environmental sustainability:

“112 Here Luhmann succinctly sums up the problem of observing complex environments and addressing complex environmental problems. The problem is paradoxical in the sense that any attempt to solve the problem with “doing things better,” such as better science, better implementation, better communication, better decision processes, better access for stakeholder groups, etc., will fail or will even deepen the problem. This is because these solutions do not take into account the differentiation of observing systems in society, and the ensuing differentiation of the environments of observing systems. The problem is the acquisition of a different kind of insight:

“113 From our viewpoint, the problem Luhmann points out here is the lack of an adequate perspectivism (cf Alrøe & Noe 2011). We have applied this insight in some concrete examples of research methodology and policy by way of suggesting separate second-order observation processes (in the form of “polycyclic communication”) as necessary elements in inter- and trans-disciplinary research on multifunctional agriculture and organic agriculture (Noe et al. 2008, Alrøe & Noe 2008). At present, we are striving to implement these insights in the form of multiperspectival methods in the transdisciplinary projects MultiTrust19 – which will analyse and develop methods for multicriteria assessment of the effects of organic food systems – and HealthyGrowth20 – which will make transnational analyses of successful mid-scale organic value chains in order to learn how they are able to combine volume and values.

“114 Communicating across specialised perspectives requires much dedication and reflexiveness, and, as Luhmann emphasises, such cross-perspectival work requires a certain modesty to avoid that some perspectives dominate others and mould them in their own image. In the words of Cilliers (2005):

“115 The conception that every observation has a blind spot and that every perspective cannot see beyond its own horizon seems a particularly good starting point for accepting a modest approach.

Conclusion

“116 In this article we have discussed three different constructivist theories and their understanding of the relation between system and environment, with the dual purpose of developing a constructivist and perspectivist conception of environment and to help confront “wicked” complex environmental problems through constructivist systems approaches.

“117 The first step was to clarify the sense in which different terms for “the environment” were used, and how they relate to

19 MultiTrust runs 2011–2013 as part of the Organic RDD programme, which is coordinated by ICROFS and funded by the Danish Ministry of food (see http://www.multitrust.org).

20 HealthyGrowth will run 2013–2015 as part of Core Organic II, which is an ERA-NET funded by the European Commission’s 7th Framework Programme.
inside and outside perspectives on environments, here labelled as “phenomenal worlds” and “surrounding worlds.” The second step was to dig deeper and identify the different logics connected to their conceptions of observation, upon which the theories — being constructivist theories — are founded. We identified two very different logics: the logic of distinction (Spencer-Brown’s Laws of Form) and the logic of representation (Peircean semiotics). These two logics are complementary in Niels Bohr’s sense; that is, they exclude each other from being applied at the same time, but their conjunction gives a fuller understanding of what is being observed.

Complex environmental problems are inherently multiperspectival, and we need theories for how to handle the many different perspectives on “the environment” and environmental sustainability. Constructivist theories are pivotal here, both because constructivism is the route to an adequate perspectivism that can handle multiple and complementary perspectives, and because the different varieties of what can broadly be called environmental research, can be sharpened by constructivist theories. However, as we have seen, there are not one but several different, and in some ways incompatible, constructivist approaches to the environment.

Luhmann’s theory of social systems is in many ways an eye-opening theory. It highlights crucial points for the sciences of complex systems and complex problems, such as sustainable food production and climate change mitigation, where society, social systems, and communication play decisive roles. Especially, his strong constructivist elaboration of observation of observation and the blind spots of observation can help overcome blind faith in “objective knowledge” and support the development of perspectivist approaches based on second-order observation. Perspectivism is as much realism as we can get.

In order to be able to utilize the strength of Luhmann’s very elaborate and stringent theory more widely, which we highly recommend, we need to consider carefully Luhmann’s own call for a modest approach that is disciplined by self-observation. In particular, we need to consider the blind spots that are created by the fundamental assumptions of strictly communicative social systems and the logic of distinction. Only in this way can we ensure that this comprehensive and promising theory does not appear as “better knowledge” but as a helpful perspective on the wicked environmental problems of society, to be used in conjunction with perspectives based on embodied learning, semiotics, and the logic of representation.

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The Construction of Embodied Agency: The Other Side of the System–Environment Coin

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> Upshot • Complementary to Alrøe and Noe’s discussion of constructivist notions of environment, world, etc., this commentary addresses the closely-related notion of agency in constructivist theories – in particular, the question of what would be required for artificial agency – and identifies open questions and fundamental disagreements among constructivist theorists.

1 The target paper by Hugo Alrøe and Egon Noe provides an insightful exposition and discussion of different constructivist theorists’ conception of the environment/world that systems/agents/subjects interact with. The nature of the systems that these theorists (Jakob von Uexküll, Humberto Maturana & Francisco Varela, and Niklas Luhmann) take as their unit of analysis varies significantly – from cells to organisms/animals to social systems – but they nevertheless share a basic commitment to viewing autonomy or autopoiesis as a key aspect of what constitutes such a “system” – or the relevant type of system – in the first place.

2 For research in cognitive robotics or, more broadly, situated and embodied artificial intelligence (AI), which is concerned with the construction – in both the literal and the conceptual sense – of robotic systems that interact with and adapt to their environments relatively independent of human control, there is the additional question of what exactly would constitute an artificial agent/subject. Constructivist theories can make important contributions to understanding the issues involved, but the question can also, versa versa, be used to identify important differences between different constructivist theories and thus further the development of radical constructivism as such.

3 The discussion in this commentary will focus on the theories of von Uexküll, Maturana, and Varela. This is because they are more directly relevant to the question of individual biological vs. robotic embodied agency and better-explored in this particular research context than Luhmann’s work. As Alrøe and Noe point out in §§93–98, Luhmann does not address in sufficient detail the relevance of the biological level for a theory of meaning (§93) and therefore does not have much to say on the type of embodied learning/adaptation (§98) that is crucial to robotic systems’ knowledge construction in sensorimotor interaction with the environment. On the other hand, as discussed in much detail by Kähr (2009, 2010), Luhmann’s work is of course highly relevant to understanding the social and societal significance of AI technology in a broader sense, including search engines such as Google.

4 Notions of artificial autonomous agency in situated/embodied AI research strongly emphasize sensorimotor interaction with the environment and independence from direct human control. Here are two representative examples:

5 By autonomous agent, I mean any embodied system designed to satisfy internal or external goals by its own actions while in continuous long-term interaction with the environment in which it is situated. The class of autonomous agents is thus a fairly broad one, encompassing at the very least all animals and autonomous robots. (Beer 1995)

6 An autonomous agent is a system situated and acting within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future. (Franklin & Graesser 1997)

7 Such definitions can of course be questioned from a number of perspectives (e.g., Sørensen & Ziemke 2007; Ziemke 2007a, 2007b, 2008). For example, one might ask exactly what is meant by “own” in “own actions” or “own agenda.” Constructivist theories should be able to help clarify the issues involved.

8 The works of von Uexküll, Maturana, and, in particular, Varela have had a significant influence on this type of AI research. For example, cognitive robotics and artificial life researchers have explicitly referred to von Uexküll, in particular his Umwelt concept (e.g., Uexküll 1973, 1957), in their discussions of how a robot’s subjective inner world necessarily depends on its sensors and effectors (e.g., Brooks 1986, 1991; Prem 1997; Clark 1997; Ziemke 2001), i.e., its modes of interaction with the environment (for examples of concrete implementations see Macinnnes & Di Paolo 2005; Capdepuy, Polani & Nehaniv 2007). But the influence also goes the other way: Varela, Thompson & Rosch (1991), for example,
used Rodney Brooks’s behavior-based robotics approach (e.g., Brooks 1986, 1991) as an example/illustration of their enactive conception of embodied cognition.

« 7 » The organismic roots of the sensorimotor interaction between agent and environment, however, have been largely ignored in cognitive robotics research (cf. Ziemke 2008; Froese & Ziemke 2009; Ziemke & Lowe 2009). From a technological perspective, this is, of course, hardly surprising, given that practically all robots have sensors and motors, while no robot today is “living” (or autopoietic) in more than a metaphorical sense. From the perspectives of radical constructivism and embodied cognitive science (e.g., Ziemke, Zlatev & Frank 2007), on the other hand, the question is exactly how this lack of a living body effects/constrains the embodied cognitive capacities of robotic systems.

« 8 » Highly relevant to this question is what von Uexküll (1982) considered the “principal difference between the construction of a mechanism and a living organism,” namely the fact that “the organs of living beings have an innate meaning quality, in contrast to the parts of machine; therefore they can only develop centrifugally.” That means, organisms grow “outwards,” i.e., the parts grow from the whole, whereas machines (at least in von Uexküll’s days) are constructed centripetally, i.e., the parts are built first and then the whole is constructed from them. This (alleged) lack of “innate meaning qualities” raises the question of to what degree robots could be said to have a subjective/phenomenal Umwelt (cf. Emmeche 2001; Ziemke & Sharkey 2001). Naturally, von Uexküll himself was not familiar with modern computer and robotics technology. However, as we have discussed in more detail elsewhere (Ziemke & Sharkey 2001), the fact remains that even today’s robots are still composed (centripetally) of mechanical parts, even if their adaptive – and to some degree self-organizing – control programs could be viewed as capable of some form of centrifugal development. Current research on adaptive/growing materials as well as on robots with living core components (such as a microbial metabolism, cf. Melhuish et al. 2006; Montebelli, Lowe & Ziemke in press) is bound to further blur the distinctions between organisms and machines that might have seemed clear-cut in von Uexküll’s time.

« 9 » Alvaro Moreno, Arantzta Etxeberría, and Jon Umerez characterize agential autonomy as implying that the internal organization of the system causes interactions with the environment and its monitoring according to internal needs. They therefore make a crucial distinction “between constitutive processes, which produce the identity and largely delimit what the system is, from interactive processes, which are not only side effects of the constitutive, but crucial to maintain the identity of the system, with the specific function of controlling the interaction with the environment” (Moreno, Etxeberria & Umerez 2008).

« 10 » While this view of the intertwined nature of constitutive and interactive processes seems to be much in line with Maturana & Varela’s (1974, 1980) original view of the central role of autopoietic organization in the constitution of cognition, it is interesting to note, from the perspective of radical constructivism, that Maturana’s and Varela’s later interpretations actually seem to differ substantially on this point. Varela (1997) argues that the operational closure of nervous systems brings forth a specific mode of coherence, i.e., a cognitive identity that is embedded in the organism. Hence, he also characterizes the relation between constitutive and interactive processes as necessarily closely intertwined:

“...[T]he cognitive self is the manner in which the organism, through its own self-produced activity, becomes a distinct entity in space, but always coupled to its corresponding environment from which it remains nevertheless distinct. A distinct coherent self which, by the very same process of constituting itself, configures, an external world of perception and action.” (Varela 1997: 83)

« 11 » Maturana (2004), on the other hand, argues that “[l]iving systems, like all systems, exist in two non-intersecting operational domains, the domain of the operation of their components (the domain of their composition), and the domain of their operation as totals in the relational space in which they exist as such”. He therefore argued that robots, despite their non-biological constitution, could very well be capable of self-consciousness if only they were made to interact with their environment the right way (through language in this case). He justified this argument as follows:

“...No doubt the manner of operating of a system as a totality arises from its internal structural dynamics through the operation of their components, but the character of what it does as a totality arises in its encounter with the medium in which it exists as a totality. ... The same happens with robots. A robot is a robot of one kind or another according to how it arises in its operation as a totality in the relational space in which it exists as such.” (Maturana 2004: 76)

« 12 » To briefly summarize: the fact that the cognitive robots used in modern situated/embodied AI research adapt/learn/self-organize (in a technical sense) in and through interaction with their environment, raises a number of interesting questions regarding the role of the living body in embodied cognition. This research is also highly interesting from the perspective of radical constructivism. This is because it raises the question of to what degree, using the above terms of Moreno, Etxeberria & Umerez (2008), the constitutive and interactive processes involved in agential autonomy can or cannot be decoupled. As the necessarily brief discussion above seems to indicate, it is far from clear to what degree constructivist theorists agree on this point.

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Multiple Environments!? 
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> Upshot • The following remarks elaborate on the basic concepts of observation and environment. Some extensions are suggested, mainly from the perspective of Luhmann's theory of social systems. Especially, the concept of structural couplings is given more emphasis, not least because of its relevance to the sustainability debate.

«1» The debate on the role of constructivist approaches is of crucial relevance in clarifying benefits and difficulties and, especially, in the use of concepts such as "environment" and "observer" within such approaches. Of interest here is its contribution to epistemology, as well as that on the fundamentals of social systems theory. Hugo Alroë and Egon Noë's article is informative and helpful in separating several arguments that are from different scholars and in different discourses.

«2» At the core of the article are two central aspects to which some remarks could be added:
1 | the significance of the discussion, whether it is about philosophical intention or part of a sociological examination, and
2 | the use of the term "environment", either as a systems theory concept or as referring to ecological questions, including physical or biological assertions. I am going to formulate my remarks on this mainly on the Luhmann part of the article.

«3» So, firstly, let me address the level at which the argumentation is set. One important point is to do with the "subject" of the observing system. The important step taken by Niklas Luhmann was to change the perspective from individual (biological or social) agents to societal systems. These functional subsystems of not only society but also organizations operate "beside" those numerous empirical subjects. Therefore, a step from individual cognitive actors (e.g. organisms, living systems) to sub-systems of society was pursued. Such a shift in perspective has influences on the concept of observation and on the concept of "environment" as well. Most of the phenomena Luhmann is interested in are on a second-order observation level. Questions within such a perspective are about the consequences that arise when social systems organize observations within a certain framework (e.g., that of "morality" in Luhmann 2008). And it is an observer on a second-order level, then, that could analyze these consequences. In those cases, the interesting issues are the specific problems that arise because of the presence of other observing systems with their own suggestions for solutions to problems as well as for activities that hinder solutions. That seems to be the important step in a second-order perspective: to see what others could not see, and to analyze the restrictions found in such a situation.

«4» There is a severe problem in interpreting Luhmann's approaches. Before and after his "autopoietic turn" (somewhere around 1980), he used concepts and terms that are drawn from classical cybernetics and seem to have ontological residues. Later on, a firm reorientation to second-order cybernetics took place. However, his wording did not always look very different. Therefore, one has to be extremely careful when relying on citations from Luhmann's writings and has to consider explicitly the time of the publication of the text.

«5» It might be helpful to introduce another distinction: the distinction between a scientific observer and an observer without scientific aspirations. In the latter case, the usual mode is to use simplifications and "acting ontologies", mostly on a first-order observation level (Fuchs 2004 0.2.1). That seems to be exactly the level where communications about ecological crisis and sustainability problems are located.

«6» We have to mention a last point about the epistemology. We should not forget that the very concept "observation" shows a paradoxical basic structure (Luhmann 1992a). The above-mentioned simplifications used in ecological communication are examples of a "de-paradoxization" ("Ent-paradoxierung") in order to be able to make decisions and take responsibility for one's own actions (Luhmann 1989: 10). It might be that the question raised in §80 could be answered when considering such simplifications.

«7» The second set of remarks are about the use of the term "environment" in the controversy on variants of constructivism and, especially, on sociological systems theory. The authors present different approaches, whose subject matter range from physical facts to highly abstract epistemological schemes. In §49 the authors mention that Luhmann also uses only the term "environment" (without an index, for example) to cover these different meanings – and identify this as a source of confusion. A lack of clarity is noted by the authors because there is no differentiation between the "inside perspective" and the "outside perspective." Luhmann himself talked about the need to distinguish two concepts of "environment." There is also an important distinction by Humberto Maturana (1988), who talks about the general environment and the specific niche of systems.

«8» That brings us to the central statement about Luhmann's conceptualization. In §81 the authors clearly explicate the following: if society has – as a system only operating communications– no body, it has no (non-communicative) environment either. Are ecosystems, climate change, all today's wicked environmental problems, then nonexistent and not relevant from a society's viewpoint?

«9» But what, from such a perspective, are "the wicked environmental problems of society"? Those which are the content of communications taking place? And with the specification "wicked" is a specific distinction drawn or was a decision made to apply a specific reference framework? But by whom or by which system? On the basis of which distinction is the qualification as "wicked" justified? According to Horst Rittel's definition of wicked problems (Rittel & Webber 1973), they lack a clear solution strategy and change during their processing. That refers, again, to the social part of the system/environment relationship in contrast to the "material" characteristics of environmental problems. With respect to §86f, it would be helpful to add a reference to a second type of fundamental structure in social systems. Besides the code as the fundamental distinction criteria, there are various programs that organize the operations of the systems. They likewise have to be considered (Luhmann 1992b: 228ff) because of their relevance to the observation process.

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In my opinion, a view on system/environment relationships and on the relevance of today’s ecological problems might benefit from a deeper view of the concept of structural couplings. From Luhmann’s writings on functional subsystems of society in the 1990s on, the term “structural coupling” became a more and more prominent element of the social systems theory repertoire.

Structural couplings represent connections that are taken for granted by both systems that interact in order to guarantee a mutual preservation of existence. The concept was introduced to oppose the implication that systems merge together and build one united system. It also provides an alternative to interpreting relationships as causal relationships.

With the concept of structural couplings, the claimed contradiction between the autonomy of systems and the interrelationships with and dependency on other systems is solved. One of the most convincing examples of structural couplings is the role of gravity in the ability of some organisms to move erect. In order to do so, some environmental conditions have to be granted by the system, and they are taken for granted by the organism. These are the necessary foodstuffs, energy for preparing meals, etc., cause severe function deficits. Signals and irritations are sent to the associated psychic systems and trigger thought processes and responses. According to Luhmann’s suggestion, then, these signals have to be inserted into the stream of communications. Only at that point, eventuality, does society come into play. Thus, a completely different type of analysis is applied compared with former theories, e.g., that of Pjirim Sorokin (1975). No direct causal connections are accepted as lasting from environmental (ecological) conditions to societal responses.

Such distinctions, as introduced with the concept of structural couplings, could contribute to a better understanding of the contributions and claims of constructivist approaches. The environment is, from such a perspective, structured. According to Luhmann, the environment of a society consists primarily of psychic systems because they provide material for the stream of communications. The observation at that level could rely on the concept of meaning on both sides. On other levels, different observation schemes are necessary. Therefore, we find on different levels (interconnected by structural couplings) different modes of observation. Not different in the pure operation mode (distinction and designation) but different in the selection of issues considered.

It has to be kept in mind that although Luhmann is not interested in ecological facts, simultaneously, he does not deny the existence of those facts. There are, in his words, other levels of reality that are definitely a source of irritations – however, not on the level of the primary, existential operating mode, the autopoeisis, the system. “Only in exceptional cases (i.e., on different levels of reality, irritated by environmental factors), can it... be set in motion.” (Luhmann 1989: 15).

But also at that level, circumstances can be imagined that lead to a destruction of the system, a breakdown of autopoeisis; that is, on the level of society, the extinction of the “participants” in the communication process.

The authors state very clearly the necessity to differentiate several meanings of environment and find different conotations in three representative constructivist approaches. A direct comparison is difficult because of the diverging epistemological frameworks that are utilized. What always has to be kept in mind is the point of reference, the reference system, laid down as the fundament from which the arguments are developed. The environment is, as a societal problem (beside others) indeed of higher complexity than the designated system, regardless of the constructivist relativisms and of the observer dependency. Various irritations from different sources reach the system and the responses, if activated, are not arbitrary and random but part of agreed social practices.

In general, we agree with Hugo Alrøe and Egon Noe’s far-reaching reflections, which offer insights into the term “environment” and its meaning from diverse perspectives. Inspired by their thoughts, we would like to offer further perspectives based on the following questions:

1. With respect to the system/environment distinction: How malleable is this relationship to redefinition and interpretation from multiple perspectives?
The meaning of different definitions of environment

2 | Almæ and Noe introduce von Uexküll’s environmental terminology. Synonymous to the term “Umwelt,” von Uexküll uses “Wohnwelt,” “self-world,” “Umgebung,” (i.e., general surroundings), “self-universe,” and others. We discuss those terms, from the closest to the “self” to that which we later define as the “unknown” environment. In analyzing these terminologies in greater detail, it is obvious that they have distinct meanings. Therefore, our question is about the terminologies’ specific definitions. In addition, we ask how relevant these terminologies might be to Luhmann’s social systems theory, which operates with only one term for environment, i.e., for that which is distinct from a system.

3 | The term “Wohnwelt” is described as a list of ecological factors existing in an animal’s system’s “Umwelt” and that are relevant for its survival (§51). We would argue that “Wohnwelt” describes the smallest entity of the term “environment,” and includes those factors most relevant for an organism’s individual survival/existence, with a high potential for resonance effects or structural couplings. The autoepoietic process of self-reproduction also includes input from this Wohnwelt. Of course, it is the system itself, through its operations, that decides what will be accepted from the environment (Wohnwelt in this case) in order to reproduce the system. In Luhmann’s terms, the system determines meaningful structural couplings with the environment, which is the very narrow surrounding called “Wohnwelt.”

4 | The term “self-world” (§47), which von Uexküll alternatively applied to “phenomenal” worlds, offers us two options for interpretation. For Luhmann, “self” is the difference between system and environment, and is mainly explained through Maturana & Varela’s concept of autopoiesis. The self also includes the environment because the “self” constructs the environment. Thus, the distinction between system and environment might be described as a fluid rather than as a “precise” distinction. All phenomena that resonate with a living organism are part of its meaningful world (§23), i.e., the “self world.”

5 | Is it correct to say that the self includes the environment? According to Luhmann, the system constitutes itself by distinguishing itself from its environment (i.e., self-constitution of the system, cf. Luhmann 1995: 9, 443, 456). The environment is everything but the self, the remainder of everything outside the system. However, we argue differently: if I distinguish myself from something, I have to know the other consciously, and based on that I make the distinction. It is, therefore, in a certain sense – maybe temporarily – part of myself.

6 | According to Luhmann, the term “eigen” (self) refers to what is reproduced in the system. “World” in combination with “eigen” implies something that we are able to survey, e.g., our personal/individual world (§48, see also §72: “the world is a limit case”).

7 | “Umgebung” is described as the immediate environment. For an animal (system) this might be its hunting ground, or from the perspective of a soil microorganism (system) a soil aggregate. According to von Uexküll, the “self world” (§47) is what makes up the meaningful part of a system’s general surroundings (Umgebung) (§21). Thus, the term “Umgebung” is clearly related to “environment.”

8 | “Self-universe,” which is another concept that is used by von Uexküll to describe the term “Umwelt,” is a play on words. It represents some kind of hybrid understanding of “environment.” While the “self” refers to something limited, the “universe” expands the view to something endless, interpreted as something that we are not able to gain an overview of, and is not known. It is impossible to distinguish between environment and system if the environment is not known. This “knowing” could mean: the system knows that it does not know about the environment, the system does not know what it knows, or that the system does not know what it does not know (Bammer & Smithson 2008).

9 | This analysis gives evidence for meaningful distinctions between different types of environment. This could open a space for revising Luhmann’s proposed system/environment distinction to a system/environment/environment distinction. We offer opportunities to construct “environment,” described as at least three types:

10 | With these three types of environments, we argue in favor of a flexible application of the term “environment.” The system always constructs one of these environments when making the system/environment distinction. A system is able to construct the first two types in parallel. The observer is able to construct all three environments. The three environment types can, but must not, occur in their pure form. There might be time-space constellations leading to hybrids of the three environment types. We argue that constructs of different environments can exist, providing a meaning for the system. The distinction of different environments also proposes that the environment constructed by the system differs from the observer’s construction of the system’s environment. Interestingly, Luhmann only explains how the system reproduces itself and treats its environment as a black box. He argues: “It (the system) perceives its environment only restrictedly and categorically distorted.”
The dynamics of the system/environment distinction

The system/environment distinction describes systems as environmentally open, which means that autopoietic systems are organizationally and operationally closed, while at the same time materially and energetically open (Luhmann 1982: 367).

Systems interact with their environment through diverse types of structural couplings. There is no loss of system independence. The structural couplings do not determine the status of the system. They merely supply the system with disturbances” (Luhmann 2002: 124).

Interpenetration between systems describes that a system provides its own communication for the development of another system. Interpenetration “exists when this occurs reciprocally…” (Luhmann 1995: 213). Communication between two autopoietic systems, or evolutionary developments, demands interpenetration (ibid: 216).

Cell division is a specific type of system/environment distinction (Maturana & Varela 1998). There could be three types of system/environment distinction. First, two systems serve each other as their environment. Second, each system creates a new and individual environment, which is separate from the other system. Third, both systems construct the same environment.

What Maturana and Varela describe as the structural congruence between organism and environment (§29) is a characteristic that can also be found in systems e.g., agriculture. The agricultural system could serve as the environment from which non-organic and organic agriculture emerge. Agriculture is the environment for both systems. From another perspective, we could also argue that non-organic agriculture is the environment for an organic agriculture system, or vice versa. Both are autopoietic systems, able to reproduce themselves independently, and “can undergo coupled structural changes” (cf. §31). If the agent defines its environment (§29), this also determines potential communications, or structural couplings.

Communication in an organic social system is not compatible with the non-organic system and vice versa. In both systems one will encounter different meanings and concepts of time and space, which might be the best explanation for the barrier between the systems. Luhmann’s perspective is very helpful for understanding why organic agriculture is also seen as a social movement (cf. Hellmann 1996). It is a social system with limited significance in the system of big agro-business, because each follows its own binary code (in the organic system, e.g., ecology/non-ecology, in agro-business, profit/loss of capital), also described through their paradigms (Beus & Dunlap 1994).

The inside-outside distinction (§§58ff) is an example of the relevance of different observer perspectives in understanding and interpreting wicked problems (§2). The system (an agent) itself constructs its own inside perspective, which is not directly observable by an observer. The observer is only able to re-construct the inner perspective of another agent through the interpretation of what the observer perceives from the outside, e.g., countenance of a person. For the observer, the observed system becomes his (the observer’s) environment \( o_e \). The system (agent) itself then makes the distinction through its own construction of an environment \( s_e \). In a continuous feedback, the observer again observes the system as a new type of environment \( o_e \) that is different to what preceded it. The complex multi-perceptivity is increased by the observer’s own environment \( o_e \), which could partly overlap with that of the agent’s system.

The observer’s construct of system/environment distinctions of another system is based on the autopoietic capacities of his own system and not those of the observed person or system (cf. Luhmann 1984: 25). Thus, the observer constructs different operations and interprets their meaning differently than the observed.

Systems differentiation is “nothing more than the repetition within systems of the difference between system and environment” (Luhmann 1995: 7), which means that further system/environment distinctions emerge in the system. This internal sys-
system differentiation is described as a “process of increasing complexity” (ibid: 18), which is an autopoietic process of reproduction. Reproduction “offers possibilities for forming within the system a new system having its own system/environment difference …” (ibid: 258), which might survive longer than the former system.

Applying different lenses to describe the system/environment distinction helps to understand complex systems and environments. To make this explicit, we study a farming system. We describe the first distinction between the farming system – defined as a social system or a biological system – and the agricultural industry as the environment. In a farming system we define animals as a system (binary code: to live/to die), while environment is all kinds of fodder. Of course animals (“non-rooted” organisms) communicate differently than grasses (meadows, pastures) (“rooted” organisms) do. They do not depend on each other, they follow different genetically defined communication procedures, and their reproduction is obviously different. Another distinction is that of a cow’s stomach (system; binary code: to digest/not to digest) and an animal (environment); and finally there is a distinction between the stomach (environment) and a microorganism community (system; binary code is to duplicate, to divide/not to duplicate). We neither argue that these distinctions are “part (system) of the whole (environment)” nor that they follow a spatial concept. Both are perspectives of general systems theory, but not relevant for this commentary. What we provide are always independent system/environment distinctions. All named systems are autopoietic, exist through internal functions and operations, and are self referentially closed; and in the sense of Luhmann they are social (communicating), and also biological (living) systems.

Conclusion

Regarding our first question, there is huge potential to reflect upon and integrate diverse system/environment distinctions. Von Uexküll’s terminology offers several ways to describe environments, but they are not precise enough as he was not aware of the issue of the observer’s construction of diverse system/environment distinctions. With respect to our second question, we argue that his interest was mainly in systems, system/environment distinctions, and system/environment interconnectedness, while the environment itself remained a complex (§66) black box. Von Uexküll provoked us to see various environments and reflect upon his perspective in the context of Luhmann’s system theory. Applying multiperspectivity to the system/environment distinction is of practical relevance when compromises between different system/environment realities are needed. In negotiation processes, these insights could help to make the roots of contradictory positions visible and to identify ways to better understand alter ego arguments. Of course there is the need to introduce the added value of these diverse constructs of environment in order to deal with wicked problems.

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Authors’ Response: Systems, Environments, and the Body

Hugo F. Alrøe & Egon Noe

Upshot • In our response we focus on how different types of systems are related from a constructivist perspective, and specifically on the relation between communicational social systems and embodied agency.

Introduction

We are happy that our article “Observing Environments” seems to have struck a chord that resonates with other researchers, and which has resulted in three Open Peer Commentaries that offer extensions, complementary notions, and further perspectives.

Tom Ziemke is concerned with the construction of robotic systems that interact with and adapt to their environments, focusing on the role of the body in situated and embodied cognition. In doing this, Ziemke finds little use for Niklas Luhmann’s work since Luhmann does not address in sufficient detail the relevance of the biological level for a theory of meaning and therefore has little to say on embodied learning and adaptation.

Karl-Heinz Simon takes an opposite approach, focusing mainly on Luhmann, even when discussing organisms, and thereby resolving the claimed contradiction between autonomy and dependency of systems with the concept of structural couplings.

These two commentaries thus choose to either disregard Luhmann’s work or disregard other constructivist theories. Thereby, they indirectly highlight the difficulties that we investigated in our article in discussing the environment across different constructivist theories.

Bernhard Freyer & Rebecca Louise Paxton on the other hand, tackle the problem of using Luhmann’s theory together with other constructivist theories, though, not surprisingly, in a less specific manner. Freyer & Paxton work in a field similar to ours, with agriculture, food, health, and wicked environmental problems. This calls for transdisciplinary research with multiple perspectives. Therefore they accept the necessity of working with different constructivist theories across the biological and social level.

Together, the three commentaries suggest a need to look in more detail at how...
different types of systems are related and specifically at the relation between social systems and embodied agency.

**Types of systems and perspectives**

- According to Luhmann (1995:2), there are systems of different kinds and at different levels. He distinguishes four kinds of systems below the level of systems in general: social systems and psychic systems, which can be characterised by their use of meaning, and machines and organisms, which do not use meaning. Ziemke disagrees with Luhmann on the relevance ofisms, which do not use meaning. Ziemke stated that in the case of embodied cognition and learning in robotics, Luhmann's social systems perspective does not have much to offer. Perhaps another example can illustrate the issue more directly. A scientific perspective, such as a specialised discipline like soil physics, can be observed both as a communicational and a cognitive system. As a social system, it establishes its own organisational form in the form of conferences, journals, peer review systems, email discussion lists, web pages, diagrammatic tools, etc. As a cognitive system, it creates its own organisation by establishing observation instruments, experimental facilities, research platforms, indicator systems, interactive models, computing equipment, etc. Embodied learning is an important aspect of science as a cognitive system, but not visible in science as a communicational social system.

- We appreciate the strength of the self-defining systems concept. But this does not make us refrain from questioning the "ontological status" of the systems we speak of.

- If we think about a farm as a system, we insist that it is a self-organising system that distinguishes itself from the environment - such as the common use of "ecosystem" where ecological interdependencies are taken to designate a "system" (e.g., Luhmann 1989: 150). We appreciate the strength of the self-defining systems concept. But this does not make us refrain from questioning the "ontological status" of the systems we speak of.

- Given the above, the farm is a social system, an organisation, in the sense that it can be described in terms of communications and that it distinguishes itself from its environment. The farm is also a physical system, in the sense that it can be observed from the perspective of physics, chemistry, geology, etc., and be described in terms of energy, material flows, chemical processes, mechanical structures, etc. Here, the "system" is not very well defined and borders of the system have to be constructed from outside. The "farm as a physical system" thus cannot compete with the "farm as social system" on Luhmann's conditions for being a system.

- But we may also say that the farm is an organism, or a cyborg, in the sense that it can be described in terms of adaptation, senses, behaviour, etc., and that it has a body that matters. From this perspective, the farm is a self-organising system that maintains its own organisation and produces (some of) its own components in terms of recreating soil fertility, breeding stock animals, growing seeds for the next season, bringing up successors, reproducing knowledge and practices, etc. (Noe & Alrøe 2006). This perspective on farms can be found in organic and, especially, biodynamic agriculture (Paull 2006).

- Farms are different and different perspectives may not be equally fitting or fruitful for all farms. For some farms, such as a modern Danish pig farm enterprise that relies on a host of externally produced inputs and that has several employees, a management board, a wide range of advisors and suppliers that enter into farm operations, couplings to legal, economic and scientific systems, etc., the "farm as social system" perspective can be very fruitful for understanding how the farm works, and the "farm as organism" perspective less so. For other farms, such as a traditional subsistence farm that relies entirely on internally produced inputs and that has only the family working on it and no advisors or suppliers, it may be the other way around. In neither case will one perspective be sufficient for understanding the empirical dynamics of the system.

**Communicational systems and embodied cognition**

- The farming system is just an example to indicate the issue we are trying to explicate. We need to talk about complex dynamical objects, such as "a farm," but we only have the immediate objects of different specialised perspectives at our disposal, such as "the farm as social system" and "the farm as organism" (cf. Alrøe & Noe 2011). Luhmann's social systems theory is not exempt from being a specialised perspective, even though it is "universal" in the sense that it is able to observe itself as a social system.

**Dependency of systems on their environment**

- Is human society dependent on its environment or is it independent of the environment? Freyer and Paxton (§12ff) discuss this question in their commentary. The question is pressing when we talk about wicked environmental problems, and when ecological economy speaks of the depen-
dency of society on ecosystems and planetary boundaries for human influence.

According to Simon (§§10–14), referring to Luhmann’s writings, there are no direct causal connections leading from environmental conditions to societal responses. Instead the relationship is described in the form of structural couplings.

However, the environment of society consists primarily of psychic systems, and Luhmann does not have much to say on the relation between a psychic system and the organism or body, nor on the relation to machines or technology. It is not clear how resonance and irritation can take place between different types of system. Therefore the dependency of society on the environment through structural couplings is, from an analytical viewpoint, rather indirect and unclear. Things such as feeling, value and empathy, which are important for taking action against environmental problems, can easily get lost through the series of structural couplings that link social communication and the body.

**Conclusion**

The cases of farming systems, scientific disciplines, and embodied cognition in robotics challenge Luhmann’s simple and rather conventional typology of systems. This is not the place to take up this challenge, but the commentaries encourage us to reiterate the recommendation in the target article. Luhmann’s theory of communicational social systems is a helpful perspective on the wicked environmental problems of society, and we need to consider how best to apply the theory in conjunction with other perspectives such as the embodied learning perspective on society as an organism.

**Combined References**


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Radical Constructivism

Making Sense and Meaning
On the Role of Communication and Culture
in the Reproduction of Social Systems

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> Context • Although the relationship between communication and culture has received significant attention among communication scholars over the past thirty or more years, there is still no satisfactory explanation as to how these two are related and how culture evolves in communication. It forces the author to turn to Niklas Luhmann’s social systems theory, which is one of the main hypotheses of how social systems emerge. > Problem • Unfortunately, Luhmann’s concept of meaning is too weak to explain the autopoiesis of communication. In looking for a solution, the author suggests that it is necessary to distinguish between personal sense structures and socio-cultural meanings and to introduce the concept of shared meaning to the systems-theoretical approach. The paper conceptualises “meaning” as a phenomenon that evolves in communication and defines “culture” as a pattern of structurally related meanings. > Findings • (1) According to Luhmann, social systems do not consist of static objects, but of dynamic operations, and for a social system to emerge, its elements – communications – must be connected to one another. The author argues that culture equips the momentary elements of the social system – communications – with the capacity for connection, and makes the social system operationally closed, self-referential, and autopoietic. (2) The problem of adaptation does not lose its importance if we understand cognition as a “self-founding activity” of operationally closed systems but transforms into a question of whether the “reality” construed by the media favours or restricts the coping of the system in the ever changing environment. (3) From the perspective of adaptation of the social system to its internal and external environments, an important condition of the continuous process of creation of shared knowledge to which individuals orientate themselves in their activities is the existence of variations. > Keywords • Communication, meaning, culture, social system, self-organisation.

Introduction

» 1 « Niklas Luhmann is one of those authors that need to be reread from time to time. Not because he changes, but because we do – both the world and our attitude towards it alter and, consequently, the problems we try to solve alter too. There are two questions to which I try to find an answer in this contribution, which is based on Luhmann’s social systems theory or the use thereof. The first one goes as follows: How do a shared knowledge and culture emerge in communication from individual constructions of people? At first sight, such a question might seem purely academic because there are dozens of books and hundreds of articles published on the relationship between culture and communication. In textbooks and popular texts, these phenomena are mainly treated together, and the words “communication” and “culture” are often said in the same breath. Against this background, it can be surprising to admit that the “how” in the relationship between communication and culture is far from obvious. We do not have a satisfactory explanation of how a common knowledge and culture emerge in communication from individual constructions of people. The cultural approach to communication exists rather as a description of certain events; its explanatory content is not very thorough.

» 2 « The question of how culture develops from individual constructions of people is also important from the point of view of rapprochement or even convergence of the “top down” and “bottom up” constructivisms. Although constructivism is far from a uniform approach, but is a very diverse, polyphonic, and heterogeneous discourse with many various points of views and fractions. However, one could speak of two perspectives: a “top down” perspective of (social) constructionism that anticipates all we take to be real to be an outcome of social relationships, and a “bottom up” perspective of (radical) constructivism that considers the individual’s experiential world as his own construction. The former tends towards the “death of the subject” where the person, if considered at all, is conceptualised only as the outcome of discursive structures, and the latter has difficulties in explaining how, in a situation where the individual’s experiential world is his own construction, social interaction, communication, and society are possible. Against this background the answer to the question of how a shared knowledge and culture develop from individual constructions of people supposes overcoming the gap between social constructionism and radical constructivism and the formation of a comprehensive view that we could call social constructivism.
Meaning without a person?

The question of how culture develops from individual constructions of people is a real puzzle for constructivists, for whom the active subject plays the central role of the constructor. He constructs sense, meaning, and reality through his thoughts and actions. Here, an inevitable question emerges: How do we combine the cognitive autonomy of the subject with successful communication? How do we conceptualize social phenomena as being autonomous from individual observers? How do we describe such phenomena as emergent and as functioning at a “higher level” than that of individual minds, yet so that the meanings created at that supra-individual level would be related to the mental constructs of individuals? Or in short: How can the human mind be social, yet personal at the same time? So, on closer inspection, the question of the relationship between communication and culture becomes a broader question of relationship between the individual and social. At the same time, it is a matter of the emergence of social order.

In order to answer these questions, we first need to turn to Niklas Luhmann’s social systems theory, in the hope of better understanding how individuals overcome cognitive autonomy in communication, and how their co-ordinated activity is possible. In Luhmann’s comprehension, networked social systems are able to transform themselves recursively and reflexively. In connection with that, Luhmann discarded the term “intersubjectivity,” which was introduced at the beginning of the 20th century by the philosopher Edmund Husserl. This term is usually interpreted as a shared or mutual understanding or matching a mental state of one person with the mental state of the other person. According to Husserl, such matching is possible with the help of a place exchange (German Platzwechsel) based on empathy. Such a place exchange is an opportunity to see the world from the point of view of another person and in the same light, which can, but not necessarily, lead to a shared understanding (see Husserl 1989: 177). Instead of seeing such intersubjectivity as an opportunity, Luhmann constructed an autonomous supra-individual level, a social system for which the human actors (consciousness systems) are merely the environment. Such social systems consist of communications.

Luhmann’s intention is understood: social processes and structures of common knowledge are largely independent from the perceptions and intentions of individuals. What led Luhmann to such a solution was undoubtedly also an attempt to adopt the theory of autopoietic – i.e., self-generating and self-sustaining – systems to the social field. According to Humberto Maturana and Francisco Varela, the elements of the autopoietic system constantly reproduce themselves and together with this the entire system (see Maturana & Varela 1987: 42–46). For Luhmann, the basic element of the social system – communication – functions recursively and self-referentially and enables the operationally closed system to be in interaction with its environment, and, simultaneously, carries self-production of the system, or autopoesis.

Although the psychic and social systems operate in very different ways, the form of the first operation is consciousness processes and that of the other, communication. With both being environments for each other, what connects them is the fact that both of them operate meaningfully. Here is one of the nodal points of Luhmann’s theory. For the system to be autopoietic, it must somehow be reached from one elemental event to the next one. According to Luhmann (1995a: 36), systems do not consist of static objects, but of dynamic operations, and for the system to emerge and persist, one operation must be connected to another. Who or what gives the psychic or social system operations a capacity for connection? Luhmann says that connection becomes a reality with the help of the meaning and that the mind reference of all operations is an imperative necessity for psychic systems, as well as for social ones (see Luhmann 1995a: 97). When the psychic system thinks and social system communicates, it is the meaning that forms a bridge between various thoughts and communications. Meaning is a universal medium surrounding all operations of psychic and social systems (see Luhmann 1995a: 59–60, 1997: 44).
According to Luhmann, both thoughts and communications have meaning in exactly the same way. At the same time, meaning is just an intra-system product for Luhmann. It is created by both the psychic system and the social system (communication system) and in each is produced independently from the other. It follows that the way psychic systems understand communication is totally irrelevant for the communication system. In other words, Luhmann ascribes the giving of the meaning not only to the psychic system but also to the communication itself, and in the latter case, meaning does not depend on individual human consciousness. However, according to the widely accepted concept, the signs and utterances the communication uses have no meaning by themselves; the meaning is only attributed in the interpreting mind. There is no other possibility in a constructivist thought. What is important in the text (I do not simply consider the limited and concentrated form of the literary language, but any coherent set of signs that transmits some kind of message) is the arrangement of signs, or syntax. Messages contain signs that are combined and ordered by syntax rules. Meaning, however, is attributed to the message by the consciousness of the individual. But Luhmann separated the meaning from the individual and attributed it to the meaning itself. He wrote that the meaning is the true ‘substance’ of this emergent evolutionary level. It is therefore false (or, more gently, it is a falsely chosen anthropocentrism) to assign the psychic, that is, the conscious anchorage, a sort of ontological priority over the social. It is utterly wrong to seek a ‘carrier’ for meaning. Meaning carries itself, in that it enables its own self-referential reproduction.** (Luhmann 1995a: 98).

Thus, according to Luhmann, it is an anthropocentricist error to see any connection between the meaning and the human consciousness.

It should be mentioned that the concept of interpenetration, which Luhmann adopted from Parsons and revised in order to conceptualise the relations between psychic and social systems (Luhmann 1995a: 213–216), does not change the situation here.

According to Luhmann, the operations of the psychic and social systems – or consciousness and communication – do not coincide. Both systems are operationally closed, autopoietic, and function self-referentially, so that consciousness is recursively related to consciousness and communication with communication. The operational closure does not mean, however, that the psychic and social systems are mutually and completely independent. In Luhmann’s theory of social systems, these are related through two phenomena: structural coupling and interpenetration (Luhmann 2008: 267–268). The first term is from Maturana’s theory of autopoiesis and the second, as previously mentioned, is from Parsons’s action theory. The concept of interpenetration in Luhmann’s interpretation denotes an “operative and structural link” (Luhmann 2002: 182) between two systems that are each an environment for each other: specifically it refers to the fact that systems make their complexity available for one another (Luhmann 1995a: 213).

The mechanism of systems integration, where the complexity of one system is used for building another system, could contradict the conditions of autopoiesis (see Luhmann 1995a: 11, 1997: 79), because in such a case psychic and social systems could not be self-referential and operationally closed. According to Luhmann, the interpenetration of consciousness systems and social systems is made possible by the fact that both types of systems are meaning-constructing systems and the meaning prevents autopoiesis from becoming allopoiesis (Luhmann 1995a: 219).

Meaning in Luhmann’s language refers to a general form of thinking and communication that must always be presupposed (Luhmann 1997: 44). Luhmann brings this universal into compliance with the general pattern of theory of autopoiesis so that the meaning becomes realised or actualised through operations of the psychic or social system, i.e., as meaningful thought or meaningful communication. “Meaning is the product of operations that use it, not a world quality,” wrote Luhmann (ibid: 44).

However, this means that we not only have two different autopoietic, self-referential systems and two different operations but, accordingly, two different meanings because the distinctions these systems draw must be different. Both systems function only as environment to the other and their mutual interaction can only be indirect – consciousness can irritate the system of communication, and vice versa. As a reaction to these irritations, each system constructs the other and their operations assume the existence of the other, but each remains separate and distinct. However, in such a case we deal with a typical structure-determined and structure-determining engagement of a given unity with another unity in its environment and this process is called structural coupling (see Maturana & Varela 1998: 75).

It is probably not accidental that in his later writings, Luhmann mostly uses the concept of “structural coupling” that became the byword for interpenetration. Sometimes, Luhmann even questions the necessity of their separation (2008: 268). It is also characteristic that while in his Social Systems of 1984, Luhmann dedicated an entire chapter to interpenetration (1995a: 210–254), in The Society of Society published a year before Luhmann’s death, structural coupling is discussed in detail but interpenetration is only briefly mentioned on two occasions (Luhmann 1997: 108 and 378). Against that backdrop, it should be understandable that “interpenetration” and “structural coupling” can be regarded as synonymous.
Meaning in Luhmann’s theory is the medium of psychic and social systems. It is the premise of experience processing that allows the cognitive system to select, and refers to what was selected from among a number of possibilities and together with that to the immensity of the world (see Luhmann 1997: 44). How the meaning as the “medium” of both thoughts and communications can be intrinsic to minds and to a social system is a separate question. From the point of view of radical constructivism and communication theory, the problem, first and foremost, lies in the emergence of meaning on the social level.

How psychic systems create meaning is clear and understandable. The consciousness forms a subjective sketch of the “external” world in the course of processing experiences. At that, it reduces the complexity of the external world down to a level understandable to it, which allows it to perceive reality and the individual to act. In that way, internal order is created instead of the complexity of the world.

According to Luhmann, the creation of meaning (German Sinnbildung) is also a property of communicative systems. Here, too, creating meaning means making a selection from different possibilities, whereas that which is not selected is no longer possible in future communication. However, here meanings exist outside of individual minds. Psychic systems are in the environment of social systems and meaning is intrinsic to social systems in exactly the same way as it is to minds.

Once again, it must be noted that the capacity for connection is critical in systems theory. Luhmann wrote in the introduction to Social Systems:

The theory of self-producing, autopoietic systems can be transferred to the domain of action systems only if one begins with the fact that the elements composing the system can have no duration, and thus must be constantly reproduced by the system these elements comprise... It is not a matter of adaptation, nor is it a matter of metabolism; rather, it is a matter of a peculiar constraint on autonomy arising from the fact that the system would simply cease to exist in any, even the most favourable, environment if it did not equip the momentary elements that compose it with the capacity for connection, that is, with meaning, and thus reproduce them. (Luhmann 1995a: 11)

Unfortunately, the explanation suggested by Luhmann, where the meaning has no carrier and is always formed as self-referential and independent from the individual’s mind, is unsatisfactory from the point of view of constructivism, semiotics or communication theory. Constructivism presumes an active individual who plays the central role of the constructor. Or, as psychologist Kenneth Gergen (1999: 237) put it: “For constructivists, the process of world construction is psychological; it takes place ‘in the head.’” One of the basic assumptions of semiotics is that signs (a word is a sign too) do not refer to an object or itself, but to the mental representation of the observer. From the point of view of communication theory, however, the signs and utterances used in communication lack meaning by themselves; meaning is provided by the interpreting mind. Hence, it is impossible to fully imagine the meaning without its carrier – human consciousness.

It should be added that three other authors, among them Maturana, have previously said something similar and drawn attention to the fact that communications do not produce other communications – people do (Viskovatoff 1999: 494, 496; Mingers 2002: 290; Maturana & Poerksen 2007: 70). As John Mingers says, Luhmann makes “little attempt to show how societal communication, as an independent phenomenal domain, emerges from the interactions of the humans who ultimately underpin it” (Mingers 2002: 290). In my opinion, the problem here does not lie in the communication, which is a social phenomenon, but in the fact that meaning evolves separately from an individual.

The fact that social systems cannot create meaning independent from individuals poses a serious problem for constructivists and communications scholars, as (a) according to Luhmann, autopoiesis of a social system is impossible without a meaning, and (b) for the system to be autopoietic, the meaning should emerge within the system. This brings me look for a different explanation that does not necessarily coincide with Luhmann’s social systems theory.

In order to better understand the relationship between the social and personal worlds, it is reasonable to observe not only the operations of psychic and social systems, as Luhmann did, but also constructions that are created in these operations. To simplify it slightly, it could be said that the constructs of the psychic system are senses consisting of cognitive schema; social system constructs, however, are meanings. These two guide a person’s actions and his ability to cope in his environment.

Here, I must give a warning. When discussing personal sense and socio-cultural meaning, it is easy to fall into the bivalent trap of “either/or” thinking and treat them as adversarial. But psychic and social systems are structurally coupled. A central element within the theory of autopoiesis, the concept of structural coupling assigns an equal role to interacting systems such that neither is seen to determine the other completely. Each system can only trigger changes in the other, but the actual changes are not predetermined (Maturana & Varela 1980: xx–xxi, 1998: 95f). Such interdependence is a constant process in which personal sense structures and socio-cultural meanings fit with one another and evolve together. As a result, those two are not as dichotomous as is sometimes believed.

Here, I understand cognitive schemata slightly differently than Immanuel Kant, for whom the schemata stood between the external world and internal mental structures and were like lenses that both shaped and were shaped by experience (see Kant 2000: A140, B179f). Schemata are rather images in our head, cognitive structures that function in the consciousness system based on prior experience. These are bundles of stored information, internal models representing knowledge that facilitate sense-making based on prior knowledge and the organization of new experiences by comparing “incoming” messages with the structure of the already existing knowledge. Such organized experience al-
allows us to make conclusions and predict the progress of events and the consequenc- es of one’s actions. It excludes incorrect (i.e., inconsistent with the existing sche- mata) selections and saves time, energy, and work, and it increases the probability or security of achieving an objective. At the same time, the schemata guide our observ- ations, communication, and activities. All these functions are not independent from one another but rather they operate togeth- er. Schemata not only provide the basis of thinking, but they also change during men- tal processes.

A specific schema is useful only in modelling a small number of experi- ences in consciousness; at the same time, the environment is immensely more com- plex than a consciousness system and, be- sides, it is constantly changing. How do the schemata cope with modelling such an environment? It should be apparent that a psychic system cannot be based on an indefinite number of schemata: internal models can only be beneficial if they can be used repeatedly. Based on the work of John Holland (1995: 34–35), we could assume that it is possible that consciousness uses a relatively small number of schemata that are already tested and that are the result of a natural choice and learning as a con- stituent element of another larger schema. It takes place in more or less the same way as children build houses, castles, and for- tresses from toy blocks. By using and vary- ing the existing schemata, consciousness forms bigger structures; this allows one to construct many quite complicated models from a fairly small number of toy blocks. If we had 10 boxes of toy blocks with 10 blocks in each, for instance, we could cre- ate 10 billion (10^10) different constructions from these 100 building blocks.

Meaning

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munication cannot be attributed to one ac-
tor (à la "He spoke so well!"), and it cannot
be interpreted only as an expression of the
abilities of one person. While it is possible
to behave and act alone, in communication it
is only possible to participate.

Also, prior social experience participates in giving meaning – already
existing common meanings. At the same
time, meanings constantly change in com-
munication. That process has been quite
well described by the philosopher Josef
Mitterer in his books Das Jenseits der Phi-
osophie (1992) and Die Flucht aus der Be-
liebigkeit (2001). As a nondualist thinker,
Mitterer questions the relationship be-
tween the linguistic description and the object
of cognition. According to him, descriptions
do not refer to or rely on the object, but de-
rive from it. Thereby, objects (and together
with them the reality) are only determined
by the sum of current descriptions or thus
far descriptions. Each new description
(from now on description) changes the sum
of thus far descriptions and consequently
also the object. Mitterer wrote:

Describing an object means to continue the
speech so far and, thus, to change the object into
a new object of further descriptions. The object
description relates to the description of the
object, in the same manner as the description so
far does to the description from now on. (Mit-
ter 2001: 107; my translation)

Reality comes after truth

Meanings are reflexively formed in
communication in the way that observ-
ers attribute knowledge, expectations, and
intentions to each other and orientate on
those. Common meanings evolving in in-
teraction enable observers to make their
choices from among the available opportu-
nities and act together.

Social activity does not depend on
an individual observer’s subjective idea
that other observers cannot see or sense,
but only on shared meanings that arise in
communication. Observers participating in
the activity constantly express their as-
sumptions in communication – that which
has come to their mind – but at a social
level these are either accepted or rejected
by participants in communication as non-
compatible with the collectively accepted
definition of reality. The opinion of a per-
son expressed in communication is not
judged on the basis of compliance with
some external objects to which cognitive
systems have no access, but on whether
the measurement of these values is internal
coherence with the existing collective con-
structions.

But communication success is not
the only criterion for assessing the de-
scriptions and meanings. There is another
yardstick or a decisive factor – practice,
the usability of meanings, and knowledge.
In relation to this, anthropologist Gregory
 Bateson wrote about constraints of think-
 ing, interaction, and communication, try-
ing to avoid the description of the impact of
evolution in terms of cause and effect (Bate-
sont 1972: 405f). He noted that Darwin’s
Theory of Evolution is based on the prin-
ciple of constraints, not cause and effect.
Everything that does not correspond to the
constraints of the environment becomes ex-
tinct. In this adaptation process, there is not
the fittest, best, most persistent, or genuine
these are all just the assessments of an
external observer who introduces his own
criteria. The main instrument, with the help
of which we are trying to hold on in this vi-
ability range, lies in knowledge created in
observation and communication, which is
useful, relevant, and suits its environment,
or not – together with everything that de-
erves from it. Of course, no adaptation is fi-
nal. When the environment changes (and it
does all the time), the adaptation that used
to be sufficient turns out to be unsatisfac-
tory and calls into question the sustainabil-
ity of the system.

Arbitrariness of our observa-
tions and descriptions does not, therefore,
mean that all descriptions and explanations
are equal and that we could pin a label of
truth on each utterance. Cognition does not
provide us with a picture of the real world;
it creates just a subjective construction and
must fit in the world. Reality comes after
truth; it functions as a constraint in rela-
tion to knowledge, pictures of reality, and
activities. It operates on a negative basis: an
ever-changing environment sets limits and
removes all versions that do not fit within
those limits (Glaserfeld 1984: 29).

Communication and culture

Distinguishing between person-
al sense structures and meaning as a social
phenomenon takes us to the question of
how to define culture. It should be clear
that culture does not merely mean belong-
ing to a social community or being within
boundaries of a territory; nor can culture
be understood as it has been since Roman-
ticism: as the fine arts or as a spiritual and
intellectual aspect of life. It is something
more than a set of norms, customs, and be-
liefs. Neither is culture constituted by the
sum of things, although people sometimes
speak in that vein. For people, things are
phenomena they provide with meanings.
Culture is not a thing; it cannot be taken as
a readymade garment from a peg.

It has been said, jokingly, that
Luhmann went to America and came back
without culture (Colli 2004: 3); this jest re-
fers to Luhmann’s studies at Harvard with
Talcott Parsons and the fact that the posi-
tion of culture is different in the systems
theory of Parsons and his student Luh-
mann. In Parsons’ action theory, culture
forms an independent subsystem of the ac-
tions system, the main function of which is
the regulating of double contingency. Par-
sons stressed the importance of values and
norms and the holding of the opinion that
the symbolic order constantly reproduces
social order and excludes the problem of
double contingency (see Parsons & Bales
1956: 195). By symbolic order, Parsons pri-
marily suggested a shared basis of norma-
tive order that already exists (Parsons 1968:
437).

Luhmann, however, did not con-
consider culture to be the only possible solu-
tion to the problem of double contingency
(see Luhmann 1984: chap. 3), and in his
main texts the role of culture is marginal.
In his book Social Systems, Luhmann de-
fined culture narrowly as “a supply of pos-
sible themes that is available for quick and
readily understandable reception in con-
crete communicative processes” (Luhmann
1995a: 163). He mentioned that

culture is not necessarily a normative content
for meaning; perhaps it is more like a limitation
of meaning (reduction) that makes it possible to
distinguish appropriate from inappropriate con-
tributions or even correct from incorrect uses of themes in theme-related communication.”

“38” In his *The Art of Society*, Luhmann even called culture “one of the worst notions ever invented” (Luhmann 1995b: 398). Despite that, some authors (Martens 1999, 2006; Colli 2004) have hypothesized that even Luhmann could not manage without the term “culture” in his analysis of social systems and used it indirectly. According to this substitution hypothesis, “culture” is an umbrella term that covers several terms, such as “distinction,” “semantics” and a restricted concept of “culture” (Martens 2006: 85–86). However, this thesis can be regarded as a rather free interpretation of Luhmann’s texts, which does not coincide well with Luhmann’s words and does not give reason to speak about Luhmann as a cultural theorist. In reading Luhmann’s texts, we can admit that he was sceptical towards the concept of culture. While writing about culture in his *The Society of Society* he said that “the term is undefined or defined controversially” (Luhmann 1997: 881). In several texts (Luhmann 1980: 16–17, 1995c: 31–32), he complains about the wideness and lack of precision of the concept.

“39” In his essay “Culture as a Historical Concept” as well as in *The Society of Society*, Luhmann primarily considered culture as the memory of the society: “… actually, culture is nothing else than the society’s memory, therefore a filter of oblivion/recollection and consideration of the past in determining the variation frames of the future” (Luhmann 1997: 588). That definition could be perceived to mean that culture maintains the traditions of a society, provides solutions to problems that have been successful at one time, forms the identity of a society, and is a control device. Knowledge that “we have always done so” increases the security of activities and decreases uncertainty. However, that understanding is too narrow.

“40” Culture would appear in a completely different light if we did not treat it solely as a heritage, as an already existing symbolic order, a set of norms and values, but we comprehended that culture is a key link in the constant reproduction of the social world without which the social would just cease to exist. More generally, culture could be defined as a collective construction. It is a pattern of structurally related meanings that takes shape in communication, and with the help of which individuals orientate themselves in their environment and that guides their observations, creation, and interpretation of messages and activities. Culture is constituted by the shared mental constructs of individuals, created, maintained, and changed in communication by meanings that are contributed to the messages by others. In that structure, meanings are related to one another. For example, the word “tree” could refer to actual trees – fir, pine, apple tree, etc. – that are separate notions; at the same time, the word “tree” is associated with other notions in culture, e.g., forest, park, firewood, etc. Each sign or utterance receives its meaning depending on its position in the general pattern of meanings and the change of one meaning brings about change in other elements of the pattern of meanings related to it and, consequently, in the whole structure. The “knowledge” that emerges this way enables individuals to operate together and constantly recreate society.

“41” Another aspect required to understand culture comes from the fact that although both consciousness and social systems are operationally closed, there are structural couplings between them. In these processes of congruence between systems arising from the changes that each prompts in the other, the personal sense structures and socio-cultural patterns of meanings suit each other. Processes taking place in both systems occur in a parallel and, to some extent, co-ordinated way, which is why we could conclude that culture is the result of the co-evolution of consciousness and social systems.

“42” Culture is not just a phenomenon preserving and maintaining experiences that have proved to be successful, as is often thought. That concept could even be misleading in two ways. Firstly, treating culture as heritage, the preservation of some fading phenomena, neglects some of the most significant sides of culture – temporal and dynamic ones. Naturally, people do not act in a vacuum, but on a culturally “marked” space. But culture is never a ready phenomenon or a set of existing norms, values or standards, but a non-stop renewing phenomenon. It does not only emerge in communication, but it also changes in it constantly. Each communication act ensues from existing meanings, but it can change them or replace them with new ones. New communication evolves out of new thoughts in which the past, present or future that are different from the previous ones are developed. And as previously stated, change in one or several elements of the cultural pattern brings about changes in all of the other elements that are more or less closely connected to them.

“43” Secondly, culture is not only some preserving phenomenon in the sense of maintenance of successful solutions, but is mainly a generative, initiating, and evoking mechanism. This way, it is not a “soft value”: culture forms the basis upon which the successful activity of a social system (societies, organizations, enterprises, businesses) is made possible at all. The advancement of society that occurs as a result is dependent upon social systems at all levels, foremost upon culture. Culture as a structurally bound pattern of meanings emerges in communication. And its vitality is assured by successful social activities. Culture organizes our experiences and allows for co-operation between persons ensuring that each individual thinks, talks, and acts somewhat similarly to others.

“44” This understanding is strongly influenced by the cultural constructivism of Siegfried J. Schmidt, but still significantly differs from it. In Schmidt’s philosop phy of histories and discourses, collective knowing that conducts communication and allows understanding consists of two interrelated domains: models of reality, (as models for possible realities) and culture programmes (Schmidt 2007: 31–43). The first is described by Schmidt as a relatively static network of categories and semantic differentiations that is specified as the collective knowledge of the members of a society about “their world.” This knowledge creates expectations that agents attribute to each other, and to which their activity is oriented in a social system. This network was established by the social-reflexive references of agents enacted through actions.
and communications, and its categories denote socially important dimensions of meaning (for details see Schmidt 2007: 31–33). However, how these categories and semantic differentiations of the model of reality are semantically related or how they can be related, which cognitive, affective, and moral components they combine, and how central or marginal these relations are is determined by the culture programme as a programme of socially practised or expected references to models of reality (ibid: 35). “Culture programmes regulate the societally acceptable references of agents to the model of reality of a society in a socially binding manner,” writes Schmidt (ibid: 127).

The idea of “programme” does not seem to come from cultural theorist Geert Hofstede, who defined culture as “Collective programming of the mind” (1980: 25, 1991: 4, 2001: 9). Instead, it comes from Luhmann, in whose theory of social systems, “programme” specifies “code.” In his The Society of Society, Luhmann has written that anything that can be covered by the code appears as contingent – it could also be otherwise. Therefore, there is a practical need for decision-making rules that would determine under which conditions the value or opposite value of the code is right or wrong.** (Luhmann 1997: 750; my translation)

Elsewhere, Luhmann wrote that the context of operations leaves too much playing ground that needs to be limited. That is why additional criteria determining under which conditions division into positive or negative values is done have been developed next to codes. We call these conditions a programme.** (Luhmann 1997: 362; my translation)

Thus, we can say that the models of reality alone are not enough – they, as a system of options, become usable through a programme of socially practised or expected references to models of reality, i.e., through rules of selection and combination, as well as criteria of compatibility in the form of a culture programme. Only this programme gets and keeps the world model going (Schmidt 2007: 36).

Unfortunately, I cannot fully agree with this clear and, at first sight, very good conception. Schmidt holds the opinion that in the interactive dependencies of the reality models and culture programmes, the difference of cultures does not primarily rest on the models of reality that for different humans is rather similar, but on the culture programme (Schmidt 2007: 41, 2005: 80f). However, people who are able to speak several languages can confirm that people build different worlds in different languages, due to which learning another language is not learning other words in order to speak about the same reality, but contact with a different reality.

Using the word “programme” to describe culture is also somewhat problematic. This word is, of course, a metaphor; nobody thinks that the consciousness of people can be programmed in the same way as a computer. However, in my opinion, this metaphor is not in line with the idea of cognitive autonomy and structural determination of which Schmidt himself has written so aptly (Schmidt 1994). “Programme” as a metaphor refers to the fact that the impact of culture is dense and homogeneous, but in such a case it is difficult to imagine differences of opinion and debates. Culture is a social phenomenon and it has not emerged beyond communication – references of actors to phenomena, themselves, and others. Rather, it develops into a phenomenon beyond actors as a collective knowledge that does not coincide in detail with the personal sense systems of a particular actor. Furthermore, the latter is much wider than knowledge of a single actor regarding culture as a pattern of meanings. A culture understood that way is structurally coupled with the consciousness of individuals. In this process, changes that result from the interaction between the consciousness system and its environment are determined by the structure of the disturbed system, not by the environment. So we can claim that the metaphor of the programme is only justified if the programme does not function properly.

Regarding culture as an interconnected and consistent set of meanings, the question of whether these structural relations constitute a system arises. The answer is negative because culture cannot be separated from communication. Culture and communication are two different sides of the same coin or sheet of paper – neither can be seen as a separate entity; they constitute a whole. Communication is not possible without culture and culture as a social phenomenon does not evolve without communication. In order for people to communicate and act together, they must have shared meanings that constantly emerge and change in communication. Schmidt has called attention to it in his Histories and Discourses, where he wrote: “Culture conducts communication, and communication imperturbably performs culture. Both make sense only in strict complementarity” (Schmidt 2007: 74).

It must be added that a social system in which shared meanings evolve is not necessarily a society as a whole. Cultural phenomena are often specific; they are related to a specific situation, group, and time. Communication constantly differentiates in the course of evolution and it feeds both the development and ability to cope in an environment. There are no choices or evolution without variations.

In culture as a pattern of structurally related meanings also lies the secret of capacity for connection of the operations of the social system. It is the culture that is the missing link in the social systems theory, in the absence of which the social cannot emerge. A meaningful relation between its elements – communications – is inevitably necessary for social systems. The problem of the capacity for connection of communication is solved as soon as one looks at meanings as an intertwined pattern. Culture as a network of (shared) meanings determines whether the participants in communication understand each other, or not. Depending on this, communication may be connected to another communication of a given social system, or not. Culture as a network of meanings enables communication, co-operation, and mutual understanding among people. But there is also a negative side to it: in the network of shared meanings, people are only their own masters to quite a modest extent.
Origin of culture

« 53 » An important feature of the social is that a society or community is a network of transactions where meanings, “collective knowledge,” and culture are generated by people in contact with other people.3 That network of interpersonal communication has no equal density; in some places, the knots of relations are compressed to such an extent, that other’s messages. In these mutual reactions, people co-ordinate their thought processes. As consciousness systems are operationally closed and autonomous, their reactions are neither one-dimensional nor linear. Each individual receives messages at the level of his and interprets them according to his experience, cognitive and emotional state, beliefs, and expectations, specific situation, etc. The evolving constructions find expression again in communication, to which other individuals in turn react, etc. In that chaotic movement of messages and mutual impacts and reactions, socially accepted meanings and patterns of meanings arise at the level of social system. Therefore, we can claim that although meanings stem from individuals, these are not constructions of one individual, rather products of a social world.4 Naturally, the social system does not “make up” the meanings; it only organizes the messages of individuals selecting and interpreting the material substitutes used in communication and connecting them pursuant to the meaning. As a result, an organized movement of the elements – communications – evolves at the supra-individual level.

« 55 » As consciousness and social systems are environments for each other, so we could talk about the impact of the environment on a social system with regard to the formation of the set of socio-cultural meanings. The influencers are messages, or suggestions for the meaning, that are presented by individuals, on the basis of which the communication system will be organised. At the same time, it is a typical self-organization process, where structure or pattern emerges in the interaction of system elements, communications. That coherent pattern is spontaneously formed in local interactions of system elements and is spread throughout the system without any element co-ordinating it. Using the term of the founder of synergetics, Hermann Haken (see Haken 2007: 19; Haken & Schiepek 2006: 80–82), it could be said that the pattern of meanings formed in interaction of the individuals’ messages “enslaves” the single particles of the system, communications. Enslavement means that in the process of the formation and spreading of the pattern of meanings, the degree of freedom present in the communication system decreases. From an enormous range of possible meanings (and together with that, numerous opportunities to discuss matters), only a few opportunities remain dominant.

« 56 » Both circular causation and the relation between the micro and macro levels function in this process. The pattern of meanings is a function of social system elements and the elements in their motion are the functions of the structure of meanings: the pattern of meanings determines the organized movement of the many elements of the communication system, and elements create patterns of meanings. Order is produced as a result of the interaction of messages in this circular process, and when looking at the circular cycle, it could seem as if the messages organised themselves. The system is operationally closed and it is organized by one or a small number of patterns of meanings. The pattern of meanings emerging in this self-organization process of the communication system is culture and, to the extent the arising configuration exists, can probably be measured and mathematically expressed as well – even though for the moment this must remain a speculative assumption motivated by results of the interdisciplinary research on self-organization such as Haken’s synergetics (see above), which shows that in some cases the emergence of new qualities can be mathematically described.

« 57 » It could be assumed that culture as a pattern of meanings is primarily formed spontaneously in the dense places within the net of interpersonal relations as a result of messages oscillating back and forth. Configurations of meanings arise in various places of the net and spread as circular waves in every direction, covering a bigger and bigger area. Thereby, they force all the communications left in their way to oscillate with them in the same way as waves swing boats on a bay. These concentric waves collide with other similar ones and, on the basis of one or several of them, a more or less general pattern of order shall emerge. While several circles of waves may persist for some time, several different patterns of meaning exist side by side.

« 58 » Another remark is that the pattern of meaning emerging in the process of self-organisation on the social level is not consensus. The latter assumes the agreement of at least most of the participants and the group solidarity of belief or sentiment. Self-organization, however, is a spontaneous process, which does not necessarily depend on the thoughts or will of individuals. Binding patterns of meanings arise within the interaction of elements – communications – and are rather a result of the enslavement of the elements of the social system.
Individuals participating in communication constantly express their views, but at a social level these are either accepted or rejected by the participants in communication as not being compatible with the collectively accepted definition of reality that co-ordinates common activity. Shared meanings evolving in communication differ from the perceptions of individuals by volume, as well as the content. A social system formed in communication differentiates from the individuals and functions as an independent system. Thereby, social activity does not depend on the subjective opinions and interpretations of individuals participating in it, but on the shared meanings.

Thus, the pattern of shared meanings emerging in communication begins living its own life and forces individual minds to consider it. This, however, does not mean that hereafter communication will create communication and meaning will create meanings and that the consciousness of an individual no longer has anything to do with them. Culture does not emerge or change beyond the references of individuals to phenomena, themselves, and others. Individual sense constructs and interprets the provision of meanings and the forthcoming shared knowledge is the fruit of the subjective experiences of persons.

Understanding adaptability

Having observed how a pattern of structurally related meanings emerges in the communication from individual constructions of people, there is another significant question before us that we cannot ignore: Why do we create our knowledge? According to the second principle of RC, the function of knowledge is adaptive, in the biological sense of the term, tending towards fit or viability; cognition serves the subject’s organisation of the experiential world, not the discovery of an objective ontological reality (Glasersfeld 1995: 51; my emphasis). That principle is derived from the developmental psychology of Jean Piaget, which also postulated that the function of cognition is adaptive. Piaget (1952, 1997; Piaget & Inhelder 1969) understood the development of human intellect as an ongoing process in which the individual either assimilates new experience consistent with the existing schemas or changes (i.e., accommodates) the schemas to fit his or her experience.

The words “adaptive, in the biological sense of the term” hint that what is meant is the relationship between an autopoietic system and its environment in which adaptation is literally a matter of survival and not just at the cognitive level where adaptability refers to the maintenance of coherence of knowledge. In relation to the latter, Piaget (1968: 101) wrote about cognitive equilibrium, in which our conceptions easily assimilate experience. These two levels are interrelated: adaptation in the cognitive domain is an important part of adaptation in the biological domain.

An individual-centred conception of cognition and adaptation of RC is, of course, familiar to the readers of Constructivist Foundations. It is based on the basic assumption of second order cybernetics that the observer is not only a participant in observation, but also a part of it. Knowledge is not passively received, nor can it be transmitted either; it is actively built up by the cognising subject. The autonomous, self-referential, and operationally closed cognitive system interacts only with its own states, and the observer can know nothing but the cognitive structures he himself has put together. Both organisms and consciousness systems, as well as social systems, develop in co-evolution with their environment and their autopoiesis depends on the capability of the systems to develop themselves and their structures to meet the environmental conditions. The purpose of knowledge constructions is to maintain autopoiesis, or, as Maturana stated: “Living systems are cognitive systems, and living as a process is a process of cognition. This statement is valid for all organisms with and without a nervous system” (Maturana 1980: 13).

To a great extent, adaptation is possible because cognition and action are interrelated. Piaget (1997: 20) has already associated knowledge with action: “To know an object is to act on it,” he wrote. Thus, we not only perceive something, but we immediately interpret what we sense as well (see, hear, smell, etc.) and apply schemes of reaction that we have created. Although there are various ways to perceive different things in the world, in the case of the schemes of reaction what exactly we sense is not important, but what matters rather is survival – that we react to our experience in a certain way and refine the relation between the experience and action in the course of the structural change. Survival simply means constructing any alternative means which manage to get by the constraints that are continually imposed on us (Glasersfeld 1984: 20–21). Whether and how we manage to squeeze ourselves between the bars of the constraints is not determined by the environment, but by us, i.e., consciousness or the social system itself. Here, it is important to notice that when talking about the “constraints of our experience,” we are not talking about an observer-independent reality – our experience also stems from our own construction. Connected to that, von Glasersfeld (1981: 92) notes that “any construction, be it physical or mental, is subject to certain constraints that spring from the material that the constructor employs.”

From this rather sketchy treatment of some aspects of radical constructivism’s theory of knowing we can arrive at the simple conclusion that the perception originating from the Modern era, according to which the Descartes’ thinking thing (res cogitans) is faced with the objects of the Newtonian mechanical universe, is not the case. Furthermore, the traditional correspondence theory of representation does not hold either. The world is, in Husserlian terms, the ever yielding, never reachable horizon of possible meanings. This is the ultimate medium in which everything takes place. It is impossible to grasp its immensity – we cannot observe infinity. The inexhaustible world per se is a smoothly functioning integrity. Human cognition, however, is built so that we make sense of the “outer world” by means of distinctions and indications. The result is constructions of real operating systems. What is needed is an explanation of how the “self-founding activity” of cognitive systems is related to adaptability in the biological sense of the term.

That question is important for communication scholars. Application of RC in communication science has shifted the research focus from the traditional media and reality relation to investigating the ways in which media construct realities. That alone, however, is not enough. When
we consider media or journalism as the “distributor of reality” and yet understand that the system has no access to how the world “really” is, the question of the relationship between the reality constructed by media and observer-independent reality outside the individual observers does not disappear, but transforms or even specifies a very practical question: does the “reality” created by media favour or restrict the survival of the system in the continuously changing environment? The question is not whether things are as we perceive them (even most naïve realists do not believe in such a correspondence); a much more important question is whether or not our notions help us survive and cope in the environment. As far as I see it, that is one of the main questions of the existence and development of the social systems. Consequently, we need to consider once again the issue of the relationship between our constructions and reality. Thereby, we have once more to turn to Luhmann’s social systems theory, which refers to the contradiction of self-referential cognition and adaptation.

In his *Social Systems*, Luhmann notes that self-referential and operationally closed systems produce their elements themselves and, as a result, their structural changes, too. This means that the environmental impact does not work without the cooperation of the system. The system cannot fit itself to the environment; it can only let itself become irritated, followed then by a change in system structures in the course of autopoietic reproduction. Luhmann (1995a: 350) justly notes that “without such cooperation from the system, the environment would remain merely the possibility of destroying autopoietic reproduction.” In the social system, each structural change is possible only by communication and such a change means the self-change of the system.

According to Luhmann, however, that process is connected to a serious problem:

...since elements and structures, situatedness and semantics are performances of the system, too much ‘of its own’ enters into the ‘adaptation’ for one to infer an increased compatibility of the system and environment as a result. Paradoxically, precisely its own part in the process of structural adaptation may prevent a system from success-fully stabilizing itself within its environment in the long run.** (Luhmann 1995a: 351)

** 68 ** Or in other words: the system tends to react to the problems that it creates, without being able to achieve a better relationship between itself and the environment (see Luhmann 1995a: 352). Luhmann refers to the fact that the systems that rely only on their constructions and totally neglect the outer world will not survive. To avoid that, the cognitive system must have a “mechanism” that, in spite of the operationally closedness of the cognition, would enable the system to react to the changes emerging in its environment.

### Bridges to the world

** 69 ** Looking for such a “mechanism” means tacking between the two errors often reached: on the one hand, that our cognition or messages reflect a reality with which personal sense and socio-cultural meaning have been provided; and, on the other, that there is no “outer reality” or that it does not matter. We could rather say that the knowledge construed in an autonomous and self-referential cognitive apparatus has two aspects: besides the self-referential side emphasised by RC is also the external referential facet of knowledge. Without the latter we could not call the purely self-referential operation that acts blindly “cognition.”

** 70 ** External referential aspect of knowledge points to the fact that every observation and every communication act refers to something. It does not mean that knowledge reflects the world as it is. The phenomena of the cognitive world do not exist ready outside us and in the same form as in our imagination. Another point that is important is that although the external referential facet of knowledge points to phenomena, it is not an inert referent of something but also seeks to be useful instruction or recipe for action, guiding the way we interpret the phenomenon and what we have to do.

** 71 ** Consequently, what the relationship between our knowledge and “the outer world” is is not irrelevant for us. This is because the efficiency of knowledge does not depend merely on its inner coherence (the enormous consistency of perceptions ruled in George Orwell’s *Animal Farm*), but also on relations with the environment in which the system functions. In understanding that our knowledge does not constitute a picture of the world, we search not for the relation of knowledge and the “reality” by looking for an iconic representation of reality, but for ways of “fitting” the constraints that the environment provides. Therefore, a significant criterion of cognition is success: cognition either helps us achieve our goals or not. Von Glasersfeld explains that suitability with an example of a key and a lock:

“A key fits if it opened a lock. The fit describes a capacity of the key, not of the lock. Thanks to professional burglars we know only too well that there are many keys that are shaped quite differently from our own but which nevertheless unlock our doors.”** (Glasersfeld 1984: 21)

** 72 ** The metaphor of a lock suggests that there are more than one working solution – more than one key could open a lock. But all these solutions must fit the reality provided to us as an environment and that does not exist only in our own imagination. Here we could conclude that the core-mechanism of adaptation is the construction of viable (i.e., successful, workable, usable, valid) experiences. But that is not the only means (in the sense of instrument or tool).

** 73 ** The human as a social being does not obtain alone the resources needed to support life: the survival unit of him as a species is a social system – a communication system. Therefore, it is logical to assume that the relationship between an individual’s or social system’s environment and its cognition runs also through communication and the shared knowledge emerged in it.

** 74 ** According to a sceptical argument that originates from antiquity, we cannot step outside sensation to compare our representations with the physical object it is supposed to represent. We can, however, compare results of our observations with that of another, then a third, etc. and that is what we do in communication. As Maturana (1980: xxii) famously said: “Everything said is said by an observer.” According to The *Laws of Form* by logician George Spencer Brown (1972: 1), every observation is constructed from two components: a distinc-
tion and an indication of something, which necessarily leaves all other things aside. The central point in the concept of observation is that once you have drawn a distinction, you cannot see the distinction that constitutes the observation – you can only see one side of it. Heinz von Foerster (2003: 284) called that a “blind spot” of observation. But the situation changes when we distinguish two orders of observation as von Foerster (ibid: 286) and Luhmann (1993: 763) did, and talk not only about first-order, but also second-order observation. The second-order observer uses a different distinction from the first-order observer and he can see what the first-order observer cannot see – the blind spot of the first-order observer. In this way, the “how” of the first-order observation becomes the “what” of the second-order observation (Christis 2001: 335). But just as the second-order observer also needs a distinction to observe the distinction of the first-order observer, he himself is a first-order observer who could be observed by another second-order observer.

Thus, different observations, distinctions, and indications make discernible different features of the world. Taken together, this means that the shared knowledge emerging from interaction of the messages of individuals exceeds the boundaries of operationally closed cognition of individuals and starts approximating ever more to the outer reality in the sense that the applied schemes of reaction are successful and their repetitive use gives the desired results.

Naturally, no knowledge emerging from the observation or self-organisation process of the communication system provides the truth of last resort. Because of the self-referential character of knowledge creation, a world beyond our personal sense structures, and socio-cultural meanings is unrecognizable; knowing is always relative: there is no and cannot be one true and complete description of “the way the world is,” as there is no last observer who knows the truth. Various observations and descriptions could, however, support each other so that a more environmentally sensitive structure emerges in the chaotic movement of messages and complex interactions between cognising systems and their surroundings. As reality can now be seen from a different angle, which reveals different possibilities, this structure can provide richer and more flexible and reliable knowledge from the perspective of solving the problems of the relation of system and its environment than each single observer might create alone. Thereby, as a shared knowledge emerges in the communication and interaction of various observers, the vicious circle of self-reference interrupts; the ancient figure of the Ouroboros stops eating its own tail and turns into a pretzel, a figure eight lying on its side, which is the mathematical symbol for infinity. Alongside that, the self-referential circular process of construction by means of what is “in here” becomes cognition. Here we reach an important conclusion: we all construct our own world as individuals, but the process of knowing is not restricted to a single individual alone, it also involves other people and this continuing and open-ended process is directed by culture.

Variations matter

Some more things should be noted. As already mentioned, the pattern of meaning that takes shape in communication is temporal – it never lasts. This means that new operations are constantly required in order to secure the continuation of autopoiesis. The actions of the observers are related to the meaning-orientation provided by culture. People treat their constructions as a reality and orientate towards them in their observations, communication, decisions, and actions. It follows from here that as the pattern of structurally related meanings has no duration, the future is always unknown – it is dependent on the agents’ choices and decisions. Those in turn depend on the shared knowledge generated in communication.

Secondly, it must be emphasised that when looking from the point of view of the process of adaptation of the social system with its surroundings, an important condition of the ongoing process of creation of the shared meanings to which individuals orientate themselves in their activities is the existence of variations. Coevolution of the social system with its environment is possible only if different observers express various notions and experience, and if several alternatives are represented in communication. Cognitive systems are unable to reach their environment operationally, and so they cannot know it independently from their own structures. Nonetheless, there are structural couplings between autopoietic systems and systems in their environment that are compatible with autopoiesis (Luhmann 2000: 107). When the right of speech and access to the means of communication are restricted (as we have seen, for example, in authoritarian and totalitarian political regimes), the repeated irritations only come from single segments of the environment and the patterns of meaning are then processed within the system as a response to those irritations. In these conditions, the system might not be capable of developing itself and its structures to meet the environmental conditions, as many irritations that may trigger necessary changes of the state are disregarded. Let it be added that we do not notice the problem when we consider adaptability, only the maintenance of coherence of knowledge.
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is currently an assistant professor in the Institute of Communication, at Tallinn University in Estonia, while previously he was professor of communication theory at Nord University, Tallinn, Estonia. He received his M. A. in 1978 from Tartu University and earned his Ph.D. in political science (political communication) in 2001 from Tallinn University. Named “Journalist of the Year” by the Estonian Journalists Association in 1995 and 1996, he has worked for leading Estonian newspapers and magazines. In the political sphere, Palmaru has served as the chief-of-staff of the prime minister of Estonia and from 2005 to 2007 was the minister of culture. Palmaru’s publications include three books and numerous professional papers.

Conclusion

«81» Thus, this article aims to show how a shared knowledge and culture emerge in communication from individual constructions of people, as well as the purpose for which we create our knowledge. As a conclusion, I would like to remind the reader of three key points. First, the author criticises Luhmann’s concept of meaning as too weak to explain the autopoiesis of communication and suggests a distinction between personal sense structures and socio-cultural meanings and an introduction to the concept of shared meaning to the systems-theoretical approach. This paper conceptualises meaning as a phenomenon that evolves in communication, and defines culture as a pattern of structurally related meanings.

«82» According to Luhmann, social systems do not consist of static objects, but of dynamic operations, and for the social system to emerge, its elements – communications – must be connected to one another. I argue that the secret of the capacity for connection of operations of social systems lies in a culture that determines the meaning of messages and regulates their acceptance or rejection by the participants in communication and belongingness of particular communication acts to the existing pattern of meanings. Observers operating in society more or less rely on the common culture, so the understanding of each other and common activities become possible in spite of the cognitive autonomy of action carriers. Culture is a key link in the constant reproduction of the social system (whether society as a whole, an organisation or the interaction of people), in the absence of which the social would simply cease to exist.

«83» Second, the problem of adaptation does not disappear when we understand cognition as an activity of self-referential systems, but transforms into a question of whether a constructed “reality” favours or restricts the survival of the system in the constantly changing environment. Substantially, the question is how individuals and social systems exclude that in knowledge constructed by an autonomous and self-referential cognitive apparatus there is too much “of its own,” which works against the systems developing themselves and their structures to meet the environmental conditions.

«84» People try to surmount the vicious circle of the operative closeness of cognition in at least two ways. First, an important criterion of cognition is its success: cognition either assists us or hinders us in achieving our purposes. That is what von Glasersfeld called “viability” – our knowledge can only be interpreted as a key that unlocks possible paths for us (Glaserfeld 1984: 18). Second, a compatible opportunity is to compare the observer’s experience with the experiences of a second, third, etc. observer. Although cognitive systems are unable to reach their environment operationally, various observations and descriptions might support each other so that an environmentally sensitive structure emerges in the effect. The structure that emerges in the chaotic movement and mutual impacts of messages and complex interactions between individuals can provide richer and more flexible and reliable knowledge from the perspective of solving the problems of the relation of system and its environment than each single observer might create alone.

«85» From the perspective of adaptability, i.e., a social system’s ability to take action to achieve a fit or balance with its internal and external environments, an important condition of the continuous process of creation of the shared meanings to which individuals orientate themselves in their activities is the existence of variations. In a situation where cognitive conditions of observation and access to the means of communication are restricted, the system might not be capable of developing itself and its structures to meet the conditions of the environment.

«86» Last but not least, although constructivism is far from a uniform approach, but rather a very diverse, polyphonic and heterogeneous discourse with many various points of view and factions. Nevertheless, we could divide most variations of modern constructivism into two: social constructionism’s “top down” perspective, which provides that all that we take to be real is an outcome of social relationships; and constructivism’s “bottom up” perspective based on the view that the individual’s experiential world is his own construction. One of the central issues in the development of constructivism is overcoming the incompatibility of “top down” and “bottom up” constructivism and the creation of a social constructivism (which differs from social constructionism). I hope my paper also helps to contribute to that.

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Open Peer Commentaries on Raivo Palmaru’s “Making Sense and Meaning”

Comparing Incomparability – The Functional Distinction between Operation and Identity

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> Upshot • The author addresses implications arising from socializing observer-dependent heuristics. Above all, Palmaru’s terminology is called into question since its conceptual deficien-
cies with regard to the relation between an observing system and its environ-
ments cause naturalistic fallacy. The author’s reply espouses a concise reanaly-
sis of the complementary relations of fundamentally incomparable domains, namely the observer and the social sys-

1. Incessant debates tend to rear up on regular basis, and there seems to be a pressing need to revise yet another delineation of the colloquially phrased question: How much “we” is in autopoiesis? Referring to Raivo Palmaru’s blueprint, this admittedly trivial phrasing expresses a renewed attempt to bridge Niklas Luhmann’s concept of communication and what at best might be named as humans’ participation within the social realm.

2. Palmaru sets out to redefine the relation between communication and culture, and along with his aim, gives an outright preference for Luhmann’s concept of communication. This preference is expressed with the proviso that Luhmann’s theory of social systems lacks explanatory power with regard to the autopoiesis (concept) of communication’s ability to explain “meaning.” Palmaru suggests overcoming this “weakness” by distinguishing dimensions of meaning, an allegedly elegant solution, which admittedly raises implications. The following remarks attempt to illustrate essential objections to this approach.

3. The point of departure for this commentary is that the communication complexities of the relations between self and society require a theoretical and epistemological framework with a high sensitivity to uncertainty. Communication theory in the tradition of systems theory and radical constructivism, with its emphasis on epistemological reflection, is particularly well-
suited to this purpose for it considers agents of communication as agents in communication systems that are complex. It further considers that communication itself is an irreducibly uncertain operation. Communication theory is thus positioned at a level beyond the agent, medium or semantics, although it remains attentive to all three fac-
tors.

4. Palmaru plainly bypasses these au fond commonplace of pertinent theory construction by establishing a range of conceptual antonyms opposing communication, and his starting point is the juxtaposi-
tion of communication and culture. The choice of means of such an alignment of abstraction levels remains questionable. The author’s dimensioning of culture as such is quite narrowly considered. Even the function of culture, which one could expect to be a prerequisite of any further theoretical consideration, seems to amount to nothing more than to contrast with communication. Palmaru introduces culture as communica-
tion’s counterpart: partly normatively posit-
ing culture, partly as conjunction of history of science if nothing else when he refers to culture’s significance in preceding “books and articles” (§2). Thus, culture appears as an auxiliary construction to surmount im-
lications of Luhmann’s work. At no point is a functional assignment for culture given. The notion itself remains on the one hand (quasi-)ontological and on the other hand vague with regard to the author’s “arguen-
do” of culture as a more or less epiphenom-

5. Considering the author’s attempt to redefine sharing as a form of socially binding participation, Palmaru’s point of departure – within the realm of social sys-
tems defined by Luhmann – is not capable of explaining a claimed overwhelming need to define communication as autopoietic. Nor does he apparently reflect on the con-
sequences of such a claim that would allow for such a conceptualization. As Luhmann (2000) unequivocally stated when opting for an “operational constructivism,”

observers of other observers cannot distin-
guish the conditions of existence of these latter observers from the conditions of knowing that what they are dealing with are particular, self-
conditioning observers. (ibid: 6)

6. However, Luhmann, evidently aware of social theorists’ basal ambition to bridge the individual (observer) and (ob-
served) environments, does not hide the fact that every sociological theory has an obligation to “resolve” the incomparability
of an observer's perception of self and otherness. Along these lines, Luhmann's sole framework, modelling these incomparable arrays, is based on relation as progression (Luhmann 1992: 31). I would like to stress emphatically that this progression is mainly driven by desistance.

« 7 » In my opinion, such a theoretical decision prevents any intermediating instance, if such an instance can be considered as where meaning is processed for more than one observing entity. Desistance as an impetus for progression is above all not geared to any “third party” that comes into play to evoke extra-systemic grounds for “common meanings” (§30). Palmaru’s division of meaning into a human domain, which is defined as personal sense structures, and social-cultural meanings, defining a social domain that itself is not identical with communication, caters for a phenomenological substitute by implication. When Palmaru conceptualizes meaning “as a phenomenon that evolves in communication” and defines “culture” as “a pattern of structurally related meanings” (§81), this endeavor seems to be “outsourcing the function” of systemic orders in preference for a “sociably compatible” construction of identity. At this juncture, the author effects just that controversial relation in the context of philosophies of mind that has been extensively covered by Luhmann’s remarks on “either subject or object” (Luhmann 1997: 886–879). In lieu of considering the consequences of Luhmann’s rendering of the subject as identical with self-reference, as the foundation of recognition and action (ibid: 868), Palmaru seems to miss the progressive aspect of this irreconcilable contradiction. This aspect, in my view, remains an essential discernment in every observer-based theoretical assumption. In his attempt to make “sharing meaning” presentable, he simply ignores autology within communication as well as autology’s consequences for a societal model:

« 8 » We finally face a binding decision: as soon as we encounter situations, we are exposed to the insuperability of a modal antagonism between the referential arrays of action and communication, which is an iteratively emergent phenomenon. Notwithstanding, this insuperability obviously allows for an essential degree of freedom in encounters. “As in the heliocentric system, there must be a third that is the central reference. It is the relation between Thou and I, and this relation is identity […]” (Foerster 1984) Identity makes a difference: identity “draws a distinction” (Spencer-Brown 1969) between an observer’s array of mind – his or her consciousness, affects, and cognitions – and his or her observable appearance as a form of being, which is perceived as mind-driven. In order to take stock of this boundary, I would like to raise awareness of its definitional “conditio sine qua non”:

« 9 » I would like to draw attention to the indissoluble paradox of interaction in general, as it tends to generate referential transfers continuously that can no longer be taken as an exclusive responsibility of their generators. In particular, interaction faces the unfolding of its paradoxical outcome when it divests itself from its agent, when interaction as a process is transferred into an “intermediate world” beyond the operationally closed (subject), where it recognizes intersubjective validity. That is clearly Palmaru’s misunderstanding in my view: by installing culture as a “gateway” between a conscious observer (self) and society, the author “naturalizes” systems indirectly by constructing an extra-systemic exchange layer for the communicatization of meaning. On this note, Luhmann’s strict distinction between action and communication becomes analytically quite reasonable, shifting accountability to a domain beyond the “subject’s accessibility by drawing the distinction that communication is inherently social.

« 10 » What does that mean for the meaning-heavy term “understanding”? Palmaru at this point equates understanding, knowledge, and cognition, which culminates in his interpretation of adaptation (§60f). Yet again his remarks remain vague as he states, “what is meant is the relationship between an autopoietic system and its environment […] is literally a matter of survival” (§61). Although one could agree with this circumscription of viability, Palmaru leaves the reader in the dark as to what exactly is meant by his reference to “an autopoietic system.” According to whether the author refers to “organism,” “consciousness,” “cognition,” “the cognizing subject” or “social systems” this varies randomly (§60). Even his compliance with second-order cybernetics’ observer-centrism (§60) interferes with the “heuristic” (Baeccker 2002: 131) notion of the observer with cognitive systems.

« 11 » I would like to make some necessary remarks on the biology of cognition in order to illustrate Palmaru’s “oversimplification” of the conception of cognition. Indeed, in keeping with the theoretical framework of second-order cybernetics (Foerster 1985), the core reference of an observer-conception will be an organism, whose basic referential scope could be described as “consciousness.” The preference for this starting operation can be easily explained when examined under the terms of a difference-logical calculus. Consciousness knows no distinction, no differentiation in the sense of a predictive presupposition in the experience of an observer – we cannot step beyond. Similarly, the choice of which concept of consciousness might fit from an
analytical perspective could be easily disputed. This is true in the sense that it seems obvious that the notion of the concept is mentioned as a function of expressing the responsibility of a mind-driven organism as an agent, in accordance with the perceivable consequences of behaviors, actions, and communications. Thereby, the "elegant" character of consciousness could be modeled as an epiphenomenal outcome of the usage of language (Maturana 1978) in a narrow sense, as well as the usage of any kind of proto-semiotic material in a broad sense (Schmidt 1996). As a biological organism, the brain is clearly closed in a relative sense. Allan Schore (1994) argues that the brain is a complex self-organizing system. In the field of neuro-semantics, Olaf Breidbach (Florey & Breidbach 1993) argues that the brain is not only self-organizing, but has to consider a holistic agency, which can usually be called "consciousness." This is because the semantic structure of the substantive becomes more transparent when extended by a prefix, and we can also use the expression of self-consciousness as a synonym.

Self-consciousness then is not a neurophysiological phenomenon, it is a consensual phenomenon emerging in an independent domain of interactions from self-orienting behavior and lies entirely in the linguistic domain. (Maturana 1980: 42)

To use another characterization: the core aspect of the evolution of self-consciousness implies a semantic mode of processing self-reference (Meitz 2009). And processing self-reference while being aware of one's self in the presence of others urges reflection:

When we human beings reflect on our living, we find ourselves living together as a matter of course in the flow of consensual coordinations of doings of languaging. [...] Yet, in any case, as we reflect we find ourselves being part of a field of operational coherences of our living. And we also find that we can explain all the worlds that we live with the operational coherences of our living as we become aware of our existence and operation as structure-determined systems that can operate as self-consciousness beings. (Maturana 2006: 100)

Operation and identity – and evidently Palmaru passes over these varying layers of observation – cannot be compared in terms of accessibility, notwithstanding that they allow what Luhmann would have defined as progression and what could be defined by Niels Bohr's (1931) understanding of complementarity. In addition, the more or less implicit equivalence of cognition, consciousness, and self– as Palmaru apparently accepts in order to define a "sphere," as opposed to social systems – disguises that encountering others or the world(s) is not a cognitive experience within a concrete environment but rather an encounter that allows semantics to be "met" that are derived from reflection, since the "other side" remains unattainable.

In conclusion, I would rather agree that a debate about autopoesis being supportive in explaining societal binding from an observer-based perspective remains a loose end in the connection between radical constructivism and social systems theory. But neither the dislocation of meaning beyond observers or communication – as Palmaru au fond proposes with his definition of culture as an intermediate – nor the reevaluation of meaning as a shared sphere exterior to a historically deduced observer, appears useful for increasing his theories' explanatory power. Finally, the overemphasis on an admittedly controversial concept such as autopoesis, as applied by Luhmann (e.g., Schmidt 1996: 28f), can blur the vision of an application of theory that accords with social phenomena. This blurring occurs when we delineate almost every observer-related category as autopoesic and yet surpass one of the most trivial reasons for holding observer-related theories at all, namely, not to objectify our own heuristics.

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Why Culture?

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> Upshot • I argue that if we decide to use the term “culture,” we need to be explicit about the problems we hope to solve in doing so. I suggest that Luhmann might have had a good reason to be hesitant to utilize the term.

1 In his article, Raivo Palmaru raises the question, “How do(es) … culture [emerge] in communication from individual constructions of people?” (§1) My intuitive commentary to his question is a counterquestion: “Well, does it?” Or rather: “How do you know it does?” Or, less intuitively and more academically phrased: “Under which conditions is it viable/helpful/productive to talk about “culture” and its emergence?”

2 Palmaru offers an interesting and inspiring suggestion for an answer to his question. I do not need to repeat it here, and I do not wish to dispute it. In fact, I cannot dispute it because I lack any criterion to judge it. Palmaru’s suggestion certainly is one possible way of conceptualizing culture in its relation to communication and individual constructions of people. What I would have liked to learn more about, what I would need to know in order to evaluate Palmaru’s proposal, is how I could go on and use his suggestions to solve empirical or theoretical problems.

3 The popular culture and media theorist Christoph Jacke coined the phrase “Culture does not exist, but we need it” (Jacke 2004, see also Schmidt 2002). In my view, this is one of the most compelling statements about culture, and I try to keep always it in mind when thinking about the term. As is so often the case, the noun “culture” all too easily leads us to a manner of speaking that implies that culture “exists.” What follows then, is the (seeming) need to explain a number of questions: How does it emerge? What are its effects? How can we change it? We might call this an essentialist fallacy.

4 I do not know whether culture “exists.” I know that it can be helpful to use and define the term in specific ways in order to solve specific research questions. There are plenty of suggestions out there defining what culture seemingly “is.” It can be seen as a system of signs and symbols, as a whole way of life, as social memory – you name it. It is never a question of whether they are “right” or “wrong.” They make sense if they help us to do our research, to observe, describe, and analyze, to solve academic or other problems. Different definitions allow us to ask different questions, to solve different problems. Each and every one has its shortcomings and blind spots.

5 Palmaru himself stresses that there is a plethora of books and articles about the relation between culture and communication, yet “the “how” in the relationship […] is far from obvious” (§1). His answer to this vagueness is to define the relationship. Yet a definition is not an end in itself. Furthermore, to describe a relation implies a specific understanding of the elements that are related. Both go together. Just as it does not make sense to judge a definition to be “true” or “false,” it is not possible to define a relation between two theoretical terms “correctly.” I cannot comment on a suggested model without knowing what it is meant to be used for. Any answer to the question, “How are culture and communication related” needs to be evaluated in the light of the answers to some further questions: What is the problem I need to solve? For which purpose do I want to use the theory/the concepts I am about to design? As a reader, these are the questions I would have liked to ask Palmaru, because I could not identify Palmaru’s implicit answers to these questions.

6 In some passages of his article, Palmaru seems to advocate a rather essentialist perspective on culture, as if he knew its “true” nature: He pleads that we could see culture “in a completely different light” if only “we comprehended that culture is a key link in the constant reproduction of the social world” (§40, my emphasis). Later on, Palmaru insists: “Culture is not just a phenomenon preserving and maintaining experiences that have proved to be successful, as is often thought.” (§42, my emphasis) I find this to be a somewhat surprising manner of speaking in a constructivist journal. Of course, it is possible to define culture as a key link in the reproduction of the social world and it surely makes sense to do so in the context of a specific theory and in order to solve a specific problem. But I would have expected a constructivist scholar to be more hesitant to announce that culture is “a” and that it certainly is not “b.” Palmaru himself refers to the criterion of “viability” instead of truth (§84). But at some points, he writes as if what he was saying was a truth, and not a suggestion for a viable solution to a specific problem.

7 In other parts of the text, it seemed to me that Palmaru is primarily interested in the coherence of theory: he has identified an underdefined term or relation, and he wants to set that right. This is a noble endeavour, but a subtle taste of l’art pour l’art remains. Increasingly, as I spend more and more time in academe, I become weary of theoretical discussions for theory’s sake alone. I want to know what I can do with a theory, and I want to judge it according to its viability for solving problems.”

8 Furthermore, I am not convinced it is a given that we need the term “culture.” There might have been more than one good reason why Niklas Luhmann was so reluctant to use the term. People who work in the arts as well as people, like myself, who consider themselves as scholars in the study of culture in the broadest sense have a tendency to tacitly assume that the term is important. But we cannot presuppose this and we need to acknowledge that the term has also been used in many problematic ways, and that it can be (and has been) used as a weapon and as a tool to devaluate or segregate people or groups. The term “culture” does not necessarily always have a positive connotation. If we as scholars advocate the term, we need to say why and for what purpose, particularly in light of this history.

9 Besides this main argument, I was surprised to read Palmaru’s remarks about “top down” and “bottom up” perspectives in constructivism as if no suggestions to com-
bine the two perspectives existed. Palmaru references Siegfried J. Schmidt's more recent works, yet he seems to be unaware of (or silently dismisses) Schmidt's seminal work *Kognitive Autonomie und Soziale Orientierung* (1994), which raises exactly this question: How do cognitive autonomy and social orientation go together? I believe much of what Schmidt had to say about this question in the 1990s is still helpful today and might be worth revisiting. Furthermore, the hiatus between macro- and micro-level perspectives and the struggle to combine the two could be described as one of the challenges for the humanities and social sciences in general. Various important theories try to solve this puzzle – think of Norbert Elias, Pierre Bourdieu or Anthony Giddens to name but a few. I find Palmaru’s vision of a “social constructivism” (§2) that bridges the macro-micro divide appealing. However, there is a long tradition and a large body of work available in this context that has to be taken into account on this route and that Palmaru does not even mention.

“I realize that my commentary might sound a lot more critical than it is meant to be. I have enjoyed reading Palmaru’s text, and I believe it offers important insights and a thorough discussion of some of the fundamentals of Luhmannian systems theory in light of some of the classical and canonical and also some of the most inspiring recent constructivist work, among it Mitterer's and Schmidt's. However, I have decided to focus on the questions that I as a reader had in order to provoke the author to address those issues that have remained implicit, too. I am certain Palmaru has a lot to offer in terms of answering these questions, not only as a scholar, but also drawing from his wide-ranging professional experience in diverse contexts. I am keen to hear his response.

Author’s Response:

*Culture Matters*

Raivo Palmaru

> Upshot • I draw the attention to the fact that the communication concept of Luhmann’s social system theory and that of radical constructivism are not congruent. Also, communication and culture cannot be understood without taking into consideration that they are two sides of the same coin and that both act as reality-generating agents.

1 First of all, I would like to thank both of the commentators who responded to my article. One of these, Martin Zierold, responded to my question, “How do[es] culture emerge in communication from the individual constructions of people?” with a question “How do you know it does?” He went on to say that he does not want to debate my paper because he lacks criteria for assessing my suggestions. Zierold points out that the issues I discuss are merely “one possible way of conceptualizing culture in its relation to communication and individual constructions of people.” He adds, referring to Christoph Jacke, that “culture does not exist, but we need it.” I agree that culture is not something that can be put on a table and studied with a magnifying glass. Instead, it is the 18th camel from the Middle Eastern story that helped three mourning brothers fulfill their fathers’ last wish. So what I suggest in my article is not the truth of the last instance, but only one possible way of explaining the connection between communication and culture. There are certainly other possibilities that give a completely different view on the connection between culture and communication.

**Why culture?**

2 Martin Zierold’s question “Under which conditions is it viable/helpful/productive to talk about ‘culture’?” is a little late, because the topic of culture already achieved a broader breakthrough in social sciences thirty-forty years ago. In communication science, connecting culture and communication became as self-evident as walking on two legs after the publication of James W. Carey's book *Communication as Culture* in 1989. According to Carey, communication does not mean transmitting messages in space as much as the constant construction and maintenance of an ordered, meaningful world. Carey even compares communication with a religious or magic ritual where a particular view of the world is portrayed and confirmed, which unites people and strengthens the relation between them (Carey 2009: 15). Therefore, according to Carey, communication is primarily a process of the representation of shared beliefs and the maintenance of society over time.

3 Nearly twenty years ago, Siegfried J. Schmidt developed cultural constructivism within the framework of radical constructivism (RC) in his seminal work *Kognitive Autonomie und Soziale Orientierung* (1994). I cannot agree with the implications Zierold draws in his §9, which leave the impression that this book is somehow at odds with Siegfried J. Schmidt’s later works. On the contrary, it introduces socio-cultural constructivism and Schmidt relies on the same logic in his later publications. Until 1994, the argumentation of RC relied mainly on the data of natural sciences, primarily biology, neurophysiology, and psychology. However, in *Kognitive Autonomie und Soziale Orientierung* Schmidt introduced cultural arguments. In the 2003 book, *Histories and Discourses*, a new manner of argumentation evolves – discursive self-grounding – which Schmidt also continued in his later works.

4 However, the abovementioned does not mean that the question “Under which conditions is it viable to talk about ‘culture’?” is not legitimate or reasonable. This question may always be asked. The reasons that made me write the target article are primarily related to my empirical studies. For example, I have compared the coverage of different political figures in fifteen media outlets. The main (so far unpublished) finding was that the media evaluated the different individual and collective agents very differently, some in a very negative way and others mainly positively. However, the output of the different media sources studied was astonishingly similar. The main reason for the limited variance of the studied variables seems to be cultural – choices of journalists, the attribution of meaning, and

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the resulting evaluation of agents being based on the prevailing pattern of shared assumptions.

« 5 » One of my main study interests is media influence. In many cases, I have measured the strong relationship between evaluations of political parties by the media and corresponding election and poll results (Palmaru 2001, 2005). However, in some cases it appears that the media has no influence at all. Why is it so? What is the process whereby media influence is generated and how can the relationship between media coverage and people’s preferences be theoretically modelled? Traditional research into the influence of the media supposes media effects in the media users. But it often appears that there are more people affected than simply the recipients of media messages, especially at the macro level. Of course, the picture changes when we also bear in mind its indirect communication with friends, family members, acquaintances, colleagues, etc. But here we encounter another paradox. Namely, upon closer inspection, it soon appears that the direct user of media could be less affected than a person who does not use the observed media outlet, and that the same medium might have a different impact in different groups. Therefore, we can conclude that linear causation does not apply in regard to media effects. Here, we are dealing with the interaction of many individuals, and the phenomena appearing as a result are emergent properties of that interaction. However, this process has needed theoretical conceptualisation.

« 6 » Therefore, I find it difficult to agree with Zierold’s critique in §7, where he says: “[i]t seemed to me that Palmaru is prima facie concerned with culture as phenomenon, not as a thing (§§42, 43, 49, and 50).” And I steadfastly speak of culture as phenomenon, not as a ready-made garment from a peg” (§35). And I commented text clearly states that “Culture is not a thing; it cannot be taken as a ready-made garment from a peg” (§35). And I have struggled with this problem through the years, but without much success. ** (Glasserfeld 2008: 100)

« 7 » Concerning Zierold’s comment, that in “some passages of his article, Palmaru seems to advocate a rather essentialist perspective on culture” (§6), similar comments were also made to Ernst von Glasersfeld himself who responded in the following way:

“\* We talk, write, and to a large extent think in languages that have been shaped by naïve realism. We look out the window and say, ‘there is a bird.’ It would be unusual to say, ‘I see a bird,’ yet this is all we could vouch for. The verb ‘to be’ confers objective existence whether we like it or not. I have struggled with this problem through the years, but without much success. ** (Glasserfeld 2008: 261f).

A problematic position

« 8 » However, I cannot but add, referring to linguisit Roman Jakobson (1981: 21–23), that messages cannot be understood outside of their context, which is why the comments related to whether or not the verb “to be” is suitable or not should be made with care. The referential function of language corresponds to the factor of context, or, in other words, the meaning of words largely depends on the contexts in which they are used. If the context is not taken into account, text often becomes completely nonsensical. In this regard, the comment of Zierold is unfounded due to the fact that the commented text clearly states that “Culture is not a thing; it cannot be taken as a ready-made garment from a peg” (§35). And I steadfastly speak of culture as phenomenon, not as a thing (§§42, 43, 49, and 50).

« 9 » In his commentary, Tino Meitz promises to call my terminology into question since its conceptual deficiencies with regard to the relation between an observing system and its environments cause naturalistic fallacy. His point of departure is that communication theory in the tradition of systems theory and radical constructivism, with its emphasis on epistemological reflection, makes it possible to understand the complexities of the relations between self and society. According to him, “[c]ommunication theory is positioned at a level beyond the agent, medium or semantics, although it remains attentive to all three factors” (§3).

« 10 » To me it appears that Meitz’s position is problematic, mainly because he equalised the communication concept of Luhmann’s social system theory and that of radical constructivism and took Luhmann’s position in defining communication, which does not coincide with the RC position. The difference is that Luhmann takes the position that it is not the individual but only communication that communicates, and not people but communications produce other communications (see Luhmann 2008: 143). According to Luhmann, a communication as unity of the three selections cannot be attributed to any one individual (psychic system) and the meaning of the communication is neither contained in the mind of the sender nor of the receiver (ibid: 139–140; 143–144).

« 11 » Luhmann defines communication as a combination of three components: information, utterance and understanding, each of which he conceptualised as selection. Information is a selection from a repertoire of possibilities. With utterance, Luhmann refers to the form of and reason for a communication, and understanding is conceptualised as the distinction between information and utterance. In Luhmann’s concept, the third element – understanding – plays a central role: a communication is ultimately determined through the understanding (see Luhmann 1995a: 143).

« 12 » In constructivist understanding, communication takes place as a reflexive social process of sign use that serves the verbal organisation of interactions or common activities. However, as we know, the signs consist of two components – the signifier and the signified, the first of them being the form that the sign takes; and the second being the concept, idea or thought it represents. The latter is naturally created in the mind of an individual. Here, the communication theories of RC and Luhmann differ significant...

http://www.univie.ac.at/constructivism/journal/8/1/063.palmaru
ly. I do not deny that communications are produced by social systems recursively and self-referentially. However, communication cannot take place without the receiver understanding the utterance in the same way as the sender. It is necessary that both must have the same understanding of meaning of the utterance. According to Luhmann, the meaning of the communication is not contained in the mind of either the receiver or the sender. According to his theory, communication is irreducibly social and on that level meanings exist outside individual minds (cf. §§ 8 – 22 in my article). My proposal to distinguish between personal sense structures and socio-cultural meanings derives from the desire to broaden Luhmann’s conception somewhat.

13 In §4, Meitz falls short of taking into consideration the existence of socio-cultural constructivism and the principle change in the argumentation strategy of constructivism, which was created by Schmidt’s book Histories and Discourses. Meitz writes that the author of the target article establishes "a range of conceptual antonyms opposing communication, and his starting point is the juxtaposition of meaning and culture" (§4). Furthermore, he thinks that, "culture appears as an auxiliary construction to surmount the implications of Luhmann’s work."

14 Meitz’s subsequent text is suitable for illustrating to what extent the process of generating information in the course of perceiving a message depends on the assumptions of the receiver. For example, he writes that "At no point is a functional assignment for culture given" (§4). However, this has been done in the target article (§§40 – 43 and 52). In his §7, Meitz writes that

"I have to insist that this is in contradiction to what I wrote in §§28 and 29, where I explicitly said that communication acts to surmount and correct the autopoietic closeness of consciousness and described communication in a constructivist manner. In comparison with Luhmann, the only vital difference is that I do not stop with the assertion that the social domain consists of communications, but I also explain how communications come about.

16 Meitz’s passage "author’s attempt to redefine sharing as a form of socially binding participation" (§5) is misleading without additional explanation because it fails to refer with sufficient clarity to the fact that knowledge is not passively received, nor can it be transmitted either; it is actively built up by the cognising subject.

17 Meitz also attempts to address a problem that I discuss in my article – How do a shared knowledge and culture emerge in communication from the individual constructions of people? – through the point of view of identity (§§8, 9, 14). Principally, it can be done through the theorem of double contingency, meaning, identity or some other way. However, because the question also lies in the fact that in Luhmann’s work the elements of social system – communications – create meanings independent of the consciousness of individuals, it is reasonable to focus on meaning and not identity or double contingency when searching for a solution. This is further supported by the fact that the two latter ways also lead to meaning.

18 So Meitz’s promise at the beginning of the remarks to call my terminology into question seems to have been unfulfilled because he (a) without realising it, placed the communication concepts of constructivism and Luhmann into the one pot and (b) rejected socio-cultural constructivism, which focuses on communication, media, and culture as the reality-generating agents. Therefore, the points of departure of the target article and Meitz’s comment appear to be too incompatible to spark a fruitful discussion.

Conclusion

19 I realise that my adaptability discussion (§§60ff) by default presumes a dualistic epistemological position and the considerable role of reality – the hidden reality always limits what is possible. I presumed that this is exactly where the critique of the commentators could have been directed. However, because there was no such criticism, I would not want to refrain from saying that most probably the problem of dualism is understood in a simplified manner. For some time, RC has developed towards non-dualism and with it attempts have been made to take the question of reality out of the theoretical domain in the contexts of our lifeworld. But this has never been achieved. Dualism cannot be avoided by replacing von Glasersfeld’s viability with the social acceptance of knowledge or inner coherence of common knowledge. In my opinion, the 20th century history of Europe confirms it more than convincingly. We have to surrender the traditional dualistic view that explicitly or implicitly presumes we have access to an experience-independence reality and that is expressed in such dichotomies as “subject/object” or “experience/reality.” This traditional approach does not sufficiently consider a simple fact that living beings are anything but passive. They do not respond blindly to the outer world, but are in a complicated interaction with their environment and gradually derive experiences – both knowledge and schemes of reaction that they create themselves. In this process, the question does not lie in the fact of whether the perceived objects “in here” correspond to the objects “out there.” For what counts is survival, coping in one’s environment.

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Radical Constructivism and Radical Constructedness
Luhmann’s Sociology of Semantics, Organizations, and Self-Organization

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> Context • Using radical constructivism, society can be considered from the perspective of asking the question, "Who conceives of society?" In Luhmann’s social systems theory, this question itself is considered as a construct of the communication among reflexive agents. > Problem • Structuration of expectations by codes operating in inter-human communications positions both communicators and communications in a multi-dimensional space in which their relations can be provided with meaning at the supra-individual level. The codes can be functionally different and symbolically generalized. > Method • More than Luhmann, I focus on the hypothetical status of the communication of meaning and the uncertainty involved. Meaning can be communicated because of reflexivity in interhuman communications; meaning cannot be observed. > Results • The communication (and reflexive translation) of denotations between semantic domains can generate “horizons of meaning” as reflexive orders that remain structurally coupled to individual minds. This elusive order contains a trade-off between “organization” at interfaces integrating (differently coded) expectations at each moment of time, and the potential of further differentiation among symbolically generalized codes of communication in a “self-organization” over time. > Implications • One can model the coding in the communication of meaning as latent variables (eigenvectors) that evolve as an implication of the interacting intentions and expectations. The structure of expectations can be visualized (at each moment) and animated (over time) using semantic maps. The self-organizing horizons of meaning operate in a multidimensional space different from the network topology, and at another pace, since meaning is provided to events from the perspective of hindsight. > Constructivist content • This perspective of the radical constructedness of social reality transforms the status of agency and organization in sociological theorizing from a source of change to a resource of communicative competencies and reflexive performativity. > Key words • constructivism, sociology, Luhmann, supra-individual, self-organization, intentionality.

Introduction

1. In his paper "Who Conceives of Society?”, Ernst von Glasersfeld argued that “knowledge of society can be gathered only from your own experiences. This goes not only for children and innocent adults, it also goes for sociologists" (Glasersfeld 2008: 63). According to this radical constructivism, concepts are fundamentally private and subjective. As the author concluded (ibid: 64), his is a theory of rational knowing that provides us with "working hypotheses" (ibid: 104).

2. I agree with von Glasersfeld about the hypothetical status of subjective concepts. However, working hypotheses can be theoretically informed. Furthermore, whereas hypotheses are generated subjec-tively – as knowledge claims – they can be validated and become part of discursive knowledge. Discursive knowledge is developed in scholarly discourses; this domain is the subject of science and technology studies. The textual mediation of manuscripts – and anonymous referee comments – plays a crucial role in this validation process (Bazerman 1988:136f; Myers 1985). However, a focus on linguistic mediation is not a sufficient approach because codes operating in scientific communications can be expected to constrain and enable the use of language among specialists for cognitive reasons (Krippendorff 2008: 92f; Leydesdorff 2007).

3. Niklas Luhmann (1986a, 1995a) raised the question of whether the evolution of paradigmatically structured communica-tions can be modeled using the specification of autopoiesis as provided by Humberto Maturana and Francisco Varela (1980). In his autopoiesis model, however, the communication is operationally closed, whereas the linguistic basis of scholarly communication leaves room for relative and periodic closure and/or opening during the evolution of scholarly discourse. For example, pre- and post-paradigmatic phases can be distinguished (Van den Daele, Krohn & Weingart 1977). Thus, a hermeneutic perspective is also needed to explain the development of scholarly discourse at the supra-individual level. As Anthony Giddens put it: **The process of learning a paradigm or language-game as the expression of a form of life is
also a process of learning what that paradigm is not: that is to say, learning to mediate it with other, rejected, alternatives, by contrast to which the claims of the paradigm in question are clarified.” (Giddens 1976: 144)

« 4 » In my opinion, Luhmann’s (1995a, 1997) sociology of communication offers important elements for such a reconstruction because of its focus on reflexivity in interhuman relations. However, Luhmann’s theory is rooted in a sociological tradition that can be traced back to the second half of the 19th century. This sociological perspective has focused on networks as coordination mechanisms that are carried by agents who fulfill roles in supra-individual dynamics. In the Grundriß of 1858, for example, Karl Marx already formulated that

“[s]ociety does not consist of individuals, but expresses the sum of interrelations, the relations within which these individuals stand. As if someone were to say: Seen from the perspective of society, there are no slaves of citizens: both are human beings. Rather, they are outside of society.” (Marx 1973: 265)

« 5 » From a (neo-)marxist perspective, Roy Bhaskar drew the following conclusion:

“Now it is important to note that because the causal power of social forms is mediated through human agency, my argument can only be formally completed when the causal status of human agency is itself vindicated.” (Bhaskar 1998: 207)

« 6 » Without explicit references to these non-humanist backgrounds, Luhmann subscribed to the same objective when he drew the following conclusion:

“When, in old-fashioned style, the human being is considered as an ‘element’ of the social system of science, one is left with no basis for the discussion of ‘relations’ or ‘interactions,’ since neither relations nor interactions are human beings.” (Luhmann 1990: 275f; my translation).

« 7 » Using Maturana and Varela’s (1980) theory of autopoiesis, however, the realm of relations and interactions is considered by Luhmann as structurally coupled to individual consciousness. Interhuman communication and consciousness can be considered as relevant environments for each other. As we shall see below, in addition to this structural coupling, reflexivity in both consciousness and communication is specified as an operational coupling between these two domains. Luhmann (2002a: 182) used the word “interpenetration” for this additional coupling.

« 8 » Let me first focus on structural coupling and Luhmann’s specification of autopoiesis at the levels of individual consciousness and interhuman communications, respectively. Consciousness is further distinguished from agency: consciousness is considered as a domain of relations among expectations enabling human beings to process meaning (internally), whereas behavior and action are attributed to personhood as integrating instancies at the individual level (Luhmann 1991, 1994). Two steps are thus involved: firstly, from action to interaction as the basic (micro) operation of interpersonal communication and, secondly, from behavior to the entertaining of expectations both individually and at the level of one’s social network of relations (Leydesdorff 2003).

« 9 » In other words, the explanandum and explanans change positions between the perspectives of radical constructivism and Luhmann’s systems theory. Whereas Maturana (1978: 53f), for example, claimed that “denotation is the very function whose evolutionary origin should be explained” and that “language is the necessary evolutionary outcome [...] of a selection realized through behavior,” Luhmann positions behavior – and action – as reflexive to communication. Communication is considered as a source sui generis (Parsons 1968; Elias 2000: 366). Unlike communication in primitive languages (such as perhaps among chimpanzees), however, a symbolic order is prevalent among humans that is both internalized and can be used reflexively for the communication of denotations and connotations – in other words, meaning.

« 10 » Whereas the generation of connotations can be explained in the biological model – “a second-order consensual domain with other organisms becomes indistinguishable from a semantic domain” (Maturana 1978: 49) – the semantic contents cannot be communicated reflexively and with reference to other possible meanings because the biological communication remains constrained by the autopoiesis of the living – and hence “embodiment” (Varela, Thompson & Rosch 1991). The denotations are developed in accordance with the development of and resonances among life-cycles. As against Maturana and Varela, Luhmann (1986a; cf. 2002a) hypothesized that the communication of denotations can generate a symbolic order autopoietically. This symbolic order provides us with a second contingency in interhuman encounters: in addition to interactions by observing one another’s behavior, Ego expects Alter to entertain expectations similar to Ego’s own expectations (Luhmann 1995a: 103f; Parsons 1951: 91ff, 1968). The sharing and exchanging of expectations in a double contingency opens “horizons of meaning” (Husserl 1969, 1973).

« 11 » Following another lead of Talcott Parsons (1968), Luhmann (1974) took this theory one step further: the linguistic media of communication can further be refined by codification, and then the symbolic order can increasingly structure a number of (qualitatively different) performative media (Luhmann 1997). Symbolically generalized media of communication are available for reflexive use by human minds. This second-order capacity for communication, for ex-

1] “Plans and action, the emotional and rational impulses of people, constantly interweave in a friendly or hostile way. This basic tissue resulting from many plans and actions of men can give rise to changes and patterns that no individual person has planned or created. From this interdependence of people arises an order of sui generis, an order more compelling and stronger than the will and reason of the individual people composing it.” (Elias 2000: 366; cf. Ludes 1989: 50ff).

2] Luhmann often avoided emphasizing the hypothetical status of his theorizing. For example, Chapter 1 of Luhmann (1995a: 12) opens with “The following considerations assume that there are systems. Although systems are only assumed,” the author adds immediately: “Thus, they [these considerations, L.] do not begin with epistemological doubt.” Elsewhere, however, emphasis is placed on the heuristic function of theorizing and the possibility of combinatory gains by entertaining hypotheses (e.g., Luhmann 1977: 49; cf. Leydesdorff 2010c).
ample, enables us to communicate without needing the use of (natural) language (cf. Habermas, 1987: 384f). Non-verbal communication among human beings – unlike communication among chimpanzees – always reflects symbolic mediation (Leydesdorff 2000). For example, one can pay for a commodity with money without having to negotiate about the price.

12 Where natural languages enable us to communicate meaning within boundaries – for example, those of a linguistic community – symbolically generalized media of communication (such as money, power, truth) enable us to communicate across borders or, in other words, globally. From this perspective, individual consciousness can be considered as a local platform of integration and potential translations among the various media available and continuously instantiated in a pluralism and complex society.

13 Intentional action can thus be considered as a provisional result of organizing the interfaces among the symbolic media in a local instantiation. Institutional agency organizes the processing of meaning analogously, but at a supra-individual level. At this supra-individual level, however, a mechanism other than “viability” (Beer 1984; see also Glasersfeld 1981) is needed for continuation over time because the supra-individual level may add an element that cannot be derived from the living without mediation. Luhmann (2000) proposed decision-making among human beings as this organizing mechanism (cf. Achterbergh & Vriens 2009: 113 ff.).

Mechanisms of integration and differentiation

14 What does this superstructure of theoretically informed hypotheses mean for individual consciousness and one’s capacity to construct radically one’s reality? The “horizons of meaning” (such as political meaning, scientific meaning, affective meaning, etc.) are analytically independent of one another and can be expected to operate with different frequencies. Political communications, for example, are structured by election cycles. Individual consciousness provides us with an additional degree of freedom or, in other words, an internal axis for the integration of the variety of asynchronous and parallel developments across space and time by raising the question of “what do these different dimensions and frequencies mean for me?” The “me” can thus be differentiated from the “I” within consciousness (Mead 1934),.

15 This differentiation within one’s mind and the different possible positions in terms of using communicative competencies makes us reflexively aware that others can be expected to entertain different sets of expectations. One needs to explain and translate into other frames of reference to reflexively understand interpersonal communication. From this perspective, the domain of expectations provides us with a “second” contingency in which individuals can flourish. The sociological perspective can thus contribute to an “ecology of the mind” (Bateson 1972) and the sociological project can be reintroduced, but from a humanistic perspective (Luhmann 2002a, 2002b).

16 Let me hasten to add that the symbolic orders of expectations at the supra-individual level should not be reified. In my opinion, the symbolic media remain constructs and in flux since constructed autopoeitically in terms of expectations of interacting intentions. Language can be considered first as the evolutionary achievement that allows us to communicate both information (uncertainty) and meaning in the same pass (cf. Luhmann 2002a). Whereas other species can span a semantic domain and behave linguistically (Maturana 1978: 51f; 2000: 462f), the symbolic order enables us to specify understanding and misunderstanding; these reflexive exchanges allow for another order of magnitude in error-correction and learning.7 The symbolically generalized media of communication enable us, for example, to use jargons in specialties and to pay with credit cards instead of cash. The concreteness of action – observable as physical behavior – can increasingly be replaced by the expression and exchange of meaning using symbols; signatures for example.

17 Luhmann (e.g., 2002b) cites Edmund Husserl as the philosophical source for understanding the results of interactions among intentions as social constructs that shape our cultural expectations. In the Cartesian Meditations, Husserl (1973) extended the notion of an individual Ego Cogito to the plural of cogitantes. Cogitantes are able to communicate with reference to cogitata – that is, objects of doubt. Whereas Descartes assumed that the individual Cogito encountered in its contingency the cogitatum as Transcendental – that is, God – Husserl “meditated” that this other of oneself could also be considered as the “intersubjective” domain of cultural expectations that embeds our psychology, but that can be accessed reflexively by bracketing the individual experience. The cogitata remain res cogitans – that is, uncertainty – but the reflexive specification of these uncertainties changes the perspective to a culturally constructed reality among other possible ones. Furthermore, the uncertainties at each moment can over time be formulated as expectations and hypotheses; hypotheses can be tested and theoretically informed.7

3] Note that the cybernetic tradition thus differs from the semiotic one as elaborated, for example, in the so-called “actor-network theory” (ANT) of Callon & Latour (1981; cf. Callon, Law & Rip 1986; Latour 1987). The semiotic actant is a result of its network of in- and output relations; next-order differentiations are not hypothesized but only considered in terms of observable relations (“co-words”) in the network.

4] Luhmann (1995a: 141f) defined understanding as a necessary component of interhuman communication. In my opinion, the concept of “understanding” as an attribute to communication is anthropomorphic and thus refers to consciousness. I take the liberty of using Luhmann’s concepts in my argument heuristically (Leydesdorff 2010c).

5] Luhmann (1995a: 67) defined information as a selection by a receiving system, with a reference to Bateson’s (1972: 315) definition of information as “a difference which makes a difference.” Different from this “observed” information, Shannon-type (or “expected”) information can be considered as (yet meaningless) uncertainty contained in a distribution, that is, as a series of differences (Hayles 1990; Leydesdorff 2010c).

6] This is one of the central arguments in Deacon (1997).

7] A hypothesis can be considered as an expectation that is theoretically informed and rationalized.
According to Husserl (1962), a "Crisis of the European Sciences" had been generated because facts were presumed to be objective, while they remain in the intersubjectively re/constructed res cogitans as theoretically informed hypotheses. Note the analogy with Maturana's (2000) proposal to consider reality as "interobjectivity." How can one study this intersubjectivity/interobjectivity as constructed – that is, without reification – and yet empirically? In this context, Luhmann's (e.g., 1986a, 1986b) contributions can be considered as proposals for a sociological operationalization.

The social organization of "interobjectivity"

Awareness of the other as a source of communicative and thus interactively enriching expectations, leads to a mediated definition of the social reality (Schutz 1967: 97 ff.). Von Glaserfeld, however, insists on the priority of the question "who conceives of society?" and a focus on the individual constructors: "society" is for him nothing more than "a collective term for the handful of people we have learned to recognize in the above sense and to whom we may ascribe a number of common characteristics as well as individual differences" (Glaserfeld 2008: 63). However, a sociological perspective allows us to distinguish between this specific hypothesis about what I would rather call a "community," and other possible forms of social organization.

First, in the interpersonal encounter, one can experience what von Glaserfeld (2008: 61) called a "second viability" if one imputes planning and foresight to others as well as ourselves. The interactions among these expectations – whether linguistic or symbolic – provide the variation for possible further developments of the communication of meaning. When these communications are at first only juxtaposed, "segmentation" is prevalent. Using a biological metaphor, this resembles the morula stage during embryonic development: each cell is still complete but no order or hierarchy is yet established.

The transition from the morula to the gastrula is induced by the need at the level of the emerging organism to synchronize cell cleavages across cells that are no longer adjacent. A rank order is thus induced by the one cell that happens to take the lead in this process. (Incidentally, this cell grows into the tail and not the head of the organism.) Using this model, recursive relations among communications that are no longer direct neighbors can be expected to induce stratification and hierarchy. A social system of communications in which hierarchical stratification prevails, for example, can be identified as a High Culture (e.g., an Empire). Note the difference with the biological system in the time order: the top of the social hierarchy has "the last word" reflexively (e.g., "Roma dixit"), whereas in the biology the first cleavage takes the lead.

The decapitation (in 1793) of the anointed body of the King of France – who was king by the Grace of God – can be considered as the culmination of a process of modernization that took centuries. The symbolic constitution of the integration of society was gradually decentralized from the embodied King to a system of discourses based on a written constitution. Political communication, for example, could internally be differentiated into a trias politica (Montesquieu 1949). This depersonalization of the constitutive communication paved the way for further differentiation of society in terms of different coordination mechanisms. The organization of society became even more complex because of the possible interactions among these different coordination mechanisms.

For example, the market and political decision-making can be considered as two coordination mechanisms at the level of society. Their interaction leads to a political economy. Possible organizations of these interactions were historically retained among the variety of nation states constructed as political economies (in the plural) during the 19th century. The integration of the social production of knowledge as a third coordination mechanism in the 20th century can be expected to lead to the gradual transformation of political to knowledge-based economies (Leydesdorff 2010a; Leydesdorff & Zawdie 2010; cf. Strydom 1999).

The communication of meaning

The coordination mechanisms in exchange systems of expectations can also be considered as eigenvectors in the networks of communications among the expectations (Foerster 1979, 1993). Note that these eigenvectors remain latent constructs of the communication. However, their position is determined not by single constructors or elements, but by the set – or, in other words, at a level that is systemic and therefore relatively global to the individual communications (links) and communicators (at the nodes) constructing and reconstructing the system locally. The causality flows forward and bottom-up with the communications, but the logic of control feeds back from the latent dimensions as an implication. In other words, the relations span a network with an architecture in which all units have a position. As these positions in the multidimensional space become increasingly condensed, they can also feed back to the relational operators (e.g., Luhmann 1997: 409). Thus, one obtains a double-layered structure of observable relations (vector values) and constructed eigenvectors (with eigenvalues).

The next-order systems structure can be expected to evolve at a lower speed than the variation from which the selecting structures continuously emerge (Simon 1973a). Furthermore, eigenvectors stand orthogonally to one another (at each moment of time), and the number of eigenvectors needed to explain the development of the network is not ex ante given. In my opinion, Luhmann used this cybernetic model of a changing and historically variable number of eigenvectors to describe the possibility of functional differentiation in a communication system that self-organizes its own reproduction as a regime at the global level (Foerster 1960). However, von Glaserfeld (2008: 64 Note 4) noted that this metaphor of eigenvectors – as used by Luhmann – is "rather loose because the recursion of operations is not governed by fixed rules" (as in 8 Luhmann indicates the latent dimensions with the word "eigenvalue." Technically, the eigenvalue of an eigenvector is the factor by which the eigenvector is scaled when multiplied by the matrix.
the static case). The functions develop over time because the system is further developing along historical trajectories.

» 26 « Historical retention can itself also be considered as one of the functions. “Organization” instantiates the system as relatively integrated for a next round of differentiation. The historical instantiation takes place at specific moments of time, but the functions develop in a self-organizing dynamics over time. Luhmann (2000) suggested that the symbolic medium of organization is decision-making. Decision-making can, for example, be formalized and codified into decision rules.

» 27 « Organization integrates historically what self-organization tends to differentiate as functions of subsystems at a (hypothesized) next-order level. In addition to these two mechanisms at the systems level, interactions at the bottom provide relational variation. However, the mechanisms of integration and differentiation can be uncoupled from specific individuals and organized at a supra-individual level, although the mechanisms of individual actions and interactions remain always needed as sources of variation both disturbing the system and driving it toward change. Whereas organizations can be shaped over time along historical trajectories, self-organizing regimes develop evolutionarily in terms of combinations of structures in space (that is, as eigenvectors) and time (that is, as eigen-frequencies and their resonances; e.g., Luhmann 1997: 1124 ff); or, in other words, in a hyperspace. Integration and differentiation can operationally be considered as two sides of the same coin: without integrating instantiations (in the network space), the communications (differentiating in a vector space) cannot further be developed towards the edge of order and chaos, and thus one would fail to induce maximization of the communicative capacities.

» 28 « From this perspective, the individual mind can be considered as the minimal unit of historical organization. The mind participates in communication as an organizing unit among other such units – as a medium – and with a possible reference to next-order organizing units. Reflexively, the communication can be integrated and organized into a system of meanings with one order or another. This order depends on the communicative competencies of the communicators and their networks. However, considering the self-organization among the codes of communication as “order” requires a decision, because these dynamics could just as easily be considered as disorder or chaos.

» 29 « Each description necessarily simplifies the complex dynamics of communication by organizing it from a perspective. When this integration is organized among individual minds (using an implicit or explicit rule), a specific organization of the semantics is shaped. When organization of the processing of meaning prevails at the level of society, a High Culture can be expected, with a tendency towards a single center of control and the illusion of cosmological order. However, abandoning the hypothesis of a single center of control provides room for functional differentiation among the different and potentially competing control mechanisms along the latent dimensions of the network. Note that the latent dimensions (eigenvectors) remain structures of expectations: these cogitata cannot be reproduced without cognitantes. The social order as an order of expectations remains radically constructed; the latent dimensions can only be accessed reflexively and their epistemological status remains that of a hypothesis.

» 30 « The option to organize the system of meaning-processing historically, both at the level of the individual mind and at the supra-individual level, provides us with another (since social) degree of freedom for the translation. For example, researchers in the laboratory may be able to validate new knowledge that engineers can use in a practical application for the development of new technologies (e.g., drugs or production processes). A division of labor in terms of combining different codes of the communication is thus made possible because of this “structuration” of the social in terms of structures of expectations (Giddens 1984: 162 ff.; Leydesdorff 2010b). Each historical manifestation has to be carried by the reflexive performativity of consciousness, but the reflected symbols can be selected differently with reference to the social needs for an intervention in a historical configuration. The communication of meaning is constrained by the historical conditions of reflexive understanding and learning (Leydesdorff 2000, 2010d).

» 31 « The symbolic orders can be instantiated and entertained in terms of fragments because the integration cannot be completed; differentiation can continuously be expected. Derivatives of the Latin verb “frangere” (to break) – such as “fragments,” “fractals,” “fragile,” etc. – are more relevant for the analysis than derivatives of “esse” (to be; e.g., “ontology”) because the different mechanisms remain operative concurrently and thus can be expected to disturb one another (e.g., Luhmann 1990: 635ff). The description of the cybernetic interactions among the subdynamics as a “system” can be questioned because there may be more systemness in some stages and in some interactions than in others.

A modification of the autopoiesis model

» 32 « Luhmann’s sociology requires a reformulation of Maturana’s autopoiesis model because the communication of meaning in interhuman relations operates differently from the observable communication of molecules (Luhmann 1986a). As Luhmann (1995a: 164) noted, the communication of meaning “cannot be observed directly, but only inferred” (italics in the original). The uncertain and hypothetical character of the communication of meaning suggests an extension of the Darwinian model of variation-selection-retention with the expectation of one more degree of freedom: variation, selection, stabilization, and possibly globalization.

» 33 « Some selections can be selected for stabilization at the trajectory level. This generates the layer of historical organization in the processing of meaning. Some stabilizations can be selected recursively for globalization at the regime level. Stabilization can be expected to occur along trajectories; in contrast, de-stabilization, meta-stabilization, and potential globalization can lead to regime formation and a symbolic order can thus be considered. These hypothesized – and therefore knowledge-based – regimes, however, can go into crises and then the system of expectations may move along trajectories to other basins of attraction. The regimes of communication, and transitions among them along trajectories, can be ex-
pected to absorb the creativity in the underlying layers selectively.

- 34 - In other words and using another biological metaphor, the complexity of communication can be considered as developing parasitically on top of the living systems (Serres 1980). This parasite, however, is not a viable system and its “living” is contextual because the historical carriers of the communication provide the medium. The abiotic selection mechanism in interhuman communications could perhaps be compared to that of a virus (Distin 2011: 203 ff.).

- 35 - The selecting structures at the systems level were defined above as the symbolically generalized expectations of codes operating as meta-representations. In other words, the system develops in terms of models that can be entertained reflexively by the modelers. Not the observers, but their observational reports communicate (Luhmann 1996)! The modelers are not only “structurally coupled” as a necessary environment of the modeling, but they also provide these reports with semantic content. There is no content in these expectations other than expectations generated in interactions among expectations.

- 36 - Perhaps it is questionable to call a social order that is so rooted in expectations among the carriers a “system” because of the biological connotations of the concept of “system” and the ensuing tendency in systems theory to reify the dynamics. Unsystematic interactions are crucial for the dynamics because interactions provide the variation. Each description of the social order of expectations as a system may reduce the complexity and volatility by invoking a meta-biological metaphor for the explanation (e.g., “morphogenesis”; cf. Archer 1995). Given the concurrence of and recursion in selection, stabilization, and globalization, it may be more important to specify the cybernetic mechanisms. The biological terminology can provide us with heuristics for the specification of hypotheses about how the social dynamics of meaning processing is different from the biological expectation (Leydesdorff 2006).

- 37 - From this cybernetic perspective, the social can be entertained as a radical construct that is continuously being reconstructed. The next-order system remains reflexively available to the carrying systems insofar as one is communicatively competent to access and translate among the differently coded communications. Unlike a “hyper-cycle” with a hierarchy implied in the description, Bruno Latour (1988) used the metaphor of “infra-reflexivity” in this context: there is no “hyper,” “super,” or “sub,” but only interaction among radical constructions, each of which can be expected to contain its own (and evolving) eigenvector(s).

- 38 - In a series of four volumes entitled “Gesellschaftsstruktur und Semantik” (The Structure of Society and Semantics) Luhmann (e.g., 1980) further developed what it means sociologically to understand communication as increasingly complex, evolving, and functionally differentiated. He argued that the development of the possible semantics upsets and, in the longer run, revolutionizes the structure of society because the historical organization has to adapt to the possible dynamics at the global level under the condition of functional differentiation of the symbolically generalized codes of communication.

- 39 - The invention of the printing press, for example, changed the order of priority in communication from the first original manuscript to be copied (e.g., the Bible) to the last-printed version, which may have been further annotated, updated, and corrected for transcription or other errors in previous versions (Luhmann 1981b). As long as the prevailing organization of society was historically constrained in the cosmology of a High Culture, some communications could perhaps be forbidden, censored, or “ex-communicated.” However, the Struggle for Investiture in the late Middle Ages opened the Western social system to the possibility of another order of relations between the Church and the Empire, based on functional differentiation. The individualistic revolutions of the 16th and 17th century, for example, made it possible to ask such crucial questions as von Glaserfeld’s (2008) “Who Conceives of Society?”, that is, the question of a concept of reality centered in an Ego Cogito.

- 40 - The constructedness of the possible dynamics of expectations presumes construction at the level of the individual mind, which was specified most emphatically by the proponents of radical constructivism. Among our concepts, however, we can also entertain expectations about the expectations of others. Building on Husserl’s notion of intersubjectivity as the carrying ground for both (inter)objectivity (Maturana 2000) and subjectivity (e.g., Luhmann 1986b, 1994) and using other sources such as Parsons’s (1951) notion of “double contingency” and the psychological reflections in the pragmatist tradition (e.g., Mead 1934), two shifts could be proposed by Luhmann:

  a. from action to interaction, and
  b. from action as a behavioral category to reflexive perception and experiencing.

The internal richness that can thus be perceived correlates with a richer perspective on cultural constructs that can be entertained intersubjectively.

- 41 - Furthermore, Husserl’s philosophical – since “transcendental” – concept of intersubjectivity was operationalized by Luhmann (1986b, 1994, 2002b) in terms of interaction, organization, and self-organization in the communication of meaning. Interactions among intentional communications generate variation; for example, knowledge claims in scientific communications. Some knowledge claims can be selected as more meaningful than others, using latent standards such as those developed in scholarly discourse. The operation of the standards leaves traces behind in historical organizations, which periodically have to be reorganized because of new developments at the field level. In the sociology of science – but analogously in other cultural domains – one can distinguish empirically between developments at the group and field level (e.g., Gilbert & Mulkay 1984; Leydesdorff 1995; Mulkay, Potter & Yearley 1983; cf. Whitley 1984).

- 42 - For example, when knowledge claims – generated in the context of discovery – are further selected, first as manuscripts, then as validated knowledge in refereed articles, and eventually incorporated into the global archive (Garfield 1975), diff-
different formats of specific organizations (libraries, departments, journals, etc.) that process these communications in relation to other contexts, are reconstructed. The organizations couple the operation of the code(s) of science to other functional dimensions such as economic viability, institutional prominence, political relevance, etc.

**Conclusion**

« 43 » In summary, I argued that the possibility of communicating meaning in interhuman relations adds to the semantic domain that Maturana (1978) specified in terms of his “biology of cognition.” Human languages enable us to invoke a symbolic order in interhuman communications that can further be constructed by codification and symbolic generalization of the meaning in these communications. In addition to historical stabilizations of patterns in the organization of meaning, meta-stabilization and globalization – that is, in this context, symbolic generalization – is possible. In a pluriform society, “horizons of meaning” can be expected to be developed in different directions. This self-organizing differentiation is countervailed by integration at the organizational level that functions as a retention mechanism for new options. This latter layer can be organized in terms of networks of relations or punctuated as reflexive instantiations in individual minds.

« 44 » Note that agency and organization can thus be transformed into another function of the communication. From this perspective, agency can be considered as the smallest unit of operation in the construction of communicative competencies that can be both reflexive and performative. Institutional agency is based on the aggregation of individual competencies in organizations. As against Jürgen Habermas (1981) who argued in favor of integration of differentiation into the vernacular and therefore a “communicative competence” in the singular, the capacity to understand and to translate among differently codified meanings requires the development of different competencies in the plural. This transformation of agency and organization from a source of change – by taking action – to a functional resource of the communication tends to transform society and its economy from a politically integrated “political” economy into a “knowledge-based” one. Note that the progression of this ongoing transition remains an empirical question (Leydesdorff 2012, 2013; Leydesdorff & Zawdie 2010).

« 45 » As against von Glasersfeld (2008), I argued that society can be considered as more than the sum total of individuals in a community because of the possible communication of meaning operating interpersonally on the communication of uncertainty (that is, Shannon-type information). Husserl’s notion of “intersubjectivity” was sociologically operationalized by Luhmann in terms of interactions among organizations, and self-organization in this communication of meaning, shaping a complex dynamics that can be modeled using autopoiesis as a heuristics. I criticized Luhmann for using this biological model without sufficient reflection because operational closure remains only a tendency in an otherwise uncertain domain of expectations.

« 46 » In another context (Leydesdorff 2010b), I argued that, using Giddens’ metaphor of “structuration,” one can obtain a sociological model akin to Luhmann’s by replacing Giddens’ “structuration of action” with “structuration of expectations.” The structures “structurating” the instantiations can be considered as Luhmann’s function systems. According to Giddens (1976: 64), these structures are “virtual,” but have remained otherwise unspecified in his theory (Leydesdorff 1993). Luhmann provided us with an operationalization that accounts for both the instantiated organizations of meaning and the self-organization of meaning over time.

« 47 » As against Luhmann (e.g., 1990, 1997), I would consider self-organization in the differentiated communication of meaning as an inherently uncertain process that may operate with shades of grey instead of the binary black-and-white of false/true (Künzler 1987; Leydesdorff 2010c). For example, some statements are relevant to truth-finding more than others. In my opinion, Herbert Simon’s (1973b) characterization of the criteria as oriented towards heuristics and problem-solving improves on the formulation by expressing the dynamic development of the symbolic codes of communication along with the communications from which they originate and on which they feed back.

« 48 » Access to these symbolic media remains a reflexive operation and requires...
communicative competencies of the communication carriers. Unlike the Greek gods, the self-organization of the functionally selected communications remains reflexively coupled to sub-optimal trade-offs among codes in organizations and among individuals. A perspective on organizations as organizing interfaces among differently codified communications in processes of translations, however, can enrich and perhaps transform the (neo-)institutional perspective that dominates currently in organizational sociology and social network analysis (Leydesdorff & Zawdie 2010; Seidl & Becker 2006).

More generally, I have pursued above a specific line in Luhmann’s theorizing that, in my opinion, is available in his writings of the 1980s more than in the later writings of the 1990s. Whereas, for example, Luhmann emphasized in the first complete presentation of his theory (in 1984) that “communications cannot be observed, but only inferred,” (Luhmann 1995a: 164, italics in the original), however, a general theory of observation became increasingly central to his later writings (Fuchs 2004; Göbel 2000: 207ff; Gumbrecht 2006; Leydesdorff 2006, 2010c). In my opinion, a differentiation between expectations – based on inferences – versus observations that can be used to update (and even test) expectations provides us with access to a model that can then be developed into a theoretically informed set of working hypotheses.

For example, the descriptions such as those in Luhmann’s historical analyses of the development of semantics and social structures could nowadays be enriched with the possibility of statistics on semantic maps and their development in terms of coded structures among eigenvectors in the social networks of communication. Without damaging any of the assumptions of radical constructivism about the subject-centered origin of concepts, the further elaboration of mechanisms that turn private knowledge into intersubjectively validated discursive knowledge can thus be made visible in terms of the historical organization of meaning in contingent domains (Leydesdorff 2011; Leydesdorff & Welbers 2011). This sociological analysis can enrich our philosophical (self-)understanding as an additional enlightenment on the possible constraints and contingencies of communication (Luhmann 1998: 18; cf. Glasersfeld 2008: 64). The specification of the dynamics of expectations may first seem as abstract as philosophical reflections, but given Luhmann’s operationalization, the epistemological status of specification of our expectations has changed into the formulation of hypotheses. Expectations about these dynamics can be theoretically informed and rationalized, tested in terms of simulations, and measured in terms of empirical footprints in the development of organizational formats.

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Symbolically Generalized Communication Media: A Category Mistake?

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> Upshot • Leydesdorff emphasises the uncertainties involved in the communication of meaning. Luhmann posited three types of media, each of which reduces one type of communicative improbability. The theory of cultural evolution supports Leydesdorff’s emphasis on the uncertainty of communication, and agrees that different media are needed for communication within and across social boundaries. But it highlights the distinction between media and the symbolic codes that give them structure; and it raises the question whether Luhmann’s symbolically generalized communication media are really media at all.

1 There are fascinating similarities between Luhmann’s sociological thesis that social systems use communications as their mode of autopoietic reproduction and the philosophical thesis that language provides the mechanism for cultural evolution. Both theses raise the immediate problem of defining communication, and for both the key lies, as Leydesdorff (§47) suggests, in the uncertainties that are involved in the communication of meaning. In this respect, cultural evolutionary theory provides some support for Leydesdorff’s modification of the autopoiesis model – but it goes further than Leydesdorff in criticising Luhmann’s model.

2 The theory of cultural evolution (Distin 2011) is that the complexity and diversity of human culture is the result of a process of the same type as that which accounts for the complexity and diversity of nature: a gradual, inter-generational process of change in a population’s characteristics, as a result of the (almost) successful inheritance of variations in the information of which those characteristics are an expression. But information cannot be inherited unless the next generation is capable of interpreting and responding appropriately to it. In biology, variations in information are transmitted between generations along with the cellular machinery for their interpretation and expression. In human societies, communication is dependent on ego’s understanding of the meaning of alter’s utterances, and this means that the inheritance of cultural information depends more on ego than it does on alter. Communication has not taken place until ego makes a link between the sound or gesture that he has observed and the information that he believes alter to have selected – and the meaning that is communicated relies on ego’s understanding of that link. A range of different meanings can be inferred from the same utterance, depending on ego’s understanding.

3 The problem, as Luhmann has identified and Leydesdorff emphasises, is that this makes communication deeply improbable: it is improbable that ego should understand alter’s intended meaning; improbable that this meaning should be preserved with sufficient stability to reach ego over boundaries of time and space; improbable that ego should accept and act upon what has been understood. And this matters, because social systems are wholly dependent on communication.

4 It is important to put this statement into an evolutionary context. The foundations for human sociocultural evolution were of course laid in a variety of physiological, cognitive, and social preadaptions, but one of the most significant was our ancestors’ uniquely cooperative disposition (cooperative in the sense of cooperating to play a game by certain rules, rather than of cooperating on the outcome). Communication is only biologically advantageous to a species in which cooperation is a low-risk activity, and for our deeply cooperative ancestors, the adaptive advantage of communication was so great that it provided the evolutionary impetus for the intricate grammatical structure of modern natural language (Hurford 2007).

5 Alter understands what ego means because they cooperate in the use of a shared language. For cultural evolutionary theory, the distinction between a language and its medium is important. A language is a symbolic code, which follows certain rules. Symbols cannot exist in the abstract – they must be realized in some kind of medium – and I divide languages into two types, depending on the kind of media they use. Natural languages use the media of human sounds and gestures. I have coined the term “artefactual languages” for representational systems such as the written word, musical notation or the conventions of architectural drawings, which are realized in objects made or fashioned by humans (Distin 2011).
The speech and gestures of natural languages are structured by systems of compositional rules about how information is to be represented by individual sounds and signs. In this way, they make understanding more likely because they increase the probability that similar utterances will be selected to represent a given selection of information, and hence that ego will infer from alter’s utterances a meaning similar to that which alter intended (cf. §10). In this sense, the codes and media of natural language correspond to Luhmann’s communication media – so long as we bear in mind that which alter intended (cf. §10). In this way, they make understanding more likely because they increase the probability that similar utterances will be maintained. They also increase the probability that meaning can be accepted by ego even though it has been communicated over such borders, does he overstretch even his own use of the term “medium”?

Although natural languages enable humans to communicate within the boundaries of established social relationships, and they rely for their success on a set of shared assumptions and a common social context. Artefactual languages enable humans to communicate beyond the boundaries of established social relationships, in order to get things done together even when they are members of different social groups, and they rely for their success on a set of shared assumptions about the knowledge that language users will bring: a common cultural context. The use of an artefactual language is a cooperative game just as the use of a natural language is; and if you do not know the shared set of rules then you are excluded from both the group of people who use that artefactual language and the semantic field that it represents. Conversely, your competence in that artefactual language will provide cultural access to that group, just as competence in a native natural language provides social access to a particular group.
context – but she gains the representational advantages that her chosen artefactual language provides within its normal cultural context. And because artefactual languages evolve to represent information in a particular semantic field, ego’s efforts to learn that language indicate that he is already motivated to understand what others have to communicate in that particular cultural context.

Rather than positing a separate medium to reduce each level of improbability, then, the theory of cultural evolution suggests that the threefold improbability of communication is reduced, in each sociocultural context, by the linguistic structures and media that have coevolved with the relevant semantic field. A common natural language enables ego to understand alter (because both are using the same system for linking utterances to information); it enables alter’s communications to reach ego across the boundaries between individual consciousnesses (because it has evolved under selective pressure to enable just such communication); and it motivates ego to pay attention to alter’s communications (because, as a multitude of sociolinguistic research has demonstrated, a common natural language, and in particular a common dialect and accent, determines access to cooperation). A common artefactual language enables ego to understand alter (because both are using the same system for linking signs to information); it enables alter’s communications to reach ego across spatial, temporal, and social boundaries (because it is detached from its human users and their social contexts); and it motivates ego to pay attention to alter’s communications (because a common artefactual language determines access to the semantic field with which it has coevolved).

This analysis suggests that while natural languages correspond to Luhmann’s (linguistically-structured) communication media, and artefactual languages to his (linguistically-structured) dissemination media, the term symbolically generalized communication media is a misnomer. I have argued elsewhere (Distin 2011: 146–165) that money is an artefactual language; but Luhmann’s other examples, such as truth, love, and power ($9), cannot meaningfully be called either languages or media.

Like Luhmann’s sociology, cultural evolutionary theory emphasizes the role of ego’s understanding in determining the meaning of alter’s communications. As Leydesdorff highlights ($47), this makes the communication of meaning an inherently uncertain process, which may be partially successful rather than wholly (un)succedful. From the perspective of cultural evolution, Leydesdorff is right to emphasise the uncertainty of communication, but in following Luhmann’s terminology he is wrong to confute the concepts of media and the symbolic communication codes that structure them. The threefold improbability of communication is reduced, not by three corresponding types of media, but by the use of languages that have evolved to facilitate communications in a particular cultural context. These languages coevolve dynamically with the communications that they facilitate ($47) and with the media in which they are realized. Their use is a cooperative game, which reduces the improbability of communication in proportion to the competences of the players ($44).

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Some Reflections on Meaning

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My focus is upon the uneasy relation of “person/culture,” a relation that any serious consideration of the important work of Luhmann cannot gloss over. The author indeed tackles this issue, but perhaps a fuller consideration of the work of Humberto Maturana sheds light on the argument.

In contrast to Loet Leydesdorff’s paper, in which the focus might be said to be on the social and cultural domains (and the ways in which these come to be what they are), my own focus of interest lies in what the person is (and what are the ways in which the person living with others comes to live the way they do in society). To be clear about this, these are different perspectives on a single shared interest: an interest in what it is to be a human being in the biological, social, and cultural senses.

My commentary attempts to bring to light just what these two somewhat differing perspectives are. It is motivated by the belief that this has bearing on the endeavors of radical constructivism, second-order cybernetics, the biology of cognition, and Humberto Maturana’s more recent attempts to describe the foundations of humanness as concerning a biology of love (Maturana & Verden-Zöller 2008). Also, it touches on some of the more problematical aspects of the phenomenological tradition.

Working hypothesis

I have difficulties with the author’s referring to the “working hypothesis” of the constructivist (§§1, 2, 47). My own take is that this stress (at least for Ernst von Glasersfeld) is upon the way that such hypotheses function as the agency or a “common sense” motor for everyday human living. In other words, though absolutely central and vital, it is a “low level” (in the sense of micro) rather than intellectual matter. But this low level predisposition is a precondition for understanding the human being as an entity that simply “bumps” into brute reality (as do billiard balls, or by stimulus/response). The working hypothesis in this implication is what signals the necessary shift from the non-reflective to the reflective. The reflective entails the “working hypothesis” as inherent to it (it is explorative), whereas the

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non-reflective is instructed and acts strictly within the terms of a given instruction. Maturana’s insight into the organisational closure of the nervous system requires a mechanism in terms of which the entity understands and participates in a community of shared interests and endeavours without such instruction.

“The communication of meaning”

4 This is another phrase that I find confusing. It raises several related difficulties in the author’s way of describing things. The problem arises because the author is seriously taking on one of the key challenges of this (constructivist, etc.) camp, the challenge of attempting the tricky task of describing from both within and outside a “domain of communication” at the same time. I have nothing but respect and applause for the attempt to relate Maturana, for instance, to more conventional intellectual traditions, where others simply avoid the complexities of such conventional intellectual traditions, where others simply avoid the complexities of such reflexive thinking and leave the biology of cognition in a dusty, unswept cul-de-sac.

5 As regards “the communication of meaning” itself, it seems there is something missing. From my own perspective, meaning is not something communicated. Rather, meaning is a quality (indeed perhaps the critical human quality), which is generated as part of the essential dynamic of communication. This is akin to Maturana’s stress that the key fundament of language is its connotative nature, and that the denotive is the thing to be explained. And this dynamic comprises the play of three different domains: the conceptual, languaging, and the symbolic. Now the point about this “play” is that it is not necessarily a play of complementarities, whose braiding marks out some unitary domain of reality – say “human meaning.” Rather, it tells part of the unfinished story of a fuzzy and asymmetric complex that, for the moment, I will refer to as “person/culture.” This complex entails aspects of our living as persons (as persons with other persons in society), but – and this is my claim – its quality is that it is unfinished and evermore shall be so. Any “supra” or “metalevel” commentary on this happening remains within the boundary conditions of such an asymmetric dynamic, and necessarily (just as for Kurt Gödel et al.) remains an essential uncertainty out of which meaning emerges as a constant engagement in living as a person.

6 The crucial thing achieved by Maturana’s position, with the inherent focus upon the “organisational closure” of the nervous system and the mechanism of structural coupling to explain co-existence, is that it “outs” or perhaps, better, neutralizes the dualistic problematic of individual versus other. When taken seriously as the fundamental architecture for biological and cognitive being, then the fuzziness or uncertainty of things becomes simply part of the background for that fundament. And the consequent challenge is to experience and explain our living coherently, given such ontological uncertainty.

7 With the above in mind, let me be explicit that the lurking problematic concerns that which Maturana has taken to calling the “person” in place of the “human being” or the “subject.” For me, the person (in the sense of Maturana) concerns the flow of living of human beings both within and without and between social and cultural and biological “skins” as an ongoing and open (i.e., asymmetrical) flow in terms of which meaning is something to be seized or “constructed” rather than something to be found or discovered “out there.” I see such a person (in other words, the human condition) as irreducibly situated on the choppy waves and current of uncertainty (and, indeed incompleteness). The biology of cognition describes the why of this (via organisational closure and structural coupling) – and the importance of this is not a reduction to biology nor that it strands us within the terrors of that bed of uncertainty (existentialism), but that it allows us to make sense of the centrality to the coherence of our human living through the generation of meaning as an intrinsic aspect of our interactions and their recurrences.

8 To repeat – uncertainty becomes not some existential threat (where it lurks in the phenomenological tradition), but is understood as an inherent aspect of the capacity to generate meaning as the carving of coherences out of the flow of what I would call the “ontological uncertainty” of our living (as a biological factor in the evolution of humanity).

9 To return to my starting point, meaning is not so much “communicated because of reflexivity in interhuman communications” while remaining unobserved (cf. Leydesdorff’s Method in the abstract), but is an essential characteristic of that reflexivity. Meaning is something lived, not something either observed or communicated.

A note on the symbolic and the cultural

10 The symbolic order only partially enables us to “specify understanding and misunderstanding” (§16). More properly, in line with Maturana, the symbolic order allows us to interact more flexibly and within a “fuzzier” set of realities than might otherwise be the case (including the cultural). This is how I take Maturana’s notion of the multiverse. The personal (or subjective) nature of each such reality, and the shifting sands of uncertainty as we realize and embrace our human living in the sea of the shifting realities of others, does not lessen through our lived interactions. Rather, it can become understood and experienced as a – if not the – vital part of human-living-in-uncertainty through the play of exchange in terms of the tokens of those symbolic orders. The acceptance of tokens having a shared abstract value, and the emergence of the system of trust that this implies, are fundamental in the bringing forth of a more flexible domain of trust. It is just such a domain that has as its elements respect for the other as the other, or what Maturana calls the emotion of “love” (acceptance of the legitimacy of the other in their domain of operation, see Maturana & Verden-Zöller 2008). Maturana’s implication is that this “emotioning” is the crucial evolutionary development of humans rather than the conventional view that it was the more abstract higher function of mind, or rationality (ibid).

11 I do not imply that the above are absent from this important and original paper. Merely, I would repeat, there is a difference of focus of interest between my own take and the author’s on these interesting matters. Without going too much into detail, one might summarise these as, on the one hand, the European phenomenological tradition (which Francisco Varela went on to embrace), and, on the other, the position held by Maturana, which appears to be outside any particular intellectual tradition. When I came across this position it caused
my own trajectory to be the converse of Varèse. I found it far more optimistic and indeed recognisable than the purely (as I saw it) intellectual phenomenological stance. I had taken seriously Michel Foucault’s analytic of the endless nature of a micro-physics of power and the ineluctable hold of power/knowledge in any particular discourse (e.g., Foucault 1970). This other intellectual position offered a far more coherent and positive way forward than Foucault’s in-depth critique of the human sciences.

To conclude, such a focus (in the sense of a choice of vantage) carries an ethical statement as to what it means to be human. Our conclusions, after all, reflect our experience of our journeys, and those journeys are, as Gregory Bateson (1972) reflected, laid down in our walking. Leydesdorff’s paper is valuable in that the author does not shy away from these issues but attempts to push them to their very boundary conditions. My sole reservation, and perhaps difference from the author, can perhaps be summarized by whether one believes that one might finally take a step of some sort beyond (or above) such an ethical horizon. Perhaps the search for certainty is the scourge of our age, more than for previous ones. Uncertainty and incompleteness have been culturally integrated as pathological and as threats to our coherence of living. They have been treated as conflicting with reason and logic, as denying the rational, when all that is needed is a reconceptualization of what it is to be logical, what it is to be rational, and what constitutes the emotional. Here Maturana’s corpus is wonderfully inspiring.

My view is that there is no such ethical horizon to be strived for (whether ontologically or epistemologically), but that we re-integrate into our culture and ways of living together the joy and certainty we can generate for ourselves in the exploration of the age-old reflection on what it is to be human. The certainty is no longer something “out there,” but in the understanding (the as- suredness) that to be a person and generate meaning erupts from an irreconcilable tension that permeates the most trivial as well as the most important of the happenings of our living. Indeed, without such a tension there would be no meaning.

Meaning is a function of uncertainty not of certainty. Lack of certainty is the necessary condition for meaning to emerge (as the reflective).

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Author’s Response: The Continuous Reconstruction of a Pluralistic Society as an Order of Expectations
Loet Leydesdorff

In response to the interesting comments of Kate Distin and Roger Harnden, let me focus on the relationship between the biological (and evolutionary) systems view and the socio-cultural perspective. Perhaps more than any other question, a core issue of sociology (political theory, etc.) has been: “How is social order possible?” I argued in this issue that Luhmann (1995a) made an important contribution by changing the answer to this question into a communication-theoretical one. In his œuvre, however, the main operationalization remained focused on historical instances (e.g., Luhmann 1980, 1981a, 1989, 1995b). In my opinion, the challenge is to elaborate the theoretical steps into designs that can be tested in empirical communication research.

I shall argue in response to Distin that for this purpose I need Luhmann’s (1997) distinction between symbolically generalized codes of communication and diffusion media. One can consider this as a distinction within the domain of “artefactual languages” that Distin distinguishes from natural language. In response to Harnden, I argue that, from this cultural perspective, the non-verbal when perceived as vital and “rooted” remains codified, although an interpersonal encounter may not require articulation in a natural or artefactual language. Harnden’s ethically motivated stance thus exemplifies my answer to Distin that one needs to assume symbolically generalized expectations about codes of communication – in this case, love and affection – that provide interpersonal communications with a specific feedback and perspective.

In Harnden’s contribution, this symbolic coding is constructed in terms of Maturana’s (e.g., 1978) theory and philosophy (the so-called “biology of cognition”). However, “interobjectivity” (Maturana 2000), or transcendental intersubjectivity (Husserl 1973), was transformed by Luhmann in two different studies (Luhmann 1986a and 1986b, respectively) into contingencies that are, in principle, amenable to empirical research because these domains are now considered as mediated (McLuhan...
shortly after the execution of Charles II in "the war of all against all" ("bellum omnium contra omnes"). This latter "state of nature" would otherwise prevail in a society that was no longer integrated religiously and cosmollogically.

As against the religious solution of the Middle Ages, in which one's individual soul could be rescued from Nature by God's Grace, Hobbes addressed solving the problem of order at the level of society. Whereas the individual solution was religiously sanctioned, the social solution is not "given." Ever since the decapitation of the king of France, the killing of the father in each of us would otherwise prevail in a society that was no longer integrated religiously and cosmollogically.

Mediation implies communication in terms of distributions among agents and therefore the possibility to use various statistics for the specification of uncertainty (Leydesdorff 1995).

The self-organization of the coordination mechanisms of society

The intellectual history of the problem of social order in modern times begins with Hobbes’ Leviathan of 1651. In the midst of the English Revolution and shortly after the execution of Charles II in 1649, Hobbes argued in favor of the installment of a sovereign with absolute power because, in his opinion, such a submission of the individual provides the only solution for "the war of all against all" ("bellum omnium contra omnes"). This latter "state of nature" would otherwise prevail in a society that was no longer integrated religiously and cosmollogically.

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The relations between codes and media in Parsons’ and Luhmann’s work were extensively discussed by Künzler (1987, 1989). Unlike Parsons’ linguistic codes, Luhmann’s codes can be considered as meta-biological and therefore turned "on" and "off" in a binary mode, as in the case of DNA (Habermas 1987; Leydesdorff 2000, 2006). Künzler (1987: 331) then proposed understanding meaning as ratio essendi of language, and language as ratio cognoescendi of meaning. That is, language can be considered as the embodiment of meaning, whereas meaning cannot be known outside of language. Meaning, however, can also operate among us when one is silent because meaning does not only codify information: meaning can also be codified recursively into a symbolic order (Deacon 1997).

The artefactual languages observable in writings and printings – Luhmann’s (1997) "Verbreitungsmedien" – provide a sufficient condition for the emergence of a High Culture as a stratified organization of society. Empires can be distinguished empirically in terms of the artefactual languages that mediate their control. Innis (1950), for example, specified how the invention of papyrus changed the modes of communication and control in Egypt when compared with Mesopotamia. More recently, the invention of the printing press (Eisenstein 1979) and, most recently, the Internet have disorganized prevailing orders.

Artefactual languages, however, cannot explain the longer-term transformation of a pre-modern and cosmologically integrated society into one that can be considered as functionally differentiated in terms of its (symbolically generalized) codes of communication. The symbolic generalization of expectations can operate counterfactually because the codes are latent (as eigenvectors). The manifest observables are instantiations among other possible instances. The system evolves in terms of what happens in relation to what the events mean for what could have happened. What could have happened can only be specified from a systems perspective (by reflexive agency participating in the communication).

One is able to carry the differently coded communications to the extent that one is reflexively and communicatively competent to do so. At the individual level, this order is a psychological and not a biological one. From this perspective, social order is not established by writing a constitution unless such a constitution reflects in writing the civil liberties that prevail in society. Such liberties as political freedom, academic freedom, or the economic pursuit of happiness are grounded in models of coordination and communication that we have reflexively internalized. A symbolically generalized order reconstructs our horizons of meaning as an order of expectations that can operate counterfactually (Grant 2000).
In the theory and computation of anticipatory systems, in my opinion, new semantics have been developed that may be helpful. Anticipatory systems were first defined by Rosen (1985) as systems that entertain a model of themselves. Entertaining this model, an anticipatory system has an additional degree of freedom to select in the present, among possible next states; for example, different phenotypes can be manifestations of a single genotype. Dubois (1998) distinguished this operationally as incursion from recursion (with reference to a previous state), and then further introduced hyper-incursion, that is, a system that can use future (as opposed to past) states for making a choice in the present.

A weakly anticipatory system can then be defined as a system that entertains a model for the specification of possible next states; a strongly anticipatory one as a system that uses expectations specified on the basis of a model for its own reconstruction (Dubois 2003: 112f). In my opinion, one can read Luhmann’s theory as the hypothesis that society communicates meaning and reconstructs itself in terms of communications about possible future states. However, this reconstruction is done in a distributed mode and in different dimensions. Luhmann (1995a) suggested three dimensions: that communications are distributed spatially, over time, and substantively (cf. Lucio-Arias & Leydesdorff 2009a). Society as a strongly anticipatory system “structurates” (Giddens 1979) our individual expectations as weakly anticipatory (since also biologically contingent, that is, embodied) systems (Leydesdorff 2010e).

In other words, communicative competence is not just knowing how to write a cheque, but also understanding the meaning of an economic transaction (with or without being able to write a cheque). One acknowledges this understanding in the symbolic communication, for example, by signing the cheque. The meaning of an economic transaction is supra-individually warranted, that is, at the level of society, and no longer valid only within in a specific organization, nation, or empire. In this sense, the meaning is symbolically generalized in a code that operates both in the transaction and at the next-order systems level. The expectation is that one pays a debt; if one fails to pay, the transaction is damaged. The expectations structure the ensuing action, such as the writing, the enforcement of the law, etc.

**Society as a counterfactual order of expectations**

An order of expectations is well known to us from science: scientific theories specify conditions that can be fulfilled and then events that can be expected to occur. The scientific model describes a set of possible future states of the system under study. Thus, a model is constructed discursively, which enables us to specify possible future states. Observations can inform the expectations in the form of observational reports. Unlike a truth that is given ex ante (as in religion), scientific knowledge is provisional, emerging discursively, and historically volatile. In other words, scholarly communication instantiates an order of expectations.

Scholarly communication is more reflexively transparent than the operation of other symbolically generalized codes of communication (Luhmann 1990). The latter can be reflected by science (e.g., in the economic sciences), but are not themselves part of science and therefore not accessible as another text (Ashmore 1989; Latour 1988). In the symbolic order, however, prices provide us with expectations of value, art with a reference to enjoyment, and – more generally – social order remains an order of expectations that is supported and sustained by social institutions.

This reflection on symbolic generalization brings me back to Harnden’s ethical argument for the priority of love (with a reference to Maturana). It seems to me that Maturana’s prime example of “love” as naturally given, such as between an infant and its mother, is tainted by the cultural metaphor of the Madonna with Child. However, Maturana’s argument is about speculation because the mother-child relationship among humans is characterized by longevity, while among chimpanzees it is not. From this perspective, the mother-child unit constitutes a basic organizational format in human society.

I do not wish to deny these biological “givens,” but only their usefulness in explaining social phenomena immediately; that is, without sociological reflection. From the perspective of the present, each previous state of the system may seem more “natural” than the cultural constructs currently under reconstruction. However, theorizing is culturally mediated: one entertains models of other possible states. For example, we have access only to the “naturally given” via a reconstruction. Was childhood so happy? Or is the pre-oedipal mother already beset with conflicts? Is love between husband and wife more “natural” than love in same-sex marriages? Since there is no possibility of a “return to nature,” one should be advised to develop the appropriate instruments for understanding society as an order of expectations.

In my opinion, important steps have been made, albeit in terms of decennia: from a sociological perspective, the social is no longer considered as given or transcendental. The communication of meaning allows for operationalization (Leydesdorff 2011). However, Luhmann (1995a: 164) emphasized that “communication cannot be observed, but only be inferred.” Instead of observing naturalistically, one can specify hypotheses about the systems of reference and the communications operating. The distributions generated by communication cannot be observed directly without uncertainty, but can be put to excellent use for measurement and thus for observation-based statistics and hypothesis testing. For example, economic transactions can be described in terms of transaction matrices, or scholarly communications and their lineages in terms of citation statistics (e.g., Lucio-Arias & Leydesdorff 2008, 2009a and b).

Furthermore, Füllsack (in this issue) proceeds to the simulation. The theory and computation of anticipatory systems provides models that enable us to appreciate instantiations (of expectations) as incursions and hyper-incursions (Dubois 1998; Füllsack 2009; Leydesdorff 2008, 2010c, 2011; Rosen 1985; cf. Giddens 1979). In other words, a focus on biological or linguistic observables without specification of theoretically informed hypotheses – that is, expectations – does not allow for making inferences about the communication of meaning.

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Communication Emerging? 
On Simulating Structural Coupling in Multiple Contingency

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1. Introduction

Proponents of classical naturalistic or realistic social ontology base their attempts to grasp communication analytically on what could be called the “intentional stance” of human interlocutors that embark on their interactions with a particular will to be understood (cf. Searle 1980; Habermas 1984–1987). This will is thereby seen as a precondition without which no communication ever takes place. In contrast to this demanding assumption, the sociologist Niklas Luhmann conceived the agents of communication as self-referentially closed systems that operate in respect to the “internal” output of their internal (“onboard”) means. For this, agents do not need any conception of an “outside world” nor of other agents in their environment. However, they need to be able to couple their means of operation to the operations of other agents in a way that, to an observer, makes them look (like they are) interacting. In other words, communication in this conception is an emergent property of an aggregation of self-contained operations effected by agents that possess means to select and indicate options from a set of given options and thereby are able to differentiate their actions to an extent that enables adaptivity to the actions of others. Consequently, Luhmann conceives communication formally as a process of consecutive selections – the selection of information, of message, and of understanding. According to Luhmann, communication takes place whenever information can be understood as message (Luhmann 1995: 139, for a good introductory account see a.o. Vanderstraeten 2000).

For Luhmann, communication therefore emerges, so to speak, “unintentionally” – if it emerges. As there is no “outside world” needed to communicate about, there is also no a priori intention necessary to get communication started. Only retrospectively might the agents’ actions be observed as intended1 and so raise expectations about consensus, understanding, and harmony.

In this paper, I will try to illuminate this conception of communication with the help of a multi-agent model. In preparation for this, I will briefly review a well-known mechanism used by social insects to “communicate” (section 2) and discuss Parsons’ concept of “double contingency” and Luhmann’s objection to it (section 3). In order to clarify Luhmann’s stance in the debate on constructivism and emphasize the respective implications of the model, I will briefly discuss Luhmann’s concept of “operative constructivism” in section 4. Finally, in section 5, I will introduce the model and briefly relate it to comparable conceptions from AI research. The aim of this endeavor is to clarify the conception of structural coupling and to demonstrate the consistency in principle of the Luhmannian conception of communication.

2. Ant search

1| Luhmann (1995: 137f) emphasizes this aspect with regard to human action (“Handlung”). This, however, concerns already established human interaction but not its emergence, as is targeted here. For the reason for this differentiation, see Luhmann (1995: 103, and in particular 109).

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3. Double contingency

The crucial point in Parsons’ conception is the fact that the interlocutors Ego and Alter are initially not constrained in their interaction by any kind of limitations or deficits in communicational possibilities. Quite the opposite: they face too many possibilities to start with. Or in other words, the crucial problem for the initiation of their interaction is not too little, but too much opportunity. The problem consists in the contingency of preconditions on both sides. Ego and Alter both face vast possibility spaces and – at least initially – have no information about which one of their options might provide them with a good chance of keeping going.

In Parsons’ conception, the problem is solved by an a priori synchronized “shared symbolic system,” a culture of, for instance, behavioral habits, a language, etc., which constrain the possibility spaces of the interlocutors to a degree at which some action becomes sufficiently likely. In everyday life, these preset constraints confine our possibilities to a degree at which certain actions not only gain sufficient probability of taking place, but sometimes even seem to become predictable. It is irritating indeed if, on greeting a colleague at the workplace, we are not reciprocated, but answered with a quotation from a mathematical textbook.

In principle, Luhmann agrees with Parsons’ assumption of pre-synchronized action constraints, but ties his agreement to the still more basic question of how these constraints emerged in the first place (Luhmann 1995: 105f). In his opinion, these constraints have to be seen as enacted too. So in respect to some theoretical past when there was no cultural pre-orientation of social interactions, Ego and Alter should be bare of any assets that could be interpreted as communicational preconditions. Referring to constructivism, he conceives Ego and Alter as self-referentially closed “black boxes,” as systems that are nothing more than an irritation to each other and that do not have any possibilities for coping with this irritation other than their own onboard means.

In its most abstract form, these means of operation are differentiations. With George Spencer-Brown (1969), Luhmann conceives the basic operation of systems as the dual acts of differentiation and indication. Systems operate in and on their world by differentiating formerly undifferentiated aspects of it and by indicating one of them – just as the air-conditioner distinguishes too high and normal temperatures and indicates “too high” as reason for sending an on-signal to the cooler. Systems in this way generate, so to speak, connectivity to their future. With each act of differentiation and indication, they generate a new state that in the next step can be differentiated again in order to indicate one part of it.

The reciprocal irritation of Ego and Alter stands for the initiation of such a process of differentiation, with irritation being a help term for an act that, when understood strictly, can only retrospectively – when interaction will have taken off – be as-

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cribed to an interaction. By itself the system just does what it does. Only to an observer might this look like irritating another system, which in its turn – again to the observer – seems to find a way in its onboard means to cope with this irritation. The system does not have to – there is no kind of teleology whatsoever in this game – but if it does, it again might induce an irritation that challenges its opposite to find a way of handling it. In this way, step by step, the two black boxes diminish their possibility spaces to a degree at which some actions gain distinctly more probability than others. Since this reduction of possibility spaces happens concurrently on both sides of the “double contingency,” over time, Alter and Ego seem to coordinate their actions. In Luhmann’s terms, they structurally couple their actions. For the observer (and eventually, if Alter and Ego reach a complexity that enables self-observation, for themselves as well) these actions begin to look like reactions. Alter and Ego seem to react to each other.

As a consequence, hence, the uncertainty of both, Alter and Ego, is reduced. Or in other words, information emerges, which from then on stands ready to channel their interactions. On a more general level than Parsons’, one could regard this information as meaning (Füllsack 2012) that provides an additional layer of information to the actions of agents and thereby raises the probability of “interaction.” In Luhmann’s conception, this meaning has the additional function of a symmetry breaker, allowing psychic or social systems to distinguish between self- and hetero-reference (cf. Luhmann 1995: 59f). In other words, it allows actors to develop identity. I will come back to this point briefly in section (e) of the model description below.

In respect to the structural coupling of agents, we might say that communication emerges as the consequence of self-contained actions that are not based on any conception of a world “outside” of Ego and Alter. Ego and Alter operate (and keep operating) solely in respect to their own onboard means. They are never anything else than closed self-referential systems with no immediate connection to any “external world.”

Nevertheless, exactly this enables them to increase gradually the probability of actions by iterating their handling of mutual irritations. Actions can thereby start to look like interactions, and eventually might even be seen as intended, consensus-oriented communications.

4. Operative constructivism

Luhmann termed this kind of observer-based constructivism “operative,” implying thereby that what provides the footing in this approach are operations and not entities – operations that are performed by a system on the basis of its own specific possibilities, and resulting in its own specific, but socially adapted, worldview.

The basic idea of this kind of constructivism is taken from Heinz von Foerster’s (1976) adaptation of Jean Piaget’s explanation of the emergence of object perception and self-identity as enacted by a child, for instance when confronted with a ball for the first time. The child develops a more or less stable, that is, a viable conception of this ball by repeatedly changing between acts of touching, throwing or catching the ball and acts of perceiving the ball’s change of position and its own relation to it. Von Foerster generalized this assumption in mathematical terms of attractors, and suggested regarding objects as tokens for the eigenbehavior that emerges in the course of interacting dynamics. Luhmann further abstracted the conception by interpreting the Piagetian interaction of motor function and perception in terms of an interrelation of first-order and second-order observation, which he drew from the distinction/indication duality of Spencer-Brown (1969).

In Luhmann’s (1995: 63) conception, systems construct something like an interim ontology, a temporarily stable conception of their world, by observing: that is, by distinguishing something and indicating one of the two distinguished sides, thereby gaining a temporarily firm base from which the next operation, i.e., the next distinction/indication, can be undertaken. Each individual distinction/indication is therefore a sort of “reality” to the system. But an observer of this distinction/indication, that is, a second-order observer, can see that this reality is constructed. The second-order observer, however, faces the same problem in respect to its own observation. Its result remains an unquestionable reality that cannot be relinquished without losing its operational base. In order to reveal its contingency, this observer needs to be observed in its own right by yet another observer, who in its turn faces the same problem again.

For Luhmann, the possibility for such an ongoing process of mutual observations arises in modern society, in which social differentiation entails a level of complexity that eventually facilitates and even provokes what can be called self-observation or self-reflection. Some of modern society’s subsystems, such as science in the first place but also journalism and even art to some degree, are literally geared towards perpetually questioning the ontological consistency of the systems’ operational bases. Thus in modernity, the observation of observers and therefore the perpetual change of perspective – of context – has become a ubiquitous mode, with the observer dependency of what is considered as “real” gaining rising awareness. Hence, in the “polycontextuality” of modern society, it is no longer possible to find any Archimedean point from which a “reality” of reality in the classical sense can be claimed. The only appropriate epistemology under these conditions is constructivism (cf. Luhmann 1992: 531).

However, to Luhmann this does not imply “anything goes,” as postmodernism suggested (cf. Luhmann 1992: 177). Besides, Luhmann also omitted to label his constructivist stance as “radical” (as might have been necessary in the times when Glaser and others had to defend their position against a broad realistic front). For Luhmann, his constructivism is operative (or recursive) insofar as it depends on the perpetual interplay of first- and second-order observation, which entails an oscillation of viewpoints of the kind that von Foerster claimed responsible for the construction of “objectivity.” An analogous oscillation works in the interaction of Ego and Alter when exposed to a situation of “double contingency.” Their oscillation in mutually constraining
Each other's possibility space might eventually run into a stable state of structural coupling, in which what has been highly unlikely before can become nearly inevitable—and subsequently might be observed as consensus-oriented communication.

5. The model

«19» In order to comprehend this process of structural coupling in its details and particularities, I generated the following agent-based model, which, unlike other ABMs, does not so much intend to "prove" a possibility of emergence of macro phenomena from a well-defined set of micro actions. Rather it is meant as an explanatory model that, similarly to earlier endeavors (cf. Kron 2002; Fleischmann 2005; Barber et al. 2006; Leydesdorff 2008), intends to illuminate central assumptions of the Luhmannian conception. In this respect, the model focuses on the way structural coupling of self-referential actors might be conceived when following Luhmann's conception of communication. For reasons of better understandability, I dissected the model into different scenarios, loosely corresponding to Luhmann's distinction of information (a), of message (b), and of the understanding of the difference between information and message (c). As it turned out, the model bears resemblance to the by now famous Talking Heads experiment by Luc Steels (1999; cf. also Borensztajn & Trehan 2006).

5.1 Information

«20» The first scenario of the model is simple and is meant to explain its basic working principle. However, it might also mediate a first notion of what in this context can be understood as structural coupling. In this scenario, a population of p computer-generated agents is confronted with n randomly appearing "things" that are assumed to be elements of a world or of an environment the agents have to survive in by distinguishing things. Technically, these things are enlisted in a <thing-list> in invariant order and, to access them, have the form of simple letter constellations such as "aaa," "bbb," "ccc," ... To the agents, however, these "things" are not accessible in this form, but appear in the form of different letter constellations that are interpreted as signs or "words" for things. These words are the only way agents perceive things. Words have the form "AA," "BB," "CC," ... and are likewise listed in an invariant <word-list> of length n. The position of things in the <thing-list> does not correspond to the position of words in the <word-list>, but is randomly assigned in the model's setup. Agents have to distinguish things via their representation as words.

«21» Initially, when starting the model, agents have no idea whatsoever of what words represent what things. At best they can "guess." But for guessing they possess a special onboard tool that has the form of a <probability-matrix>, with n rows that hold entries for words and n columns that hold entries for things (see Figure 1). All entries are set to zero at the start of the simulation.

«22» This matrix serves as a kind of "memory" for the agents. Whenever one of them is "irritated" by the representation of a thing, that is, by a word, the agent checks the row of her probability matrix corresponding to this word. Of course, initially there is no difference in this matrix. All entries are set to zero. So the agent picks one position in this row at random and interprets the heard word as indicating the thing corresponding to this position. The agent "guesses." And in many cases the guess will be wrong. But if it coincidentally should be correct (with "correct" meaning a correspondence that benefits survival), the agent memorizes this success by increasing the corresponding matrix position by one point. From then on, whenever the agent is "irritated" again by a word, she will find a differentiated probability matrix from which she chooses the highest entry and—with a certain probability—interprets the corresponding thing as the one represented by the word.

«23» To avoid already determining technically these interpretations in the first steps of the process, agents compare each entry to a random number between 0 and 100. The corresponding thing is assigned only if this random number is smaller than the entry. Agents thus have to increment entries up to 100 to be finally sure of word–thing correlations. Nevertheless, with this simple procedure, agents rapidly learn to discriminate things correctly via words. As I have shown on other occasions, employing slightly more complex genetic algorithms (Füllsack 2010, 2011a), this simple procedure works analogously with changing environments as long as the agents' learning capability has more flexibility (that is, faster adaptability) on average than the environment.
Agents can be seen as finite state machines. This information, however, is just information to them. It is a difference that makes a difference to the agents.

« 24 » Note, however, that first, what is here called “learning” is of course an anthropomorphic interpretation of a process of structural coupling. By itself the “learning” agent is nothing more than an autonomously acting mechanism having no other perception of its world than an aggregated “experience” of those of its acts that have proven “successful.” And second, we should note that what is here called “memory” has no real access to any “past” of some sort. Agents always check only the highest, that is the last, entry in their matrices, and determine their interpretations from this. The process thus follows a Markov chain and agents can be seen as finite state machines.

« 25 » Nevertheless, one might interpret the entities of the model as agents learning to discriminate things via words by being structurally coupled to their environment and finding ways to cope with irritations. Remember Maturana and Varela’s (1987:137) submarine driver who, on being congratulated for avoiding reefs, is confused because all he did was read certain dials and maintain correlations between indicators within the limits of his equipment. Like this submarine driver, our agents have no concept of any reefs or other world particularities. They act solely on the grounds of their own onboard means.

5.2 Message

« 26 » In the second, slightly more complex, variant of the model, things are not presented in the form of words to the agents, but agents react themselves to an “irritation” by a thing with the utterance of a word. “Things,” “words,” “thing-list,” and “word-list” are all the same as above and this means that correspondences are initially undetermined. Agents have no idea about which word to choose for indicating a thing. An utterance of a word is interpreted as a mechanical (re)action just like an ant emitting pheromones when finding food. And as in the case of ants, other agents in the population can “hear” the uttered word. However, in this case, the other agents have no idea of which thing the word was uttered in reaction to. And, as we will see, they also do not have any “understanding” of the word as being uttered by an agent. For them, it might as well have been coincidental noise.

« 27 » As in the case of pheromones, a correct attribution of the heard word to the thing in reaction to which it was uttered, (and also, as we will see in variant 3 of the model, a correct attribution of the word to another agent as “sender” of a message), would benefit the listener, presumably in respect to some kind of collaboration in foraging or the like. Initially, however, there is no collaboration possible, for there is no “connection” between the agents. Agents have no idea of other agents in their world. They are conceived as self-referentially closed operating systems, black boxes, which construct their world solely with their onboard means. Among these, however, again there is a memory in the form of a matrix with n rows and n columns with all entries set to zero initially.

« 28 » Now we might interpret the ensuing process in terms of the Parsons/Luhmann “double contingency” concept. The procedure is as above. Whenever an agent hears a word, she checks the row in her probability matrix corresponding to the thing “meant” by the word. If entries differ, she checks for the highest, compare it to a random number between 0 and 100, and if this number is smaller than the entry, utter the corresponding word from the word list. Likewise, the hearer of a word analogically compares this word to all positions in the rows of her probability matrix that correspond to the positions of the word in the word list. Again, the highest entry is compared against a random number between 0 and 100, and, if higher, is assumed to indicate the thing that corresponds to the column the entry was taken from. If the assumption is right, the corresponding positions in the probability matrices of the agents are raised by one point. An entry of 100 eventually implies certainty about a word designating a thing. If all agents have 100%-entries for all things in their world, their onboard means of communication are considered determined. No further changes are possible (see Figure 2).

Figure 2: Left: development of a probability matrix column for two agents, solid red for Ego and dashed blue for Alter, from step 500 to step 1,350 in steps of 50, the peak going up over time. Right: the final probability distribution in a column of the probability matrix of five agents, in this case converging on two different words. In this way, in terms of Luhmann’s conception, agents simply concurrently constrain their initially “open” (i.e., in all positions equally likely) possibility spaces. They do this without “connection” of any sense, but by structurally coupling. Their probabilities for uttering certain words in reaction to certain things co-evolve.
agents confronted with 3 things. The plots show a typical correlation development in a population of 10 agents with 3 things.

- **30** Hardly surprisingly, after some iterations agents "convene" on certain words for certain things (see Figure 3). In the experiments, with \( p \leq 10 \) and \( n \leq 5 \), agents practically always converge on one language, meaning that all agents are using the same words to indicate things. Agents are thereby not allowed to use words homonymously, that is, to indicate different things with one word. For this, in order to prevent their probability matrices from running into a dead end, the possibility had to be implemented to decrease probabilities again when two words reach high entries simultaneously. For this reason, simulation runs with \( p > 10 \) and \( n > 5 \) at times can become exceedingly long. However, even with \( p = 25 \) and \( n = 10 \), typical results consist of a population with around 50% of the agents speaking one language and the rest differing in not more than 50% of their words. With David Lewis (1969), we might say that agents convene on a "babbling equilibrium."

- **31** As should be clear by now, the model can be seen in analogy to the Chinese Room scenario with which John Searle (1980) argued against the notion of thinking machines. Obviously, agents act similarly "automatically" without any intention to generate interaction. One might say that interaction (or at least some kind of coupling between agents) emerges, so to speak, "behind the back" of the agents. The difference with Searle's fiction of a non-Chinese speaking translator who just blindly follows the rules of a book that he has to correlate English and Chinese words is that the agents in this model do not have a book beforehand. The book (in the form of a differentiated probability matrix) emerges in the course of the action (which thereby might start to look like interaction). In some way, this seems reminiscent of the difference between Parsons' and Luhmann's versions of double contingency. What eventually allows contingency to be overcome and thus enables interaction is not pre-given, but emerges in the course of structurally coupled self-referential actions.

- **32** However, as this concerns Luhmann's constructivist stance and his concept of information (which conforms more to Bateson than to Shannon), we have to admit that this aspect is not completely realized in the model. Since the probability matrices used by the agents are – as explained above – finite and of the same size for all agents, there is some pre-given synchrony in the model. The finiteness of the matrices rather complies with Shannon's capacity of a cable or the set of symbols from which one is selected in order to determine information. In contrast, for Luhmann, information is not an entity that can be transmitted from sender to receiver based on both of them having the same set of options and therefore the same choices. Rather, the set of options – here, the probability-matrix – should be conceived as emerging as well. The model abstracts from this aspect. In a next version, it therefore might be more appropriate to resort to the conception of Jaynesian probability (cf. Fiorillo 2012), which seems to stress the observer-dependency of information in a similar way to Luhmann.

8 | This conforms to the objection Donald M. MacKay (1969) has put forth with regard to Shannon's conception. See Füllsack (2012).
9 | I am indebted to an anonymous reviewer for this information.

**5.3 Understanding information as message**

- **33** In the third variant of the model, I endowed agents again with slightly more possibilities to couple. In addition to the probability-matrix for aggregating "knowledge" about thing-word-correlations, they now are supposed to discriminate between a word being uttered by another agent and a word as coincidental background-noise.

- **34** However, the principle is the same as above. Agents react to randomly generated things by uttering words that are selected in respect to entries in probability-matrices. In order to visualize these reactions (for the observer of the model, not for the agents themselves), agents, when uttering a word, are made to take on a certain, initially randomly assigned, color that technically is provided in an invariant list of possible colors with length \( n \).

- **35** Simultaneously with the agent's word, the model generates one or more random words that agents can also perceive. Or, put differently, the model generates background noise in addition to the utterances of the agents. In order to indicate hearing and interpreting a certain thing, agents are made to take on a color from the color-list. Taking on the same color as the speaking agent and interpreting the correct thing from the heard word (the one in reaction to which the speaker has uttered the word) is considered a success. In this case, agents are regarded as "understanding" a word (information) as coming from another agent in the form of a "message" and not in the form of noise from the background of the model. For this they are "rewarded" with an increase in the respective positions of now two matrices, one for the probability of a word representing a certain thing and another one for choosing a color corresponding to that of a "speaking" agent.

- **36** The ensuing process might be seen as a sort of second-order structural coupling. Agents couple in respect to interpreting things via probability-matrices for word-thing-correlations. Additionally, their probability-matrices for word-thing-correlations couple with lists for color-correlations as well. Agents, so to speak, couple to their "material" environment from which the thing-irritation arises. At the same time, they couple to other agents that "irritate" them.
with words uttered in response to their own “material,” structurally coupling. As a result, agents seem able to discriminate between “correct” words coming from other agents and coincidentally generated background noises that are technically, indeed, words as well but are not assigned to other agents as speakers. We could interpret this as agents “understanding” the difference between “information” and “message” by way of multiple structural coupling. Note, however, that the agents in this scenario cannot distinguish other agents as such. In other words, they do not (yet) ascribe an identity to each other.

5.4 Some results

« 37 » In the variants of the model mentioned so far, all agents have equal chances to utter and to hear and interpret words. Their coupling depends very much on coincidental initial “irritations” to which their probability-matrices lock in (Arthur 1989). From these path dependencies, networks of coupling possibilities emerge. If an agent in its first steps, for example, repeatedly couples to a “red” agent in “agreement” on the word “AA” meaning the thing “ddd” and additionally couples to another “red” agent in agreement on the word “BB” meaning the thing “ccc,” her probability for guessing red as the color that indicates “agent-message” (and not noise) might rapidly grow to a level at which the coupling to other agents that, in their interaction-history, experienced — say — “blue” or “green” as indicating “messages” becomes impossible. As a consequence, the population differentiates. The parts become “incommunicable” to each other. True, to avoid running into dead ends, the model provides a possibility to decrease color-probabilities in the same way as word-probabilities. However, probabilities can be reinforced by members of the same color-network so that they do not decrease quickly. For this reason decreasing can take a pretty long time. As a consequence, in the experiments the agent population often polarized into at least two groups of roughly the same size that remained “incommunicable” to each other over long periods of time.

« 38 » The following tables (Figure 4 and 5) show extracts from probability-matrices, with agents listed from the top down. In the left column, the color-probability-matrix of ten agents at step 750 is shown. At this point in time, 6 agents “convened” on “understanding” blue as indicating a “message,” 4 “convened” on red. The middle column shows the corresponding word-probabilities of the ten agents at the same time. Although the “choices” of agents 8 and 9, for example, do not seem to differ too dramatically and therefore indicate a possible coupling in respect to word-thing-correlations, they are “incommunicable” in respect to color-probabilities (here, red and green). Hence, in order to enable an overall “agreement,” agents have to “reconsider” their color-choices. The right column shows the same word-probability-matrices after 12,000 steps. At this point, “agreement” on one color is accomplished, but not all agents convene on words. While a majority (red underlined) seems clearly inclined to agree on words, as defined by the first, second, and third position in the respective rows, agent 9, for example, still seems to be in the process of changing her “choice” (e.g., a probability of 88 (which has to decrease) against 76 (which has to increase) in the third row) and agent 3 “disagrees” on the words, as defined by the first and second row of her matrix.

« 39 » As said before, if coupling proceeds contradictorily, (that is, influenced by agents that themselves are influenced from different sources), the emergence of a complete set of words can take a long time. In these cases, agents are forced to “reconsider” their selections, that is to decrease the entries in their matrices in order to be able to converge on an allowed (that is, not homonymous) set of words. In the above example, agents “agreed” upon using the same word-set, that is, one language (for designating just 3 things), after 19,467 steps.
5.5 Identity

In the last, still slightly more complex, variant of the model, agents are supposed to develop identity. Their actions are now considered successful if they not only correctly interpret things from uttered words and discriminate between agent-generated ("messages") and background-generated words ("information"), but also successfully discriminate between other agents as sources of words. In short, agents’ actions are considered “successful” if a “speaking” agent is “recognized” as the carrier of a particular identity and thereby distinguished from other agents as carriers of different identities. What might be sociologically interesting in this variant is the fact that agents start out with no self-identity whatsoever. Their self-identity emerges in the process of mutually ascribing identities to each other. Or in other words, agents break the symmetry of self and other in the course of structurally coupling and, as a consequence, start to establish a stable preference that, according to Luhmann (1995: 59f), sediments in the general form of meaning.

In order to enable this process, agents are endowed with yet another probability matrix for memorizing identity probabilities (Figure 6). An agent, when confronted with a thing, now in addition to checking her matrix for thing–word correlation and the list for color correlation, also has to check the matrix for identity correlation. If there is no entry higher than zero at first, she just “guesses” who she might be and decides randomly on an ID in the form of a name. This name then is “heard” by another agent and checked for its probability of designating a particular agent. If all probabilities are zero, she “guesses” too. And as before, if this guess is correct it is “rewarded” with a corresponding entry in the matrices of both interlocutors. Also as before, agents are not allowed to use names twice. Thus, once a name is assigned to an agent, others who have high probabilities for using the same name have to “reconsider.” In this way, slowly but steadily, identities form, this way, slowly but steadily, identities form, and an “understanding” of “information” as “message” emerges. The relatively simple coupling of three probability arrays generates a correlated system that to an observer might seem the result of the well-orchestrated and thereby already distinguished system that to an observer might seem the result of the well-orchestrated and maybe even intended interaction of autonomous actors. Were they not obviously just computer generated agents, we would, who knows, ascribe to them the will to communicate and to be understood.10

Figure 6: Names and probability arrays of 5 agents “convening” on (in this case) the same 5 words. Left to right: identities, words, word probabilities, identity probabilities, and color probabilities. Internally, agents are ordered from top to bottom, which corresponds to the order of columns in the identity probability matrix.)

Conclusion

Of course, in the light of contemporary ALife and AI research, the model as introduced in this paper is rather simple and far from using (all) the possibilities modern IC technology provides. The model has, however, not been generated to test and expand these possibilities, but to illustrate aspects of what Niklas Luhmann might have had in mind when conceiving his theory of communication. The model tries to show that the aggregated actions of autonomously operating “black boxes” that have no conception of an external world (let alone of a society they are members of) suffice to generate — via structural coupling — a form of correlation that might well be interpreted as the result of intended (willful) attempts to cooperate and to be understood. If the model and the assumptions it is built on hold water, this might give reason to consider Luhmann’s constructivist conception of communication scientifically more reasonable than competing theories that draw on an irreducible quality of consensual communication.

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10 As some ALife researchers seem to wish to make the possibility of reproducing conditional on the emergence of identity (Varela 1992), it might be interesting to give agents, once endowed with IDs, the chance to reproduce according to the number of their “successes” in communicating with others. Predictably, from the ensuing evolutionary selection, the “babbling equilibrium” of partially different languages should vanish. This and related experiments will be investigated in subsequent work.
Is Communication Emerging or Sui Generis?

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> Upshot • In Füllsack’s paper, the communication network is considered as emergent. This raises the question of whether society is emerging or sui generis. This contribution discusses the latter (perhaps counter-intuitive) perspective and some analytical consequences.

"Whereas Freud, from a biological starting point, arrived at the recognition of the distinctive properties of social systems, Durkheim began with the conviction that clear distinctions between social and personal systems were essential; in his famous phrase, society was a reality sui generis." (Parsons 1968: 432).

In his paper, Manfred Füllsack studies the communication network system as emergent; but the human actor can also be considered as an effect of the communication of meaning. Human reflexivity provides a necessary condition for interhuman communication, and vice versa (Luhmann 2002). Füllsack’s paper raises the question of whether society is emerging or sui generis (cf. Füllsack 2009). This contribution discusses the latter (perhaps counter-intuitive) perspective and some analytical consequences.

Talcott Parsons (1952; 1964: 18), in his analysis, argued that sociology finds its origins in the convergence of Durkheim’s insight that “the individual, as a member of society, is not wholly free to make his own decisions but is in some sense ‘constrained’ to accept the orientations common to the society of which he is a member” with “Freud’s discovery of the internalization of moral values as an essential part of the structure of the personality.” Parsons’ crucial innovation, in my opinion, was then to reverse the arrow in the traditional problem of how social order is maintained (cf. Hobbes): that is, the integration of action into social structure. For Parsons, action is not integrated into social structure, but social structure is integrated into each action. If structure is always integrated into action, however, there is no environment left, and therefore no systematic position for feedback by action(s) over time can be defined.

Niklas Luhmann (1977: 65; 1978) argued that Parsons’ theory can consequently be seen as the most systematic attempt to understand the relation between the individual and society as one that is internal to the system. Luhmann (1995) proposed to reformulate the relation between the individual and society in terms of two types of systems, which operate in each other’s environments and over time. Society is then considered as a communication system among individual minds (Luhmann 2002). The two systems are analytically independent but they interact in events that can then be labeled “actions” with reference to actors and “communications” with reference to the network. This model provides us with an opportunity to operationalize the external cybernetic relations. In addition to relations between actors and the network, one has to specify how the network can obtain (and maintain) a complex structure.

How is information generated in a communication system? When does a communication network develop according to its own logic? How can one follow Luhmann when he argues that the communication system is not only operationally closed, but even self-organizing (“autopoietic”), analogously to the self-organizing character of biological and psychological systems (Maturana & Varela 1980)? The usual way to argue for the social system as sui generis has been by using the argument of “double contingency” in interactions (Parsons & Shils 1951: 3–39; Parsons 1968; Luhmann 1995: 103ff). Füllsack follows this model and extends it to multiple contingencies among agents (§§8ff). However, the “double contingency” of Ego and Alter for each other is a necessary, but not sufficient condition for the existence of a communication system: the “double contingency” has consequences for the awareness and behaviour of the actors involved but it does not have to imply “communication” as part of an operationally closed and different system that could then also be considered as an external source.

One can argue for the existence of the network as a distinct system by using Claude Shannon’s (1948) mathematical theory of communication: the expected information content of the system is equal to the uncertainty within this system. As long as an actor processes on its own, it – that is, the actor as a system – can only attribute its uncertainty to itself. However, as soon as two actors communicate, neither of them can internally generate the information necessary to exclude the possibility that uncertainty has originated from (noise in) the communication. The uncertainty can be attributed to each of them or to the communication. Therefore, one has to assume that the communication system itself is able to generate uncertainty by operating (Leydesdorff 1993: 58f.).

http://www.univie.ac.at/constructivism/journal/8/i/103.fuellsack
Communication Without Emergence?

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> Upshot • Our criticism aims at the premises of Füllsack’s simulation model, i.e., we claim that his interpretation of the Luhmannian concept of double contingency contradicts the systems theoretical approach in fundamental ways. Neither the view of communication as an emergent system, nor the theory of double contingency is addressed in an adequate manner. Thus Füllsack in fact does not simulate a systems theoretical approach to double contingency but simulates a mere reduction of the social to the individual psyches.

In his paper, Manfred Füllsack offers a model for simulating the emergence of communication. It starts with the situation of "pure" double contingency, with ego and alter "bare of any assets that could be interpreted as communicational preconditions" (§10). Basing itself on the premises of the systems theoretical approach of Niklas Luhmann, the model does not serve to prove the Luhmannian assumptions about double contingency (cf. §19), but rather to "illuminate central assumptions of the Luhmannian conception" (§19). It raises the question of how communication works despite (and even because of) the psychic systems of alter and ego – which constitute the situation of double contingency – being opaque black boxes to each other.

There are serious points to criticize in the article’s argumentation, culminating in two main aspects for criticism: first, his interpretation does not give a proper account of the Luhmannian theory, rather it is diametrically opposed to it; second, and even worse, the premises of the simulation themselves seem to be contradictory.

The problems begin with Füllsack depicting communication as a mere aggregation of agents’ actions (“an emergent property of an aggregation of self-contained operations effected by agents that possess means to select and indicate options from a set of given options,” §1). Though he recognizes the triadic constitution of communication – consisting of the three selections of information, message, and understanding – he ascribes this selection capacity to the agents. Doing so, Füllsack misconceives the essence of the Luhmannian systems theory: the self-reference of the social through the processing of an own system–environment difference whose function is the permanent reduction (in reference to the psyches of alter and ego) and organization (in reference to communication) of complexity (cf. Luhmann 1995: 107f). It is the main point of the Luhmannian conception of emergence that communications constitute elements that in no way resemble the elements of the psychic systems in their environment (cf. Luhmann 1995: 144). Communication means irreducible self-reference.

Furthermore, referring to the actors capacities, it is not theoretically adequate to state that communication emerges “unintentionally” (§1). It is more appropriate to say that the individual psyches serve as points of references for the communication process (cf. Luhmann 1995: 165f).
Here it is important to distinguish the two components, information and message: via the message, ego *ascribes* to alter a certain intention to communicate a piece of information to him. This form of communication has to be distinguished from mere informative events such as an earthquake or a hurricane or solitary non-social acts such as brushing one's teeth or tying one's shoes, which are not observed as intended to inform an ego about something (cf. Luhmann 1995: 151). Füllsack misses the differentiation between a telos of the social and the communicatively ascribed motives of the actors that appear as addressees in the self-referential process of the social.

« 5 » Even more difficult is the relation between actors and the emergence of social order in the situation of double contingency, as it is presented by Füllsack. Again, he misconceives the dimensions of the problem: Talcott Parsons (1968) *did not* claim, as Füllsack does, that the problem of social order is *a priori* solved by a common shared symbolic system. On the contrary, Parsons just says that a common shared normative system is a necessary condition for social order, which cannot be presupposed. Social order can evolve factually or fail to emerge at all (Hobbes’ *war of all against all*). Thus Parsons’ thesis is an empirical one: if there is social order, then a common shared normative system is given, too. In other words: following Hobbes, Parsons models a classic conflict between actors, who have divergent interests in the resources of each other. In contrast to that, Luhmann does not conceptualize a conflict because alter and ego *share the same interest* in certainty of expectations – they only do not know how to get there. It is only under these conditions – which characterize a coordination problem, not a conflict – that Luhmann does not need norms to solve the situation of double contingency. Doing so, he models a less difficult problem, whereas Parsons deals with the most difficult one. At least Parsons goes further into the problem of cooperation, which is that rational actors may intend social order but, due to the free-rider problem, the individual ambitions cannot be transformed into a collective solution. Luhmann just does not consider this dilemma. Füllsack reveals that he does not differentiate the problems when he first says that “Alter and Ego seem to coordinate their actions” (§12) while he mentions in another passage that the actors develop a relationship “that might well be interpreted as the result of intended (willful) attempts to cooperate” (§42).

« 6 » Taking the coordination problem as initial point (referring to Luhmann) and pursuing an agent oriented simulation, it has to come – depending on memory: that is to say, how fast agents forget – more or less quickly to a state of coordination of actions since the reduction of expectation uncertainty is the goal. This has already been the result of the simulations by Kron & Dittrich (2002), in which further constraints have to be met that Luhmann leaves unmentioned (cf. Kron, Lasarczyk & Schimank 2003).

« 7 » Following this interpretation of Luhmann’s model of double contingency, Füllsack is quite right that Luhmann shares the premise of given constraints on action by excluding the problems of cooperation and conflict. However, he is wrong again when he claims that Luhmann wants to know how these constraints *come into existence*. Otherwise Luhmann would have to explain – which he does not – where alter and ego got their intentions from to solve the double contingency with the solution circle “I will do what you want if you do what I want” (Luhmann 1995: 117). In fact, for Luhmann, the abstraction of constraints serves as a heuristic instrument to ask for the qualification of certain actions/events to break the circle of external and self determination mentioned above, just to find chance and the temporal dimension (unlike the social dimension for Parsons, cf. Luhmann 1995: 104) as functional equivalents for solving the situation of double contingency. Luhmann (1995: 118) explicitly states that there cannot be any situation that is completely indeterminate: rather, alter and ego always enter the situation of double contingency with certain, even if only minimal, expectations (cf. Luhmann 1995: 108). In consequence, this renders *ad absurdum* the premises of Füllsack’s simulation, that alter and ego “are nothing more than an irritation to each other” (§10). Luhmann assumes that the observation of double contingency reproduces the reciprocal perception of identities as its own precondition to which (even if minimal) expectations are ascribed. In contrast to that, Füllsack makes use of ontological assumptions when he takes as given agents that *then* ascribe identities to each other (cf. §40). Yet this process presupposes the identification of “x,” which consequently allows for further characterization. The same applies to the correlation of things and words: the simulation presupposes an environment independent of its observing psyches, which can only represent (!?) their environment by ascribing words to things (“representation as words,” §20). This again ignores the self-referential character of psychic systems, which means that each reality is a reality for a psychic system and thus, in more general terms, for an observer. The ascription of a symbol is an internal system operation. Instead Füllsack applies an external criterion of correctness by means of a definite correspondence between a thing and a word. Furthermore the criterion “beneath survival” (§22) is such an abstract one that it could be realized by manifold symbolic indications for one and the same thing. Füllsack does not simulate the autoptosis of agents because he observes with the distinction of agent/environment rather than observing how the agents observe.

« 8 » As a result, Füllsack cannot observe self-referential structuration since his model presupposes a “pre-given synchrony in the mode” (§32) in which the agents matrices are all identical and abstracts from the constitution of the matrices themselves. Thus Füllsack presupposes – similarly to Luhmann, but in another respect – a structural similarity between alter and ego without explaining where it comes from or how this can be possible. How can it be that those words articulated by alter are the same words that are perceived by Ego (§26) – even though both of them operate self-referentially and separated from each other? This indicates that alter and ego cannot be as different as Füllsack maintains. Indeed, consciousness and communication are the result of a co-evolutionary process in which they developed together in a dependence relationship (cf. Luhmann 1990: 44ff, 1997: 198). Both systems are coupled through the common medium, language (Luhmann 2001: 117). However, Füllsack misses this explanatory conception of communication: on the one hand he over-emphasizes the difference between the psychic systems (“onboard means might differ from system to system,” §7), on the other hand he claims
that the agents coordinate blindly without any intention or situational awareness, which can only work due to a structural similarity of the agents' matrices. Similarity, difference, and identity of the psychic systems would rather have to be modelled as a result of their participation in communication, just as communication draws its structural similarity from its dependence on consciousness. Füllsack's model lacks this premise circularity. Instead, Füllsack processes a kind of methodological psychology in which the self-reference of the agents marks the unquestionable and only premise of the argument. In opposition to his assurance in footnote 3, that "structurally coupled actions make them [the agents] socially concerted," Füllsack assumes a blind coordination "behind the back" of the agents (§31), i.e., the social coordination corresponds to a mere statistical correlation of the matrix values but has nothing to do with a communicative process of intention ascription. In Füllsack's interpretation, the social is rather an accidental, statistical co-existence without its perception by the agents. Interaction is equalized with a mere co-existence. Thus Füllsack suggests an interpretation of the Luhmannian double contingency in which the emergence of communication is a mere fiction produced by an observer, which is evidenced by Füllsack's apparently intended fictionalizing use of social contexts: agents couple in a way to the operations of other agents which "makes them look interacting" (§1), the actions of other agents can be observed "as intended" (§2), "Alter and Ego seem to coordinate their actions" (§12), the actions "look like reactions" (§12), alter and ego "seem to react to each other" (§12), and actions can "look like interactions, and eventually might even be seen as intended, consensus-oriented communication" (§14; emphasis ours). Insofar as his argument might suggest that social systems are agent fictions, the theoretical and modelling complexity would increase (cf. Kron 2005: 315ff; Schimank 1988).

In a nutshell, Füllsack misconceives the essence of the Luhmannian systems theory: the distinction between psychic and social systems. Exactly this hints at the crux of agent-based simulations of the Luhmannian systems theory: systems dynamics have to be modelled depending on the internal states of the agents – which Luhmann explicitly avoided. This indicates that the simulation of social systems has to find new paths beyond agent-based modelling.

**Author's Response:**

**Systems as Realities**

**Sui Generis with Eigenbehavior?**

Manfred Füllsack

— **Upshot** • The differentiation between society being emergent or sui generis seems to correspond to the question of whether the development of interaction, in particular communication, should be considered bottom-up, top-down or as a sort of circular concurrency of bottom-up and top-down causes. This is reminiscent of the philosophical debate about the implications of the terms **emergence** and **downward causation**.

« 1 » The commentary of Loet Leydesdorff focuses on an interesting differentiation that in some sense, as I read it, also seems central to the commentary of Thomas Kron and Pascal Berger, namely the question of whether society is to be considered emergent or sui generis. To some extent this differentiation seems to correspond to the question of whether the development of interaction, in particular communication, should be considered bottom-up, top-down or a sort of circular concurrency of bottom-up and top-down causes. As mentioned in the paper (§32), I take it that Luhmann's conception stresses this circular mode, whereas my model, as I have to admit, rather focuses on emergence, that is, on the bottom-up dynamics of the process. However, as I shall try to point out briefly below, concurrency, although not explicitly a focus, is not completely ignored in the model. Before this, however, in reaction to the rather sharp criticism of Kron and Berger, I would like to remind the reader of the original intention of this paper. The model has not, as claimed by Kron & Berger (§1), been generated to "offer a model for simulating the emergence of communication," although, as I have to admit, its title might provoke this expectation. Basically, the model was meant to illustrate a particular aspect of the Luhmannian conception: namely, as the paper's subtitle indicates, the aspect of structural coupling in multiple contingency. In other words, the paper deals with the question of how the evolution (the emergence) of a society of interacting agents can be conceived if the agents' possibility space is to be thought of as being contingent, that is, not pre-synchronized by any "will to communicate" or any other intentional stance.

« 2 » To me, the issue raised by Leydesdorff of whether society is emergent or sui generis is reminiscent of the philosophical debate about the implications of the terms "emergence" and "downward causation." To illustrate the relation of my model to this differentiation, it seems helpful to look briefly at some details of this debate.

« 3 » Historically, the term "emergence" has been suggested to denote the development of a system's macro-level properties that are suspected of originating from micro-level interactions without complete knowledge of how these properties are
brought about in detail. For instance, 19th century scientists could not explain the fluidity or transparency of water, which was known to consist of hydrogen and oxygen, when both of these components show no fluidity or transparency on their own. As a consequence, higher-order properties suspected of arising from the interaction of lower-level components that do not bear these properties were associated with the Aristotelian notion of a whole being more than the sum of its parts. With this reference, the term "emergence" remained vague and disputed, above all due to the uncertainty about whether something was missing in the explanation it offers, and if so, what. (cf. Clayton & Davies 2006).

« 4 » With the advent of the digital computer, however, a possibility appeared to demonstrate unequivocally that unexpected ("new") macro-level properties can emerge from the interaction of lower-level components that do not show these properties. Investigations such as those into the dynamics of coupled differential equations (Lorenz 1969) or the behavior of cellular automata (Wolfram 2002) showed that micro-level interactions can generate phenomena that behave in a particular way that gives reason to speak of an eigenbehavior or an eigenform (Foerster 1976) of these phenomena. Consequently, such phenomena can be considered analytically as realities sui generis in the sense of the Luhmannian conception of a system; for example, a social system of communications. With Wolfram's words, these investigations gave reason to a "new kind of science" based on the assumption that scientific explanations do not need to resort to external (metaphysical) causes such as a "will to be understood" in order to grasp emergent phenomena. If a phenomenon's explanation cannot be deduced from observing individual components, it has to be searched for in the interaction and aggregation of components. In this sense, therefore, it seems that communication can be seen as stigmergic, in the same way as the foraging coordination of ants, which is not deducible from the behavior of a single ant. That is how one might interpret Luhmann's suggestion of a conception of communication that explicitly opposes subject-philosophical (and mended inter-subjectively) explanations of communication.

« 5 » Unfortunately, I learned only after devising my model that there is a body of research in AI and robotics that uses an approach to the emergence of language and communication that is quite similar to that of my model. The most famous study in this is probably the "Talking Head" experiment by Luc Steels (1999). In connection with this, there is also a much simpler multi-agent model that simulates the emergence of a common meaningful lexicon, known as the "Minimal Naming Game" (Steels 1995). As mentioned above, however, my prime interest when devising my model was the Luhmannian concept of structural coupling in double (or in this case multiple) contingency. The cross tabulation of the data of several interconnected matrices in this model is meant as a suggestion for how to conceive Luhmann's notion of structural coupling from the perspective of computer-based simulation.

« 6 » The way I see it, this cross tabulation of matrices also provides some sort of account for the above-mentioned aspect of downward causation; that is, the systemic influence of society sui generis on the components that generate it, the "networking of the network," as Leydesdorff (§7) calls it. « 7 » For some time in European substantive philosophy, the term "downward causation" caused some irritation (Kim 1993) since it seemed difficult to conceive of a phenomenon determined by entities that themselves are considered influenced by the phenomenon they caused. But with the rising attention to cyclic processes such as auto-catalytic chemical reactions or circularly bequeathed web-page relevancies in search-engine algorithms (cf. Füllsack 2011a), the term seems to have become less controversial. Today, not even philosophers seem to be much irritated by cyclic causation, such as that of language, which, once it evolves, starts to feed back on the cognitive constitution of the agents that initiated its evolution. Luhmann, in his time, might have faced more headwinds still. He rightly insisted on the concurrent and interdependent emergence of psychic and social systems.

« 8 » My model does not account for this concurrency in the first place (but see the model in Füllsack 2011b or the discussion in Füllsack 2012). And this, by the way, is one reason why I do not – as Kron & Berger repeatedly claim – use the term "psychic systems" when referring to my agents. Drawing on a suggestion of James Crutchfield (1994), my agents are conceived far simpler than what one would be willing to regard as a psychic system (cf. Figure 7).

« 9 » Agents are elementary particles whose self-contained actions on a micro-level cause the emergence of a structurally coupled system on macro-level that might be observed as an interaction or even communication system (I shall come back to this condition of observation below). As insinuated in the sketches, the agents in these models start out ready-equipped with sensors and effectors, which in my case are

http://www.univie.ac.at/constructivism/journal/8/i/103.fuellsack
matrices for memorizing the experiences of past actions and their “successes.” With Luhmann, one could rightly ask where these sensors and effectors come from if they are not evolving themselves in a process that has to be regarded as social itself. The agents’ constitution can hence be seen as pre-given. In this regard, I readily concede to the reproach of presupposing conditions that should be regarded as evolving themselves within the constraints of the particular logic of a society sui generis. In this respect, my model is an abstraction, just as any model is. Nevertheless, it considers a sort of feedback as well, which takes effect once society emerges as such. At least in the model variant with agents developing a sort of identity in interaction (section 5.5), society can be seen as a system providing essential constraints on the agents’ constitutions. In respect of the specific logic – the eigenbehavior – of this system, the suggested expression of a “networking network,” as distinguished from an acting actor, seems to be a very appropriate term.

However – and only now would the point be reached where it makes sense to speak of “psychic systems” – an observer that manages to evolve all the complex preconditions that are usually associated with psychic systems might eventually be seen as capable of self-observation. This observer then would be able to observe her own actions as interactions. This observer would consider her interactions as concerted of course, and her communications as willfully intended. And she would have expectations of how other psychic systems interact and how these interactions should be conceived analytically. She would have a firmly established opinion of how such interactions should be simulated if a true representation of the Luhmannian conception of communication were at stake – just as Kron & Berger have it.

Combined references

Constructivist Criteria for Organising and Designing Educational Research

How Might an Educational Research Inquiry Be Judged from a Constructivist Perspective?

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> Context • Ernst von Glasersfeld's radical constructivism has been very influential in education, particularly in mathematics and science education. > Problem • There is limited guidance available for educational researchers who wish to design research that is consistent with constructivist thinking. Von Glasersfeld's radical constructivism, together with the theoretical perspectives outlined by constructivist educational researchers such as Guba and Lincoln, can be considered as a source of guidance. > Method • The paper outlines a constructivist knowledge framework that could be adopted for educational research. The discussion considers how judgement of what counts as knowledge could be made, and how the set of procedures chosen could enable the researcher to represent the findings of the inquiry as knowledge. > Results • An argument is made for researchers to explicate the criteria for judging an inquiry. Each criterion can then be linked to the standards to be reached and the techniques for generating data. The joint satisfaction of criteria and techniques for a constructivist inquiry creates conditions that indicate the "trustworthiness" or "authenticity" of an educational research study. > Implications • The illustration of how a constructivist inquiry could be judged recognises how the contribution of von Glasersfeld's radical constructivism can be used to inform the practice of educational research. > Constructivist content • The argument presented in the paper links to radical constructivism and suggests ways in which it can be applied in the context of educational research. > Key words • Knowledge framework, methodological criteria, trustworthiness, authenticity.

Introduction

In a discussion in this journal on the future of radical constructivism (RC), Siegfried J. Schmidt called upon scholars to improve RC’s acceptance. One suggestion he made was that work should be done to “prove its practical usefulness in solving clear cut problems in various disciplines” (Schmidt 2010: 10). Empirical studies such as those by Dewey Dykstra Jr. (2005) have contributed to an understanding of RC’s practical usefulness in the field of education and this paper seeks to address Schmidt’s suggestion in the context of educational research. The problem is that researchers who wish to adopt a coherent constructivist knowledge framework1 for an educational research inquiry face a considerable challenge in ensuring that all aspects of the research project are consistent with constructivist thought. In addition to questions of ontology, epistemology, and methodology, which need to be addressed, a constructivist educational researcher also needs to consider how data should be analysed and interpreted in a manner consonant with constructivist thinking.

This paper presents an argument for how a constructivist educational research inquiry could be judged. It suggests criteria and standards against which a constructivist research inquiry could be evaluated and possible techniques a researcher could adopt. Implications for what counts as knowledge, and how research can be designed and conducted, together with considerations for empirical data analysis, interpretation, and reporting will be discussed.

1 | The term “knowledge framework” refers to an explanation of what counts as knowledge and how the set of procedures chosen enables the researcher to represent the findings of an inquiry as knowledge.
As Gabriele Lakomski expresses it: what counts as knowledge in that inquiry. One of the fundamental considerations of (Guba & Lincoln 1989). Epistemological phenomena, such as those central to educational investigation and research into social processes (Cobb 1994). The theoretical perspectives of constructivist educational researchers such as Yvonna Lincoln and Egon Guba (2000) will also be considered. As a consequence of this, the term “constructivism” is used for work that draws from the latter perspective so that it can be distinguished from RC.

This paper could be used as a stimulus for discussion in the RC community about how to develop a radical constructivist knowledge framework, and others might wish to consider addressing the same topic as this paper from a radical constructivist perspective. This paper is not intended to provide a prescription of how educational research should be organised and designed. Rather, the intention is to suggest a useful and practicable process for educational researchers that is consonant with constructivist thought.

A constructivist knowledge framework

Different views about the nature of investigation and research into social phenomena, such as those central to educational research, arise out of the assumptions made about, and philosophical stances taken on, issues of ontology and epistemology (Guba & Lincoln 1989). Epistemological assumptions guide the researcher’s judgement of the appropriateness of different methodological choices in an inquiry. Thus one of the fundamental considerations of any research inquiry is an understanding of what counts as knowledge in that inquiry. As Gabriele Lakomski expresses it:

**the application of any type of research method and the defense of the results of inquiry thus obtained implies a view, or views, of what is to count as knowledge. The point of preferring one set of methods over another is to believe that the chosen set will lead to knowledge rather than mere belief, opinion, or personal preference.**

(Lakomski 1992: 193)

It is this act of judgement – a judgement of what counts as knowledge, and how the set of procedures chosen will enable the constructivist researcher to represent the findings of the inquiry as knowledge – that forms the substance of the following discussion.

RC “starts from the assumption that knowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience” (Glaserfeld 1995: 1). It supports the idea “that the conceptual constructs we call knowledge be visible in the experiential world of the knowing subject” (Glaserfeld 1989: 122, my italics). Therefore, RC is not concerned with knowledge matching what is sometimes termed an “objective reality” but focuses on fit, where “knowledge can now be seen as fitting the constraints within which the organism’s [individual’s] living, operating, and thinking takes place” (Glaserfeld 1986: 108, original emphasis). Thus the judgement of knowledge is made through the specific framework from within which an individual operates, and knowledge is judged for its capacity to fit within the individual’s experiential world.

Constructivism as a methodology

Any educational research inquiry should seek an emphasis on strategies and procedures that fit the constraints of the research, including the framework within which the researcher operates. But decisions about the fitness of particular procedures affect not only the viability of the study but also its quality. These decisions can only be made against a background of what the researcher is endeavouring to represent as knowledge, what constitutes legitimate knowledge, and the possible effects of the research.

In the field of education, Norman Denzin and Yvonna Lincoln have termed this the “triple crisis of representation, legitimation, and praxis” (Denzin & Lincoln 2000: 17) and these three terms provide a useful heuristic for examining the way in which educational research can be conducted. Although the second term, “legitimation,” is the concept that links most directly with constructivist work, the other two terms “representation” and “praxis” have arisen in response to postmodern and poststructuralist arguments that are now deeply embedded in approaches to educational research. These two concepts are concerned with reporting research and the effects of research, issues that may not necessarily be foregrounded in a theory of knowing and learning such as RC. However, the ideas associated with “representation” and “praxis” will be discussed in terms of how these could be consonant with constructivist thought and incorporated in a constructivist knowledge framework.

“Representation” is concerned with how the experience of research participants is represented in the text reporting the study. This arises from poststructuralist and postmodernist work in different disciplines, including education, that highlights that any written text that purports to capture the direct experience of the research participants is limited in its capacity to do so. This has implications for educational research because postmodernism sees knowledge as dependent on “socio-cultural practices and contexts, unacknowledged values, tacit discourses and interpretive traditions” (Usher, Bryant & Johnston 1997: 207), regardless of the procedure used. The postmodernist rejection of grand narratives undermines the importance of the plurality of possible perspectives from different groups of people in connection with class, ethnicity, and gender (Ager 1991). For the researcher, this means that all texts “are always partial and incomplete; socially, culturally, historically, racially, and sexually located” (Lincoln 1995: 280). Poststructuralist positions that are embedded in educational discourse and thinking reinforce this and present challenges to the traditional assumptions about the ways in which texts are written and how they are interpreted by the reader.

The impact of language, discourse, and power on any knowledge claim raises doubts about authoritative knowledge in a social world. As an educational researcher, the question hitherto key assumptions of educational research.
it is necessary to heed the words of Thomas Schwandt, who believes:

“...we must learn to live with uncertainty, with the absence of final vindications, without the hope of solutions in the form of epistemological guarantees. Contingency, fallibilism, dialogue, and deliberation mark our way of being in the world. But these ontological conditions are not equivalent to eternal ambiguity, the lack of commitment, the inability to act in the face of uncertainty.” (Schwandt 1996: 59)

As part of demonstrating an understanding of the uncertainty and mutability of knowledge, the two terms “reflexivity” and “positionality” are often used by educational researchers. “Reflexivity” refers to the questioning a researcher engages in regarding representations of the self and others, and the implications of one’s own practice of research, in the research process. It concerns ways in which the process and the products of research are affected by how the research is conducted and the individuals involved in the research (see Pillow 2003 for further discussion). “Positionality” refers to a researcher’s elucidation in the research text of her/his own background experiences and standpoint in social, cultural, political, and other relevant terms, and how the text is necessarily situated within that standpoint. Reflexivity about the values, assumptions, and methodological choices will not ensure that embedded subtexts related to aspects of positionality are transparent, but it helps to reveal the researcher’s perspective and interests (see Lincoln 1995 for further discussion). The location of any educational research text in social, cultural, historical, ethnic, and gendered terms is incontrovertible and different readers will interpret any text differently.

“Legitimation” refers to verification issues associated with the inquiry. Some educational researchers have argued that canonical criteria such as external validity, internal validity, reliability, and objectivity, are underpinned by a positivist ontology and epistemology, and are inappropriate, particularly in interpretivist inquiry. In response to this, Guba and Lincoln (1989: 233) developed criteria for “verification” that they posit are more appropriate for constructivist inquiries. These criteria are suggested as replacements for, and are in parallel to, the traditional criteria. The implication of correspondence with positivist criteria, at least in terms of axioms, is a limitation acknowledged by Guba and Lincoln (1989: 245). However, their criteria of transferability, dependability, confirmability, and credibility represent a useful starting point for the consideration of criteria within a constructivist methodology and will be discussed in further detail in the next section.

The third term highlighted by Denzin and Lincoln (2000), “praxis,” is shaped by legitimation and representation, and relates to whether or not it is possible to effect social change. An assumption that conducting a research study will always effect change, or that it is desirable to effect change, ignores the complex web of political and pragmatic considerations. Further, it may represent a value-laden position that assumes that Western notions of emancipation and empowerment are appropriate and desirable in all contexts, including non-Western ones. As Clive Seale (1999: 10) argues, “societies which value conformity, based on an uncritical trust in authority and tradition, are routinely stigmatised in such a view,” and any privileging of Western ideals of praxis could be inappropriate in educational research studies conducted in different societies. Moreover, political sensitivity is an integral part of methodological awareness. The ethical responsibility qua researcher to consider potential ill-effects on participants as a result of a study could override emancipatory ideals in research contexts where political conditions warrant caution. Where there is a risk of harm to participants, researchers would need to take into account any risks associated with pursuing aims of social change.4

Criteria for judging an inquiry with a constructivist knowledge framework

Criteria that are used for the assessment of the validity, or “trustworthiness” (Guba & Lincoln 1989: 233), of an educational research inquiry signify characteristics or qualities that relate to how the research will be considered legitimate. Criteria are not absolute, and methodological criteria can be expected to be context-dependent, given that methodological decisions are contextualised within any research study. A researcher could be expected to explicate the standards expected for each criterion rather than rely on implicit assumptions. As these criteria may be used in any evaluation of the research study, it is also necessary to provide an explanation of possible techniques that can be used to realise the expected standard.

In the following section, methodological criteria based on Guba and Lincoln’s (1989) trustworthiness and authenticity criteria that can be used to conduct a study will be addressed. An appropriate standard for each will be outlined, as well as the techniques through which the standard could be realised during the research process. These are summarised in Table 1 and Table 2. Each of these elements contributes to a network; and it is the holistic strength of the network that counts in the research, not any one isolated aspect. In a qualitative judgement about a research inquiry, the overall configuration is what matters, and it is on this basis that a constructivist research inquiry should be able to withstand scrutiny.

The criterion of transferability relates to the traditional concept of external validity and is concerned with the applicability of the data and findings to different settings. As discussed earlier, the corollary of the influence of postmodern and poststructuralist arguments in education is that decisions about the extent to which the findings are transferable to other contexts may be more easily made by the reader of the research text. Although the onus is placed on the researcher to inform the reader adequately through “thick description” (Geertz 1993: 3), the reader could be placed in a more privileged position than the researcher to decide upon the extent of transferability to other contexts. As Lincoln and Guba suggest:

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4 This argument relates to research that involves human participants and would not necessarily be applicable in cases that do not involve human research participants. The researcher would need to consider the risks to her or himself qua researcher if there are no human research participants. If there are human research participants, then “an ethic of respects for any persons involved in the research they are undertaking” (British Educational Research Association 2011: 5) implies research that does not result in harm to a research participant.
Constructivist Criteria for Organising and Designing Educational Research

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<tr>
<th>Criteria</th>
<th>Standards</th>
<th>Techniques</th>
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<td>Transferability</td>
<td>Reader is adequately informed, through explication of procedures and the context, to be able to accept or reject the applicability to other contexts.</td>
<td>portrayal using “thick description” (Geertz 1993)</td>
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<td>statistical generalisation from sample to population</td>
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<td>“fuzzy generalisation” about the case (Bassey 1999: 72)</td>
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<td>Dependability</td>
<td>Researcher demonstrates reflexivity and presents logic for decisions related to research procedures. Researcher provides adequate explication and justification for those decisions.</td>
<td>“dependability audit” (Guba and Lincoln 1989)</td>
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<td>explanation of context within which procedures used for statistical generalisations are conducted</td>
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<td>Confirmability</td>
<td>Data, and interpretations from the data, are documented and supported.</td>
<td>explication of context (with “positionality” as a subset)</td>
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<td>clear and unambiguous coding schemes of qualitative data</td>
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<td>adequate “knowledge management” of data</td>
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<td>adherence to conventions for statistical methods</td>
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<td>Credibility</td>
<td>Work has representation of each research participant’s constructions distinguished from researcher’s own constructions and representations.</td>
<td>demarcation between raw data and interpretation of data, and maintaining representation of voices of participants</td>
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<td>explication of different frames of reference held by participants and researcher</td>
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<td>internal validity of statistical instruments</td>
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<td>Fairness</td>
<td>Researcher justifies ethical decisions underpinned by a maintenance of trust between the researcher and participants.</td>
<td>informed consent, avoiding coercion, providing relevant information, respect for privacy and time, not withholding benefits, respect and honesty, maintaining confidentiality and anonymity (Wellington 2000)</td>
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<td>(the ability to construct a study grounded in ethical principles)</td>
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Table 1: Explication of methodological criteria (trustworthiness), standards, and techniques (terminology for criteria adapted from Guba & Lincoln 1989). Note: The notion of “informed consent” in educational research is drawn from guidelines for educational researchers provided by, for example, the British Educational Research Association.

**Whether [working hypotheses] hold in some other context, or even in the same context at some other time, is an empirical issue, the resolution of which depends upon the degree of similarity between sending and receiving (or earlier and later) contexts. Thus the naturalist cannot specify the external validity of an inquiry; he or she can provide only the thick description necessary to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility.** (Lincoln & Guba 1985: 316)

Regardless of whether qualitative or quantitative procedures are used, the principle behind transferability remains the same: judgements about similarity between the receiving context (or the population) and the sending context (or the sample) could be made more readily by the reader in instances where the reader has greater familiarity with the receiving context.

The criterion of “dependability” draws from the traditional notion of reliability, or the consistency of the study. “Reliability” refers to the idea that if the study were replicated under the same conditions the results would be the same. This meaning of reliability is more problematic in studies that are socially, culturally, and historically situated. “Dependability” relies on an adaptation of the notion of reliability and refers to the potential replicable nature of the study. In other words,

**given the theoretical perspective of the original researcher and following the same general rules for data collection and analysis, plus similar conditions, another investigator should be able to arrive at the same general scheme.** (Corbin & Strauss 1990: 15)

Thus, “dependability” in this study refers to adequate explication of the context and decisions about procedures, data generation, and data analysis, including justification for any changes in qualitative procedures as the research matures. Guba and Lincoln (1989: 242) refer to this as a “dependability audit.”

The criterion of “confirmability” is a replacement for the traditionally “neutral,” or “objective,” stance expected by researchers, in keeping with a realist philosophy where a researcher aims to understand a “real world” separate from the values and biases of the researcher. For an educational researcher, a transparent explication of the contextual features of the research and the “positionality” of the researcher is preferred as an alternative approach and is compatible with the RC position that “does not say there is no world and no other people, it merely holds that insofar as we know them, both the world and the others are models that we ourselves construct” (Glaserfeld 1995: 137).

The criterion of “credibility” is derived from internal validity, the latter premised on a “correspondence” theory of truth and the ability of the data to match an external reality. “Member checks,” which refers to “the process of testing hypotheses, data, preliminary
categories, and interpretations with members of the stakeholding groups from whom the original constructions were collected (Guba & Lincoln 1989: 238f), are often considered essential for establishing credibility. However, this assumes that research participants view the process through the same frame of reference as the researcher, and that “taken-as-shared consensual meanings” (Cobb & Yackel 1996: 185) and understanding of the interpretations can be developed. Assertions that research should “open each [of the concerned parties] to critique in the terms of other constructions, and provide the opportunity for revised or entirely new constructions to emerge” (Guba & Lincoln 1989: 89) necessitate a conducive political climate. While this position is reasonable to adopt by the researcher and interested readers (as concerned parties), beyond this it represents an ideal.

Abstaining from the use of member checks then involves alternative measures. One mechanism is that credibility could be contingent on ensuring that the researcher’s own expressions of understandings and meanings are clearly distinguished from the expressions of the participants in the study, an essential part of the quest to construct a coherent account of the research.

For educational research that is conducted within teaching communities, there are expectations about the roles and responsibilities of different participants such as teachers, students, and researchers. Teacher-researchers conducting research in the institution in which they work find it necessary to balance the dual roles of educational researcher and institutional “insider,” as well as appreciate the expectations of teacher-colleagues and students who are participants. Thus, engaging in these types of studies involves making practical choices in relation to these factors that chart the course of the research. This is because principles to guide the researcher often exist in tension with the assumptions, values, and behavioural norms of the research context. Further, throughout the research process, researchers need to be cognisant of the prevailing norms of the institution.

Richard Pring suggests some general rules for conducting educational research. Amongst others, one relates to the “right of reply from those who have participated in the research but who may believe that alternative conclusions could be supported by the data” (Pring 2003: 63). This can be linked to the Duhem-Quine thesis that observations are always to some extent “theory-laden” and that theories are always “underdetermined” by the empirical evidence (Quine 1980: 41f). This idea has an impact on the extent to which participants are involved in the creation of the research text and the interpretation of the data.

The extent to which participants have input into the final research text can vary. One option would be to create jointly the research text where participants and researcher are intimately involved in the interpretation of the data. However, this would ignore “the recognition of the possibility that it may be neither feasible nor possible to harmonize observer and ‘insider’ perspectives so as to achieve a consensus about ‘ethnographic truth’” (Angrosino & Mays de Perez 2000: 678).

This approach also fails to consider that in order to “co-create” the research text, participants are required to consent to higher levels of participation in the research process. A shift towards “reciprocity” in the research relationship (Lincoln & Guba 2000: 182) requires the willingness of participants to assume a greater role in the research process than is required in research where the researcher is predominantly responsible for most research decisions.

**Ethical considerations**

The criterion of “fairness” relates to the “ascertaining and presentation of different value and belief systems represented by conflict over issues” (Lincoln & Guba 1986: 79) that inevitably emerges in the research process. Inherent in this conflict is the differential power relationship between the researcher and the participants. Thus ethical issues are an important aspect of fairness.

RC may “imply a starting-point for the development of an ethical system, not the system itself” (Glaserfeld 2009: 119). Other constructivist work that provides direction includes that of Heinz Von Foerster (1995: 7), who, in a discussion on ethics, stated that “only those questions that are in principle undecidable, we can decide.” Thinking related to the “biology of love” (Maturana & Verden-Zöller 2008: 81), which illuminates the importance of accepting the legitimacy of others, is also useful. However, this work would need to be interpreted within ethical guidelines for educational research provided by, for example, the British Educational Research Association (2011).

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5 | I am grateful to an anonymous reviewer for drawing my attention to these points.
These frame a number of different responsibilities for the educational researcher to ensure that they “operate within an ethic of respect for any persons involved in the research they are undertaking” (British Educational Research Association 2011: 5). From these, educational researchers need to “construct a set of rational principles appropriate to their own circumstances and based on personal, professional, and societal values” (Cohen, Manion & Morrison 2000: 71). Jerry Wellington (2000: 57) outlines eight guidelines that provide a useful heuristic for the researcher. The guidelines can be classified as follows: seeking informed consent from research participants, avoiding coercion of individuals to participate in the research, providing relevant information regarding the study, avoiding deception about aspects of the research, respecting participants’ privacy and time, fairness — not withholding benefits from participants, fairness — respect and honesty for participants, and maintaining confidentiality of data and anonymity of participants’ identity. These guidelines can be considered and interpreted in turn in order to make contextually-sensitive judgements related to the design, conduct of the research, and how it will be made public.

Lincoln and Guba (1986) also refer to four other “authenticity” criteria. They use the following terms: “ontological” — the extent to which the study aids individual understandings to become more informed; “educative” — the study’s contribution to how individuals appreciate the understandings of others; “catalytic” — how practical action is stimulated in response to the inquiry; and “tactical” — whether the inquiry is “empowering or impoverishing, and to whom” (Lincoln & Guba 1986: 82). The first two criteria can be collapsed to form one criterion under the label of “originality authenticity.” This label avoids confusion arising from Lincoln and Guba’s (1986) particular use of the word ontological. The new label reflects the meaning of the criterion more appropriately. If the study offers new perspectives on familiar territory, or offers perspectives on new territory, then it is able to contribute to making the researcher or the reader more informed about her/his own understandings, and with a greater appreciation of the understandings of others.

### Research questions

Contributions from the RC community that could inform educational researchers wishing to conduct research using a radical constructivist knowledge framework that is practicable would be useful. Future work of benefit to educational researchers would include studies that explore various ways in which the criteria explicated in this paper could be adapted to reflect an RC perspective. Such studies would help to provide insight into how educational researchers who wish to adopt an RC knowledge framework can select appropriate sets of criteria and techniques when designing research. Following this, educational researchers could begin to explore such questions as: Are there additional criteria applicable in particular strands of educational research? Are there other techniques that researchers that have used successfully and how do these connect to particular criteria? Further, studies that not only adopt a radical constructivist knowledge framework but also investigate aspects of RC with implications for educational practice would be of particular interest. These will inform educational researchers wishing to create knowledge in order to further educators’ understanding of teaching and learning.

The catalytic and tactical authenticity criteria are relevant only in contexts where the goals of the study directly include ones of social change, or emancipatory action. To reflect this interpretation, the label of “emancipatory authenticity” is used to denote the criterion. As noted earlier, political, pragmatic, and ethical considerations should be taken into account.

The criteria and techniques mentioned above are not necessary, in a logical sense, but it can be taken that they would be sufficient to judge the quality of a study. In a particular educational research study, any of these criteria may be satisfied to a greater or lesser degree but their joint satisfaction to a high degree creates conditions that indicate the trustworthiness and/or authenticity of the study.

This joint satisfaction to a high degree creates conditions for knowledge from an educational research study that can be judged for its capacity to “fit” within the experiential world of the educator. From the perspective of RC, an important question is: Does this knowledge from the study fit the constraints within which the educator’s “living, thinking and operating takes place”? (Glasersfeld 1986: 108). Thus, within a constructivist knowledge framework, criteria such as those outlined in Tables 1 and 2 are recommended as a source of guidance for educational researchers.

Although the preceding discussion regarding methodological criteria, standards, and techniques is in the context of educational research, it is likely to have wider applicability to other forms of social science research inquiries. In one respect, however, educational research is distinctive.

One of the aims of educational research, as a field of inquiry, is to advance knowledge of learning processes. A constructivist inquiry in education is therefore concerned with constructivism not only as a knowledge framework but also, in certain cases, with constructivist-related areas as the focus of the inquiry itself. An example of this would be a study that investigates classroom pedagogy informed by constructivist thinking. This type of study implies certain responsibilities for the researcher in respect of credibility. That is, where the focus of the research is on constructivist-related pedagogical issues, the expectation that the researcher will adopt and explicate a constructivist knowledge framework would be stronger. This connects with the “credibility” criterion in Table 1.

From the perspective of realism, the claims a researcher makes from the research study aim to reflect or depict an independent, knowable “real world.” In Humberto Maturana’s (1988: 41) words, “the quest for a compelling argument” may mean researchers take actions to impose “views on the other without reflection, de facto negating him or her.” In contrast, from a construc-

http://www.univie.ac.at/constructivism/journal/8/1/hr8_kemp
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The Game of Fictional Mathematics

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> Upshot • Leng attacks the indispensability argument for the existence of mathematical objects. She offers an account that treats the role of mathematics in science as an indispensable and useful part of theories, but retains nonetheless a fictionalist position towards mathematics. The result is an account of mathematics that is interesting for constructivists. Her view towards the nominalistic part of science is, however, more in conflict with radical constructivism.

Mathematical realism is the account of mathematics that sees mathematical entities as existing as abstract entities, independent of our rational activities. Among the most important arguments in favor of mathematical realism are the indispensability arguments, which are generally traced back to W. V. Quine. A possible nominalist answer to realism is the fictionalist position. A fictionalist considers mathematical statements, such as “2 + 2 = 4,” as false since they do not refer to anything. Nevertheless, it is possible to imagine the truth of this statement, namely within the story of mathematics. Mary Leng’s book is a defense of such a fictionalist position. In order to claim that such a position is tenable, Leng aims at rejecting the indispensability argument. Although the first chapters of this book give a sufficient theoretical background of the debate on this argument, readers interested in a thorough overview of this argument can benefit from Mark Colyvan’s book The Indispensability of Mathematics (2003).

The book starts with the presentation of the indispensability argument (Chapter 1). Leng gives the following premises of the Quinean argument (7):

- Naturalism: We should look to science, and in particular to the statements that are considered best confirmed by our ordinary scientific standards, to discover what we ought to believe.
- Indispensability: Statements whose truth would require the existence of mathematical objects are indispensable in formulating scientific theories that are considered best confirmed by our ordinary scientific standards.

- Confirmational holism: The confirmation our theories receive extends to all their statements equally.

The acceptance of these three premises leads to the conclusion that we ought to believe that mathematical objects exist. The strategy to undermine the indispensability argument will be to reject confirmational holism.

Leng starts her proposal with a naturalistic approach to ontology. In Chapter 2, Leng defends the first premise of the indispensability argument, which is Quinean naturalism. Quine presents naturalism as the denial of a first philosophy, meaning that philosophers should acknowledge that philosophy of science does not occupy a privileged position in facing scientific practice. Rather, philosophers should start from within scientific practice itself. When faced with the question of ontology, naturalism obliges us to look to natural science for answers. The justification of the existence of any object can only be given on scientific grounds. In the rest of the book, Leng argues that adopting this naturalistic approach provides no reason to believe that mathematical objects do exist.

One of the criticisms of the naturalist premise in the indispensability argument is formulated by Penelope Maddy (1992). Her complaint is that in the practice of pure mathematics, natural science has no authority. Mathematicians do not look at natural science in order to test their mathematical theorems. In the case of a conflict between mathematical and scientifically justificatory principles, why should the latter be superior? In Chapter 4, Leng argues that pure mathematics, again following Quinean terminology, is mathematical recreation. The practice of pure mathematics involves:

**(a) formulating mathematical concepts and (b) enquiring into the consequences of the assumption that those mathematical concepts are instantiated.** (83)

According to Leng, there are no ontological reasons that justify a collection of axioms in mathematics. Reasons offered for adopting these axioms can rather be viewed as a justification of their capability to characterize interesting mathematical concepts.

Next to her adoption of a naturalistic point of view, Leng accepts the indispensability premise (Chapter 3). This is an interesting move, since Leng departs here from other fictionalist strategies of rejecting the indispensability argument. Most notably, Hartry Field (1980), who arguably provided the most influential fictionalist treatment of...
the indispensability argument, attacked the indispensability premise. Field sees mathematical theories as valuable and useful fictions, but argues that mathematics is nonetheless about nothing at all. The strategy to account for their place in scientific theories is to explain the success of mathematical applications in terms of conservatism. A theory including mathematics is conservative over the nominalistic counterpart of this theory, when the former does not lead to any nominalistic consequences that would have not been derivable from the nominalistic theory alone. A theory could be reformulated without any reference to mathematics and without loss of derivable nominalistic content. Field presented such a nominalization of the Newtonian Gravitation Theory. Leng discusses several criticisms of Field’s project, but she does not give a conclusive rejection of his approach to fictionalism. Rather, she will

“reserve judgment on whether Field’s program can in fact be completed: the central claim of this book is that the indispensability argument can be shown to fail even if mathematics is indispensable in formulating our scientific theories.” (70)

By accepting two of the three premises of the indispensability argument, all is yet to play for. In the following Chapters 5 and 6, Leng attacks confirmational holism. The strategy is to indicate that within scientific practice itself, the confirmation of a theory does not imply the recognition that the overall theory is true. This is typically the case when these theories involve idealizations. In certain cases, these idealizations can be replaced by descriptions of concrete physical systems, but often these idealizations are forced upon scientists due to the constraints of theorizing. Complete descriptions of the physical system are often not available, and even if they are available, scientists would not be able to deal with these descriptions on a theoretical level. Leng refers, in accordance with criticisms of holism formulated by Maddy (1992), to fluid mechanics. Scientists use the idealized description of fluids as homogenous continua. Such idealizations show that scientists do use, indispensably, theoretical assumptions that are known to be false. This allows Leng to sever the link between the theoretical role of an entity and the ontological commitment to this entity. The next step is to argue that it is possible to regard the role of mathematical entities without ontological commitment.

The fictional view of mathematics Leng proposes is based on the work of Kendall Walton (1990), who is a popular inspiration for mathematical fictionalists. In Chapter 7, Leng argues that mathematics, in the terminology of Walton, is a prop-oriented game of make-believe. One of Walton’s prime examples used to clarify this practice is to imagine Italy as a boot, allowing us to locate Crotone “in the arch of the boot.” This suggests a game in which Italy is metaphorically described using a boot-prop. A similar example is of playing with a doll, when one pretends the doll is a real person. The doll is here a prop in a game of make-believe. This notion of props gives Leng the opportunity to connect the fictional mathematics in theories with the real things these theories describe. The strategy is to adopt non-mathematical objects as the prop of a game of make-believe by identifying them as urelements in a suitable version of set-theory. The idea is to take

“some axiomatic presentation of set theory with urelements, together with the assumption that the urelements are just whatever non-mathematical objects there are, as the principles of generation of make-believe. Then how things are with the non-mathematical props will make fictional some utterances in the context of this make-believe.” (177)

Hypotheses about urelements, the objects that we ontologically accept, generate fictional imaginings in mathematical theory that express physical content.

In the final chapters 8 and 9 and the conclusion (Chapter 10), Leng stresses dissimilarities between her fictionalist position and Bas Van Fraassen’s constructive empiricism. At first sight, there is a resemblance between these two positions, but Leng’s fictionalism makes a crucial distinction between mathematical and unobservable non-mathematical objects. Constructive empiricism remains agnostic on the ontological status of unobservable entities such as electrons. Mathematical fictionalism is, however, also able to hold such entities as existing. According to Leng, this makes her position less problematic, since it can better account for the success of science. While constructive empiricists can only point out the empirical adequacy of a theory in order to explain the success of science, mathematical fictionalists can also refer to the positing of unobservable entities as causes of observable phenomena. Furthermore, we do not have to commit ourselves to a realist position in order to explain the successful role of mathematical objects in scientific theories.

Mathematics and reality is an intriguing piece of work. The main contribution, in my view, is that readers sympathetic to the fictionalist stance no longer have to feel obliged to see mathematics as a dispensable part of science. Certainly, some aspects require further elaboration. The main focus of the book is the Quinean indispensability argument. In recent literature, an enhanced indispensability argument (Baker 2005) has been proposed, claiming that mathematical objects exist when they are indispensable as explanation. Leng mentions the role of mathematics in explanation, but within the scope of this book this does not receive much attention. In the context of recent attention, a closer examination of this role and the fictionalist interpretation would be illuminating.

It is clear that, turning to the relevance for constructivist approaches, mathematical constructivists have much to gain from countering the indispensability argument and its realist conclusion. At first, this book can be seen as providing a strategy to refute the indispensability argument. On the other hand, Leng aims at presenting a coherent form of mathematical fictionalism. She is, however, well aware of the fact that she does not give an argument for fictionalism being the position that one ought to adopt:

“But what I have not, so far, argued is that our reflective understanding on the role of mathematical hypotheses in our theories rules out a realist attitude to those hypotheses […] it seems that the most that we can conclude is that adopting a broadly naturalist approach to ontology requires us to be agnostic about the question of whether there are mathematical objects.” (259)

Leng justifies the move beyond agnosticism and the choice for fictionalism by referring to Ockham’s razor.
Once the indispensability argument is refuted, one is free to explore anti-realistic positions such as constructivism. Leng does not explicitly address constructivism, but one can see that the fictionalist position does have constructivist elements. Quinean realists defend a distinction between pure mathematics, as mathematical recreation without ontological grounds, and applied mathematics that we include in our ontology. Leng states that all mathematics is recreation without ontological grounds. In a recent article in this journal, Quale discusses a radical constructivist approach to mathematics: “any mathematical knowledge – whether pure or applied – (is and must be) constructed in the mind of the knower to model (i.e., describe and explore) some part of her experiential world. Thus there is no such thing as the “right mathematics,” lying out there waiting to be discovered” (Quale 2012: 110). Quale describes this as the “game of mathematics.” The resemblance with the notion of recreational mathematics is clear, although Leng takes a firmer anti-realistic position than the agnostic radical constructivists.

This is a crucial point of dissimilarity between Leng’s mathematical fictionalism and the radical constructivist position. Radical constructivists are ontologically neutral, rendering ontology to an irrelevant non-issue. While the outcome of Leng’s view on mathematics is also attractive for radical constructivists, her overall approach to science is in conflict with this ontological neutrality. Following the indispensability argument, we ought to have ontological commitment to all and only those entities that are indispensable to our best scientific theories. By refuting conformational holism, Leng counters the idea that all indispensable entities exist. But following naturalism, she still believes that we have to look to science in order to find out what exists in the world. Instead of believing in the existence of all indispensable entities, Leng’s fictionalist only believes in the nominalistic content of scientific theories. Radical constructivists would presumably disapprove of such a naturalistic approach to ontology. Consequently, radical constructivists who reject the naturalistic premise, do not have to worry about the indispensability argument at all. Considering the ontological acceptance of the nominalistic content of scientific theories, the fictionalist position of Leng is probably unappealing to the radical constructivist. Nevertheless, the book remains an interesting rejection of the idea that we need to be mathematical realists when considering the role of mathematics in science.

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Me, Music, and I: Embodied and Enactive Cognition meets Music

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> Upshot • The fact that both “consciousness” and “music” are quite elusive terms makes the attempt to explain the nature (or even the existence of) “musical consciousness” a compelling quest. The papers in this book tackle these problems in an engaging way, ranging from sociology of music to drug altered music cognition. Some also apply enactive and ecological approaches to music cognition, which makes the book an interesting read for constructivists.

David & Eric Clarke’s Music and Consciousness: Philosophical, Psychological, and Cultural Perspectives is a broad publication addressing scholars interested in each of the research fields mentioned in the book’s title. Consisting of twenty well-crafted chapters, the book draws heavily on the embodied approaches to consciousness, including a chapter on enactivism.

What are the possible relationships between music and consciousness? In the preface chapter of the book, its editors point out just a few: the mere similarity based on the observation that both of music and consciousness combine social, conceptual, technical, emotional, perceptual, and motor attributes (xix); and, more importantly, the fact that as music has the capacity to both reflect human subjectivity and be the powerful element responsible for constituting this subjectivity, it thus can offer us important insights into consciousness (xx). The opening chapter of the book, “Music, Phenomenology, and Time Consciousness” by David Clarke offers the reader insight into the importance of Edmund Husserl in his studies on both music (further developed, as the author reminds us, by scholars such as Jason Brown and commented on by Jacques Derrida) and time consciousness. Interestingly enough, Husserl (and his ideas) returns in almost half of the papers included in the book. David Clarke’s chapter is followed by Eugene Montague’s paper, which aims to compare the famous “hard problem” of consciousness (as argued by philosophers such as David Chalmers) with a similar issue in musical research, namely “the incorporation of subjective experience within an objective explanatory framework” (29). Furthermore, and perhaps interestingly for constructivists, Montague argues that:

“...musicology would do well to revisit theoretical perspectives that reject a fundamental opposition between objective and subjective, such as the (European) Continental tradition of phenomenology, since such perspectives have proved useful in meeting challenges posed in the study of consciousness.” (29)

Montague returns to Husserl’s analysis of time consciousness, aiming to use it to understand the objectivity of a musical piece through the subjective experience of the body, while acknowledging the important insights of Antonio Damasio in this research area (for accounts of embodied music cognition see, for instance, Leman 2008).

In the subsequent chapter, Michael Gallope offers a Derrida-inspired deconstructivist approach to the phenomenology of consciousness, leading him to skepticism about musical experience and the very existence of musical objects as such. In a similar fashion, while referring to French philosopher Jacques Lacan’s thought and that of other philosophers interested in psychoanalysis, Ian Biddle explores the topic (and models) of musical listening in everyday lives.

The fifth chapter of the book – Bennett Hogg’s “Enactive consciousness, intertextuality, and musical free improvisation: deconstructing mythologies and finding connections” may be of direct interest to the constructivist community. This is because Hogg draws on the classical work by Francisco Varela, Evan Thompson, and Eleanor Rosch, The Embodied Mind, especially the connection between

“...the idea of consciousness understood as enactive cognition and the perceptions within philosophy that knowledge depends on being in a world that is inseparable from our bodies, our language, and our social history – in short, from our embodiment.” (Varela, Thompson & Rosch, 1993: 149)

Hogg discusses the connection between such an understanding of consciousness and a speculative and specifically musical/sonic
interpretation of the idea of intertextuality. He then inspiringly turns to an analysis of Jerzy Grotowski’s pioneering works in experimental theatre and its leading idea of “think[ing] with the whole body” while improvising. Importantly, Hogg uses Varela, Thompson, and Rosch’s idea to tackle and criticize what he calls “nature–culture binarism,” while introducing the readers to the principles of their version of enactivism. In the following, sixth, chapter of the collection, Ansuam Biswas discusses the issues of mind, meditation, and music as movement. Importantly, in this chapter Biswas gives an account of theories of the biological value of music along with the importance of music for meditation and the relations between music and movement (including the relations between “motion” and “emotion”). Bethany Lowe (in the chapter entitled “In the head, only the heard…: music, consciousness, and Buddhism”) reflects on meditation and its relation to music, often reminding readers of the works of Varela & Shear (1999) on the first-person methodologies and approaches to consciousness. In a similarly Eastern fashion, the eighth chapter of the book covers the issues of North Indian (Hindustani) classical music and consciousness. David Clarke and Tara Kini’s contention is that Indian music both “emanates and is able to instill deep states of consciousness” (138). Interestingly, the authors of this paper are themselves practitioners in this field.

The following chapter, on the other hand, shifts away from Eastern meditation music to the issues of William James’s influence on music, computing, and consciousness. Its author, Meurig Beynon, aims to show how James’s thinking, especially that connected with his views on computing, can do justice to the varieties of musical experiences without compromising the integrity of the first. Drawing on the parallels between composing and playing music and computer science (with empirical modeling as a tool), he provides a very interesting contribution to this book. Next the renowned cognitive musicologist Laurence M. Zbikowski explores the differences between the different kinds of consciousness (present when listening to music) and language. Similar to the stances of the embodied music cognition research program, Zbikowski suggests that musical materials have the potential to serve as an analogue of (human) motor movement (188).

The abovementioned works of Antonio Damasio return in the eleventh chapter, written by Eric Clarke. Clarke distinguishes between Damasio’s ideas of core and extended consciousness (for a discussion about this and a role for constructivist approaches, see the discussion in Matyja 2011) and David Edelman’s primary and higher-order consciousness. Clarke is interested in the primary consciousness of music – i.e., the immediate perceptual engagement with music – although throughout the chapter, the author also discusses the variety of theories (found in (ecological) psychology of music) on direct experiences of listening. For example, Clarke (referring to J. J. Gibson’s ecological approach to perception fashion) discusses the idea that: “music perception can be understood as adaptable attunement of listeners to their structured environment” (204). In fact, many scholars are interested in enactivism and music, such as Joel Krueger (2011) and Mark Reybrouck have also related to Gibsonian ideas (e.g., the musical affordances).

In the next chapter, Alicia Peñalba Acitores, tackles issues directly connected with embodied music cognition. These include the importance of the body in two types of musical consciousness: 1) the perception of an ongoing musical material in which the body is involved 2) our higher-order (musical) consciousness – the capacity to become self-conscious of musical involvement.

Following Edelman’s distinction, Acitores argues that both primary and higher-order types of consciousness are built on bodily inputs, and that the feeling of that body is possible through proprioception. In the last part of the chapter, Acitores offers her explanation of how musical consciousness occurs based on J. Kevin O’Regan and Alva Noë’s (2001) sensorimotor contingency theory. In Chapter 13, Rolf Inge Godøy draws directly from the paradigm of embodied music cognition, analyzing so-called “sound–action awareness” in music, claiming that the awareness of musical sound can be understood in terms of awareness of sound-related actions. The very idea of embodied music cognition is that musical sounds are inseparable from bodily movements. Godøy writes that we “…understand any sound and/or sound feature as actually included in some sound-producing action trajectory” (235).

Any contemporary book giving an account of music and consciousness should also contain a detailed review of the basics in the brain of human interaction with music. The subsequent chapter by Katie Overy and Andy McGuiness serves this purpose, again with the emphasis on the embodied basis of human–music interaction. In this chapter, entitled straightforwardly “Music, consciousness, and the brain: music as shared experience of an embodied present,” the authors aim to investigate the neural basis of musical experience alongside the theories on the embodied nature of consciousness. Here, they define the experience of musical listening as a “shared subjectivity” – namely, the innate bodily responses to musical gestures. This chapter thus also consists of a broad description of the role of the human mirror neuron system in music cognition.

The psychedelic effects of drugs (including cannabis) on perception and performance in music (with a focus on time perception in the process of performance) is discussed by Jörg Fachner in Chapter 15. He thus focuses on scientific studies and on anecdotal evidence provided by musicians and observers of musicians using drugs. On a similar note, Fachner’s work is followed by Chapter 16, which examines the musical facets of the special state of mind that is induced by ayahuasca (an Amazonian psychodelic brew famous for the vivid hallucinations it induces). In this chapter, Benny Shanon reviews and analyses the phenomenology of auditory and musical effects encountered in the special state of mind induced by this drug and its effects on music experience and musical performance.

Shifting away from the issues of drugs and music, the last four chapters of the book fall into social philosophy and politics. The first of them (“Consciousness and everyday music listening: tracing, dissociation, and absorption” by Ruth Herbert) explores the range of consciousness occurring within the everyday experiences of music, thus offering a phenomenology of everyday listening. Next, Tia DeNora considers the role of music in consciousness formation understood from a pragmatic perspective, which fo-
cuses on consciousness as a form of creative work within its social and cultural settings. Chapter 19, “Public consciousness, political conscience, and memory in Latin American nueva canción” by Richard Elliott explores the impact of political movements in Latin America in explaining the ways in which consciousness (or “political conscience”) might be applied to groups as much as to individuals. The final chapter of Music and Consciousness examines poetic and musical expression from the psychological point of view.

To conclude, this collection of papers offers a variety of approaches to the topics of music and consciousness. In particular, the chapters related to embodied and especially enactive music cognition (and ecological psychology) may trigger the interest of constructivists and lead to further explorations in this steadily growing field of enactive music cognition.

References


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Publication Review

Recent Books and Articles Related to Constructivist Approaches

**Biology**


> Reductionism has largely influenced the development of science, culminating in its application to molecular biology. An increasing number of novel research findings have, however, shattered this view, showing how the molecular-reductionist approach cannot entirely handle the complexity of biological systems. Within this framework, the advent of systems biology as a new and more integrative field of research is described, along with the form which has taken on the debate of reductionism versus holism. Such an issue occupies a central position in systems biology; nonetheless it is not always clearly delineated. This partly occurs because different dimensions (ontological, epistemological, methodological) are involved, and yet the concerned ones often remain unspecified. Besides, within systems biology different streams can be distinguished depending on the degree of commitment to embrace genuine systemic principles. Some useful insights into the future development of this discipline might be gained from the tradition of complexity and self-organization. This is especially true with regard to the idea of self-reference, which incorporated into the organizational scheme is able to generate autonomy as an emergent property of the biological whole.

**Cognitive Science**


> In this article, we review the nature of the functional and causal relationship between neurophysiologically/psychologically generated states of emotional feeling and action tendencies and extrapolate a novel perspective. Emotion theory, over the past century and beyond, has tended to regard feeling and action tendency as independent phenomena: attempts to outline the functional and causal relationship that exists between them have been framed therein. Classically, such relationships have been viewed as unidirectional, but an argument for bidirectionality rooted in a dynamic systems perspective has gained strength in recent years whereby the feeling-action tendency relationship is viewed as a composite whole. On the basis of our review of somatic–visceral theories of feelings, we argue that feelings are grounded upon neural-dynamic representations (elevated and stable activation patterns) of action tendency. Such representations amount to predictions updated by cognitive and bodily feedback. Specifically, we view emotional feelings as minimalistic predictions of the action tendency (what the agent is physiologically and cognitively primed to do) in a given situation. The essence of this point is captured by our exposition of action tendency prediction–feedback loops which we consider, above all, in the context of emotion regulation, and in particular, of emotional regulation of goal-directed behavior. The perspective outlined may be of use to emotion theorists, computational modelers, and roboticists.


> I assess the relevance of John Dewey’s well-known article, “The reflex arc concept in psychology,” for a historical revision of the emergence of the recent embodied approach in the cognitive sciences. In particular, I try to identify its specific contribution in the shift from Dewey’s conceptual analysis to the way in which, during recent years, certain research programs have developed their methodological profile and put it to work in experimental and modeling practices. My hypothesis is that, under a certain interpretation, Dewey’s article plays the role of the main intellectual precursor in the development of embodied cognitive science and, specifically, the related dynamical approach.

**Relevance:** The paper presents perspectives for an active/cybernetic/dynamical systems perspective on embodied emotion theory (James, Damasio, etc.).

underlying shift in methodological profile. Among the conglomerate of programs that can be included within the general denomination of embodied cognitive science, the article focuses on the dynamical approach, which stands out, on the one hand, for its radical character and, on the other hand, for its characteristic brand of cognitive-scientific approach.

### Cybernetics


> This publication constructs a methodology of active learning for observing the observer: the tool used is the construction of games. The basic question is: What actions can be taken to allow the subject to observe himself, and how can learning activities be used as a way of reconstructing the subject's experience during the observation? The basic reference framework for the qualitative research is constructivism. The conceptual and philosophical analysis of research is second-order cybernetics, which gives relevance to the theory of the observer and the relationship between the observer and what is observed. For the construction of the games the group is organized according to specific structures, which make up a work network within the proposed experimental scenario. Every reflexive discourse (conceptual, informational and descriptive) on the describer's properties system will be formed, at least, of the perspectives, dispositions and distinctions in the language of the observer. In this sense, to observe the observer is not a representation of analyzable, controllable and predictable process, rather to observe the observer will be interpreting the metaphors that constitute him or her at any stage of experimentation that is proposed. The usefulness of the game as a methodology for observing the observer means that it is possible to propose a comparison between the dynamics of the social system built by the participants in the application of the methodology and the networks that can be built in terms of the language used. > **Relevance:** The publication addresses a methodological approach for learning to observe the observer. In von Foerster's words, observing the observer consists of describing the properties of the describer. First, we start from a position in second-order cybernetics which turns out to be a radical constructivist position. Then, we make a connection between observer, constructivism, metaphors and learning. The game is the designing pillar and the tool used to incorporate the proposed methodology. The games follow rules: constitutive, regulative and strategic. The structure of the game uses ideas of syntegration by Beer, and reinterprets them in a scenario of experimentation called the Cybernetics of Cybernetics course. In the game, each participant experiences the world which constitutes the game and the role of the observer in observing. Some final remarks discuss the use, advantages and limitations of the methodology proposed.

### Cultural Studies


> This paper deals with personal development in its social contexts. It demonstrates how personal development works and appears in communication. Therefore there will be an analysis implemented which is based on system-theoretical propositions of the social sciences which reveals the reciprocal relation between consciousness and communication. The evidence of communication will be explained in different models and under different aspects, e.g., learning and socialization, paradoxical operations and forms of development. The constructive character of identity and reality will be discussed in its sociobiological origins. As a result “knowledge” will be re-defined as an intentionally directed contingent way of perceiving and acting. It leads to the conclusion that personal development is an irreversible process which becomes evident by the expansion of personal choices in the code of truth and love as ecological criteria. > **Relevance:** The publication demonstrates an interdisciplinary approach based on the general language of cybernetics and systems theory. The method is taken from Maturana’s way of explaining how science works and it comes to conclusions which makes evident why the constructivist paradigm may be useful for humanity and society.

https://www.grin.com/login/#documents/196163/text

http://www.univie.ac.at/constructivism/journal/8/1/132.review
Publication Review: Constructivist Approaches

The dual status of being an observed system (as opposed to first-order cybernetics, cybernetics or cybernetics of observing systems). The subject matter of the present paper is the cybernetics of observed systems (as opposed to first-order cybernetics, especially from the work of Heinz von Foerster, where the idea was taken from cybernetics, especially from the work of Heinz von Foerster, where the idea was derived from the cybernetics of observing systems. However, the continued use of cybernetics has led to the development of new approaches within a community of observers who must be enabled to live with the wickedness of the problem with minimum harm. > Relevance: The idea of self—observation in research is a gift from cybernetics, especially from the work of Heinz von Foerster, where the idea was central to the framework of second—order cybernetics or cybernetics of observing systems (as opposed to first—order cybernetics, which is the cybernetics of observed systems). The subject matter of the present paper deals with demonstrating the possibility of coordinating interaction of observers in a group setting so that the group itself acquires the dual status of being an observed system as well as an observing system. Such a group can generate new standpoints or schemata based on the inputs from its members, thus giving rise to new viewpoints. 

http://cepa.info/757


> Purpose: To point out the relevance of Heinz von Foerster's work to modern embodied cognitive science and artificial intelligence research. Approach: The paper discusses (a) von Foerster's contributions to understanding the limitations of the computer metaphor which has long dominated cognitive science, and (b) his theories concerning how reality is constructed in organizationally closed organisms, and what the underlying neural mechanisms are. The latter is exemplified with a simple neuro-robotic model that illustrates the constructive and anticipatory nature of memory. Findings: von Foerster's work on the integration of a radical constructivist philosophy of knowledge construction with models of the underlying neurophysiological and sensorimotor mechanisms is still highly relevant to the understanding of embodied cognition and robotic models thereof. Value: This paper identifies conceptual contributions that von Foerster's constructivist cybernetics can make to cognitive science's still limited understandings of the embodiment of cognition and "representation." > Relevance: The paper addresses the relevance of radical constructivism in general, and von Foerster's work in particular, to modern embodied cognitive science and artificial intelligence research.


> Purpose: This study explores Grade seven students’ experiences of doubt and certainty in mathematics. During nine months of (bi-monthly) sessions, students engaged with several mathematical prompts; their interactions with each other and with the teacher—researcher were video-taped, transcribed, and coded for learners’ evolving perceptions of what was (a) sufficient to define certainty (including what was experienced as intuitive or counter-intuitive and ways such certainty was interrupted), (b) relevant to the tasks (including understandings that initially dwelled on the periphery of awareness), and (c) mathematically connected. The study is conceptualized within an enactive view of cognition that emphasizes autonomous, co-emergent, and embodied knowing. It became clear that doubt and certainty emerge from a broader, holistic, understanding that is largely beneath ordinary awareness. An important aspect of the study was to bring more of this understanding to awareness. Here, Francisco Varela’s notion of research—er as empathic coach and Eugene Gendlin’s notions of “felt sense” and “implicit intricacy” assumed importance. By attending to
Constructivist Approaches

Interdisciplinary
>> The immune self is our reified way to describe the processes through which the immune system maintains the differentiated identity of the organism and itself. This is an interpretative process, and to study it in a scientifically constructive way we should merge a long hermeneutical tradition of asking questions about the nature of interpretation together with modern understanding of the immune system, emerging sensing technologies and advanced computational tools for analyzing the sensors’ data.  
> Relevance: The author claims that our immune system is a meaning-making system in the context of biology of cognition as well as the hermeneutical tradition.  

>> In this chapter I propose a leadership model that represents a synthesis of four emerging fields of study: cultural biology, systems theory, Deep Ecology, and selected leadership models. This model is congruent with an emerging ‘eco-leadership paradigm’ and may be seen as providing a conceptual foundation for leadership within that paradigm. I begin the chapter with an overview of relevant models proposed by leadership theorists as a starting point for my discussion. Then I move into a discussion of cultural biology, as it lays the foundation for the model by clarifying the essential ties between the individual and their environment. This is followed by systems theory, which allows us to further extend our understanding of the individual and its environment. This is followed by Deep Ecology, which provides a road map for living in a manner that reflects what cultural biology and systems theory teach us. I conclude with a discussion of what I will call the Deep Systems Leadership Model and demonstrate the interconnectedness of its components. Each component tells us in a different way that we are linked in a fundamental manner, both to one another and to the environment around us. Taken together, they help build a view of leadership that is non-hierarchical and non-positional; is a capacity rather than a position; and is more of a lifestyle adopted after deep reflection than a skill gained through specialized training.
> Relevance: The leadership model proposed in this chapter utilizes elements of Maturana’s work on autopoiesis and his concept of cultural biology as a foundation, also bringing together concepts such as systems thinking, adaptive leadership, and deep ecology.

Mathematics
>> This article communicates findings from a year-long constructivist teaching experiment about the relationship between fourth grade students’ multiplicative structures and their construction of improper fractions. Students’ multiplicative structures are the units coordinations that they can take as given prior to activity – i.e., the units coordinations that they have interiorized. This research indicates that the construction of improper fractions requires having interiorized three levels of units. Students who have interiorized only two levels of units may operate with fractions greater than one, but they don’t produce improper fractions. These findings call for a revision in Steffe’s hypothesis (Steffe L. P. (2002) A new hypothesis concerning children’s fractional knowledge. Journal of Mathematical Behavior 20: 267–307) that upon the construction of the splitting operation, students’ fractional schemes can be regarded as essentially including improper fractions. While the splitting operation seems crucial in the construction of improper fractions, it is not necessarily accompanied by the interiorization of three levels of units.
> Relevance: This article takes a radical constructivist approach to mathematical learning and develops local theory about how students’ units coordinations are related to the fraction schemes they can construct.  

the holistic sense that points to implicit under- standing, it was possible to broaden the scope of what was deemed relevant in selected contexts. It was found that previously subconscious understandings nonetheless influenced learning. Once named (even broadly), implicit understanding co-evolved with language in developing mathematical understanding. By attending to external indicators of felt meaning, learners interacted with each others’ implicit understanding, thereby bringing it closer to consciousness and into conversation. Prematurely insisting on clarity and logic precluded awareness of the implicit.  
> Relevance: It introduces Varela’s notion of the “empathic second person coach” as an approach to studying the lived experiences of mathematics learners.  

Epistemology
>> The current debate in social sciences shows that the paradox of observing – the embeddedness of observers in the process of observing – is at the heart of the controversy about their cognitive status and future. Although the problem of observing has been addressed in numerous theoretical perspectives, the prospects for resolving this paradox remain problematic. Locating a point which allows reflection on the process of auto-poiesis in general, not just the operation of a particular autopoietic system, may be one condition for resolving this paradox. Such point will offer reflection on all autopoietic systems, including the observer. The dynamic balance between equilibrium and disequilibrium is the mechanism which regulates the process of auto-poiesis. Since the function of regulation is essentially a re-

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This article describes many foundational issues concerning what is known as constructivism in mathematics. First of all, there is a flaw in the foundations of Bishop-style constructive mathematics, BISH, as discussed. A main theorem shows that the two current BISH definitions of “continuous function” are not equivalent within BISH, and that – together with the natural properties of “continuous function” – they imply the FT (fan theorem) axiom. The theorem sparked an investigation into the realm of topology and the axioms underpinning intuitionism (INT), classical mathematics (CLASS), recursive mathematics (RUSS) and BISH. Some new elegant axioms are introduced to prove theorems showing that CLASS and INT are closer than usually believed (“reuniting the antipodes”). The distance to RUSS is greater, due perhaps to a philosophical difference regarding “real world” phenomena. There is a connection with the old philosophical debate on determinism and perhaps with the debate in modern physics as well. The real-world experiment described in section 7 could cast an alternative mathematical light on this matter. > Relevance: The article is entirely concerned with the foundations of constructive mathematics.

Neuroscience


Enactive approaches foreground the role of interpersonal interaction in explanations of social understanding. This motivates in combination with a recent interest in neuroscientific studies involving actual interactions, the question of how interactive processes relate to neural mechanisms involved in social understanding. We introduce the Interactive Brain Hypothesis (IBH) in order to map the spectrum of possible relations between social interaction and neural processes. The hypothesis states that interactive experience and skills play enabling roles in both the development and current function of social brain mechanisms, even in the absence of immediate interaction. We examine the plausibility of this hypothesis against developmental and neurobiological evidence and contrast it with the widespread assumption that mindreading is crucial to all social cognition. We describe the elements of social interaction that bear most directly on this hypothesis and discuss the empirical possibilities open to social neuroscience. The link between coordination dynamics and social understanding can be grasped by studying transitions between coordination states. These transitions form part of the self-organization of interaction processes that characterize the dynamics of social engagement. The patterns of this self-organization help explain how individuals understand each other. Various possibilities for role-taking emerge during interaction, determining a spectrum of participation. This view contrasts sharply with the observational stance that has guided research in social neuroscience until recently. We also introduce the concept of readiness to interact to describe the practices and dispositions that are summoned in situations of social significance. > Relevance: The paper derives in explicit form some of the empirical neuroscientific implications of the enactive approach to intersubjectivity.


Philosophy


We need to realize that a paradigm based on the view of the universe that makes irreversible time and evolution fundamental forces us to view man as a product of evolution and therefore an observer from inside the universe. The theories of the phenomenological life world and the hermeneutics of communication and understanding seem to defy classical scientific explanations. The humanities therefore send another insight the opposite way down the evolutionary ladder, with questions like: What is the role of consciousness, signs and meaning in evolution? These are matters that the exact sciences are not constructed to answer in their present state. Phenomenology and hermeneutics point out to the sciences that they have prerequisite conditions in embodied living as a conscious being imbued with meaningful language and a culture. One can see the world view that emerges from the work of the sciences as a reconstruction back into time of our present ecological and evolutionary self-understanding as semiotic intersubjective conscious cultural historical creatures, but unable to handle the aspects of meaning and conscious awareness. How can we integrate these two directions of explanatory efforts? The problem is that the scientific one is without concepts of qualia and meaning, and the phenomenological-hermeneutic “sciences of meaning” do not have a foundation in material evolution.

Relevance: A modern interpretation of C.S. Peirce’s pragmaticistic evolutionary and phaneroscopic semiosis in the form of a biosemiotics is used and integrated with N. Luhmann’s evolutionary autopoietic system theory of social communication. This framework, which integrates cybernetics and semiotics, is called cybersemiotics.

http://vip.iva.dk/signs/Articles_Signs_International_Section/2011/Brier%202011%20Cybersemiotics%20Whole%20article%20short%20version%20version.pdf + http://copia.info/798


Big data biology – bioinformatics, computational biology, systems biology (including ‘omics’), and synthetic biology – raises a number of issues for the philosophy of science. This article deals with several, such as: Is data-intensive biology a new kind of science? To what extent is big data biology data-driven? Can data “speak for themselves?” I discuss these issues by way of a reflection on Carl Woese’s worry that “a society that permits biology to become an engineering discipline, that allows science to slip into the role of changing the living world without trying to understand it, is a danger to itself.” And I argue that scientific perspec-
tivism, a philosophical stance represented prominently by Giere, Van Fraassen, and Wimsatt, according to which science cannot as a matter of principle transcend our human perspective, provides the best resources currently at our disposal to tackle many of the philosophical issues implied in the modeling of complex, multilevel/multiscale phenomena. > Relevance: Many interesting things can be learned about the irreducibly human nature of scientific knowledge in a perspectivist stance (“view from somewhere”) while avoiding futile constructivism vs. realism debates. Qua perspectivists, constructivist empiricists à la Van Fraassen and constructive realists à la Giere can cooperate in a profitable way.


Emotion theorists tend to separate “arousal” and other bodily events such as “actions” from the evaluative component of emotion known as “appraisal.” This separation, I argue, implies phenomenologically implausible accounts of emotion elicitation and personhood. As an alternative, I attempt a reconceptualization of the notion of appraisal within the so-called “enactive approach.” I argue that appraisal is constituted by arousal and action, and I show how this view relates to an embodied and affective notion of personhood. > Relevance: It proposes an enactive conceptualization of the phenomenon of appraisal. http://people.exeter.ac.uk/gc243/index/GC07_EnactiveAppraisal.pdf + http://cepa.info/775


The theory of autopoiesis is central to the enactive approach. Recent works emphasize that the theory of autopoiesis is a theory of sense-making in living systems, i.e., of how living systems produce and consume meaning. In this chapter I first illustrate (some aspects of) these recent works, and interpret their notion of sense-making as a bodily cognitive-emotional form of understanding. Then I turn to modern emotion science, and I illustrate its tendency to over-intellectualize our capacity to evaluate and understand. I show that this over-intellectualization goes hand in hand with the re-jection of the idea that the body is a vehicle of meaning. I explain why I think that this over-intellectualization is problematic, and try to reconceptualize the notion of evaluation in emotion theory in a way that is consistent and continuous with the autopoietic notion of sense-making. > Relevance: It links emotion theory and the enactive notion of sense-making.


Our aim in this chapter is to bring emotion theory and the embodied view of cognition closer to each other. We first present an overview of classical (pre-Jamesian) theories of emotion and show that they were all psychosomatic. We then turn to the disembodied stance of cognitive science and trace how and why emotion theory came to lose the body. We argue that cognitive science not only neglected the body, but also tended to classify previous theories of emotion as either cognitive or physiological. This tendency has fostered a tension between these two features of emotion that exists to this day. The main manifestation of this tension in current emotion theory is the tendency to see cognitive and bodily processes as separate aspects or constituents of emotions. Finally, in the remainder of the article, we sketch an embodied approach to emotion, drawing especially on the “enactive approach” in cognitive science. > Relevance: It develops ideas for an enactive approach to emotion.


The problems associated with a really conscious decision do not disappear by mixing determination with a touch of coincidence. Both must enter into a higher unity. In so doing it will emerge that a certain degree of freedom of choice (or free will) is just as omnipresent as consciousness – an inherent part of reality itself. > Relevance: This paper unites aspects of radical constructivism, non-dualism and first-person approaches to explain freedom of choice by a broader definition of consciousness. http://free-will.de/free-will.pdf


Perceptual modalities have been traditionally considered the product of dedicated biological systems producing information for higher cognitive processing. Psychological and neuropsychological evidence is offered which undermines this point of view and an alternative account of modality from the enactive approach to understanding cognition is suggested. Under this view, a perceptual modality is a stable form of perception which is structured not just by the biological sensitivities of the agent, but by their goals and the set of skills or expertise which they are deploying at a given time. Such a view suggests that there is no such thing as an experience that is purely visual, auditory, or otherwise modal and that our attempts to understand consciousness and the mind must be conducted within a framework that provides an account of embodied, goal-directed adaptive coping with the world. > Relevance: This paper provides an enactive analysis of perceptual modality, and argues for a more constructivist view of how consciousness is analysed, specifically according to the skilled activities in which an agent is engaged.


Can we see the expressiveness of other people’s gestures, hear the intentions in their voice, see the emotions in their posture? Traditional theories of social cognition still say we cannot because intentions and emotions for them are hidden away inside and we do not have direct access to them. Enactive theories still have no idea because they have so far mainly focused on perception of our physical world. We surmise, however,
that the latter hold promise since, in trying to understand cognition, enactive theory focuses on the embodied engagements of a cognizer with his world. In this paper, we attempt an answer for the question: What is social perception in an enactive account? In enaction, perception is conceived as a skill, crucially involving action (perception is action and action is perception), an ability to work successfully within the set of regularities, or contingencies, that characterize a given domain. If this is the case, then social perception should be a social skill. Having thus transformed the question of what social perception is into that of what social skill is, we examine the concept of social contingencies and the manner in which social skills structure – both constrain and empower – social interaction. Some of the implications of our account for how social and physical perception differ, the role of embodiment in social interaction and the distinction between our approach and other social contingency theories are also addressed. > Relevance: This paper provides an outline of an approach to social perception grounded in sensorimotor and enactive approaches, particularly the participatory sense-making approach of De Jaegher and Di Paolo (2007). It also provides links between enactive approaches to social activity and the constructivist views of cultural psychologists such as Jerome Bruner.

Psychology


> This essay concerns a philosophical examination of the nature of mind and the relevant implications for mental health. Traditionally, realism and constructivism are regarded as two contrastive positions in explaining the nature of mind. While realists take discovery of reality as the main function of mind, constructivists regard it as creation of reality. Hence, epistemologically, realists emphasize on correspondence to reality as the criterion of validity or truth of the mind’s contents, whereas constructivists regard the inner coherence of constructs as the main criterion. Inner coherence of constructs or resolving inner conflicts; capability of constructs for adaption to problematic situations; and correspondence to reality as an ideal in the long run are the discussions and aims of this paper. > Relevance: This paper deals with the theoretical basis of mind and mental health based on constructivist psychology.


> In our understanding of constructivism, ethics is unavoidable because people are always embedded in ethical perspectives that infuse everything they do. “Anything goes” is never an option, even if what goes varies by person. After distinguishing three versions of constructivist theory, we briefly summarize and counter various criticisms that portray constructivism as endorsing an “anything goes” relativism. Then we outline a constructivist model of ethical meaning-making. > Relevance: It outlines a constructivist model of ethical meaning-making and counters criticisms of constructivism as a form of “anything goes” relativism.


> This paper’s intention is to show how qualitative repertory grids (Procter, 2002) are useful in mapping construing in a family. Three types of grid are illustrated: the Perceiver-Element grid (PEG), the Event-Perceiver Grid (EPG) and the Perceiver-Construct Grid (PCG). Byron’s play, “Cain: a Mystery” (1821) is used as a case example. > Relevance: Qualitative grids (QG) are a flexible way of researching and displaying people’s constructions occurring in a variety of situations. They are useful in clinical, educational and organisational work and have already been used in 16 different published applications and research dissertations. This paper uses a play to illustrate their use and power, introducing three of the forms of QG.


> Circular Therapeutics offers a groundbreaking contribution to the application of second order cybernetics and radical constructivism to the performance of psychotherapy. Drawing the distinction between interactivity and narrativity, the Keeneys re-emphasize and expound upon the most important contribution of second order cybernetics to change-oriented interaction: inclusive circularity (bringing the therapist more inside circular interaction). When cybernetic epistemology is embodied in therapeutic performance, therapists act improvisationally, allowing circularly organized interaction rather than interpretive knowing to guide their participation in therapeutic change. This way of “acting in order to know how to act next” becomes the heart of change-oriented performance. The authors trace the history of cybernetic thinking in family therapy, including discussion of the field’s (mis)handling of Gregory Bateson’s ideas. The case is made for abandoning pre-determined therapy models, including those that claim to be cybernetic or systemic, as they limit our capacity to interact without benefit of an imposed and presupposed interpretation. > Relevance: Klaus Krippendorf writes that “Circular Therapeutics transcends that disconnect and offers compelling accounts of what cybernetics can do when actually embodied in the practices of living.”
GUIDELINES FOR AUTHORS

STRUCTURE OF THE PAPER
Please make sure that your paper contains the following parts.
Title, optionally subtitle
Author(s) with affiliation(s) and email(s)
Meta information, structured abstract of about 200 words (see right), up to 6 key words
Introduction: The first chapter initializes the contact between author and reader, and should be guided by the question: “Why should the reader get involved with my paper?”
Main text: Ideas should be presented in a logical sequence = “Is there a clearly defined progression of information? Does one paragraph lead smoothly into the next?”
The writing style should be simple, using as few words as possible. Conciseness and brevity are valued.
Conclusion: Provides a summary = “What main points did I make, what did I show?”
Discusses the paper’s relevance = “How is my paper related to constructivist approaches?”
Optionally it may provide an outlook = “What could be done next?”

Alphabetical list of references. References must not be included as foot-/endnotes.
Biographical note and photo of each author.
List of at least 5 potential reviewers.

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• Overall length: 3000–9000 words
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• To emphasize, use italics type (no bold)
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Paper type: Which type of inquiry do you follow? Choose from: CONCEPTUAL, EMPIRICAL, SYNTHETIC (formal or computational models), SURVEY (guiding summary of a field), PERSPECTIVE (of senior researchers)
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Perspective: From which perspective do you argue in your paper? Choose one from: BIOLOGY OF COGNITION, CONSTRUCTIVIST EVOLUTIONARY EPistemology, CYBERSEmiotics, ENACTIVE COGNITIVE SCIENCE, EPISTIC STRUCTURING OF EXPERIENCE, FIRST-PERSON RESEARCH, NON-DUALIZING PHILOSOPHY, RADICAL CONSTRUCTIVISM, SECOND ORDER CYBERNETICS, THEORY OF AUTOPOIETIC SYSTEMS.

STRUCTURED ABSTRACT
Context: What is the current situation in your discipline with regard to the topic of your paper? Why is it a problem in your discipline at the moment?
Problem: Which problems do you want to solve? What are the reasons for writing the paper or the aims of the research?
Method: What is the approach to the topic and what is the theoretical or subject scope of the paper? How are the objectives achieved? What are the main method(s) used for the research?
Results: What was found in the course of the argumentation? What is the solution to the problem you pose?
Implications: What is the value of the paper? For whom are your insights beneficial? What do you suggest for future research? Are there identifiable limitations in the research process? What outcomes and implications for practice, applications and consequences are identified? What changes to practice should be made as a result of this paper?
Constructivist content: What is the connection with constructivism? Does the paper link to one of the constructivist perspectives covered by the journal? Do you argue in favor of a new constructivist perspective?
Key words: What are the six most important concepts and notions in the paper? Don’t repeat key words already used in the meta information.

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• Surname of author(s) no comma Year
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• “…text.” (O’Regan & Noë 2001: 940)
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Luhmann’s Relation to and Relevance for Constructivist Approaches

Editors: Alexander Riegler and Armin Scholl

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