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“Once more into the breach ...”

Dewey I. Dykstra
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Target Article

Arguments Opposing the Radicalism of Radical Constructivism

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► **Purpose** – Examination of the main arguments for radical constructivism and the critical arguments put forward against it. ► **Findings** – Although there is no reason to doubt the value of constructivism as such, it can be stated that any epistemological radicalism lacks plausibility. There is ample evidence that we still can adopt a critical realist outlook, even if every part of our world view is a construction. ► **Implications** – We should engage ourselves in the development of an anti-metaphysical, non-objectivist epistemology. By far the most promising contribution should be a version of pragmatism. ► **Key words** – cognitive constructivism, critical realism, epistemology, pragmatism, reality, viability.

Preface

1 The following tract presents an outline and review of the theses proposed by radical constructivism. It acknowledges the fact that radical constructivism must be credited with the merit of having persistently enhanced the constructivist discourse. Numerous analyses of the “radical” constructivists may expediently be adapted by “moderate” constructivists provided that the epistemological hypotheses are disregarded. Not every form of constructivism represents radical anti-realism and, indeed, this can not plausibly be so, as the following review intends to demonstrate. For the sake of accuracy, one can differentiate between a “cognitive constructivism” and a “radical constructivism” (Nüse et al. 1991, p. 1). What may already be pointed out at this early stage is that the plausibility of the radical conclusions is nourished by the fact that, as a contra-position, an objectivism and a naïve realism are constructed. The representatives of radical constructivism do not, however, limit themselves to the relativization of cognition to a subject, as is the case in critical realism (Groeben 1995, p. 150); their conclusions are more far-reaching, which justifies

regarding them as relativists (Fischer 1995, pp. 21, 28). Also characteristic of this is Ernst von Glasersfeld’s definition of the “epistemic solipsism” (Glaserfeld 1987a, p. 404). The publications of von Glasersfeld are well suited to exemplifying how far a simple copy theory can be constructed as a contra-position. He confronts perception and cognition, as “constructive” actions, with their subsequent conception as “imaging” actions, and further states: “Instead of an iconic relation of conformance or reflectance we can apply the relation of matching” (Glaserfeld 1992a, p. 30). He had already referred to the “iconic’ relation of the conformance” to be merely conceptually based on isomorphism “even though only a rough convergence is postulated” (Glaserfeld 1992a, p. 18). In the course of this, the definition of isomorphism is construed very closely, just as von Glasersfeld is only able to perceive the definition of the correspondence objectively in terms of truth-theoretical relevance (Glaserfeld 1995b, p. 37). Non-trivial copy theories are, however, indeed thinkable, as is exemplified by Ralf Nüse. He points out that it is possible to perceive the imaging relation mathematically. Human perception constructs are subse-

quently (only) *signs* for aspects of the objective reality. Reality and constructed truth dispose of different properties, which, however, “covariate” with each other (Nüse 1995, p. 178). Isomorphy may subsequently also relate to the concurrence of structural changes within two sectors that are independent of each other, and it is plausible to state that the truth constructs comprise information relating to the reality. “Just as a fuel indicator provides a statement relating to the fuel level, without actually being the same, the phenomenal world subsequently provides a statement relating to the actual world, without exactly being this actual world.” (Nüse 1995, p. 179)

2 For this reason, when dealing with radical constructivism great attention must be paid to the implications of the assignment of definitions and the adequacy of conclusions.

3 What is presented here as “radical constructivism”, is necessarily simplified and distorted, as there are considerable differences amongst the authors, who, in addition, have changed their opinions over the course of time. This is most significantly expressed by the fact that the authors Humberto R. Maturana and Francisco J. Varela, who formerly produced theories in a quasi symbiotic way, have now ceased to cooperate, for which reason they are forced – for the first time – to develop truly *autopoietic* constructs of the world.

4 On the one hand, radical constructivism can be regarded as *philosophical* theory of cognition and it is mainly presented by some authors as such. On the other hand, it can also be regarded as an *empirically-founded, naturalized* cognition theory, which is naturally emphasized in the argumentations of natural scientists.

The basic assumptions of radical constructivism

5 The *radical* constructivists continue to refer to the long standing *skeptical* argument that the human being is not able to step out of his intellectual world in order to compare it with reality, as this is always already mediated intellectually. One has “no other access to everything one observes using one’s cognitive apparatus, as exactly this one cognitive apparatus” (Glaserfeld 1995b, p. 36). Skeptics deduct, from the non-ability to know a fact, the conclusion of its non-existence. For this reason, radical constructivists follow the basic assumption that there is no strict relationship between sensory stimuli and “realization” (there would however exist the need for further arguments to be able to assume a limitation of cognition ability from the unreliability of perception, cf. Groeben 1995, p. 154). The respective reasoning can be found within neurobiology and the biological systems theory (H. R. Maturana and F. J. Varela). According to this theory, all sensory information is of the same type: it concerns the processing of electrical discharges, in the course of which only the intensity of a stimulus is coded, and not the cause of the stimulus (Foerster 1992, p. 58). The “information” is therefore merely of a “quantitative” and not a “qualitative” nature (Glaserfeld 1992a, p. 21, footnote 21; Wendel 1990, p. 187). For the analysis of neuronal stimulation, another entity is required, namely the brain. The processes prevailing there must communicate how a “certainty of the cognitive world in terms of the content” is created, if the “specificity of the stimulation” is not supposed to depend on “the quality of outer reality” (Wendel 1990, p. 188).¹ Here, the theory presenting all living creatures as autopoietic systems is applied. It is characteristic of such systems that they, in cycle-similar and cyclic-causal closed processes, autonomously produce all components that they themselves consist of and subsequently reproduce via the production of their components (Wendel 1990, p. 189).² This does not apply to the brain, as it is materially and energetically dependent on the body and cannot sustain its functions merely through its neuronal activities. It is therefore merely a “*self-referential*” system (Wendel 1990, p. 90), and subsequently energetically open but operational and semantically closed (Knorr-Cetina 1989,

pp. 88f.). Expressed “Luhmann-poietically”: “on the operational level [there exists] no contact to the environment, which of course does not exclude, on the reality levels of physical nature which are not broken by system boundaries, that influences pass through” (Luhmann 1995, p. 24). This means that it makes a difference whether or not one assumes the brain to be an organ or a cognitive system. The human being is therefore an autopoietic creature that disposes of self-referential cognitive systems, even though they can naturally not be closed systems. This implies a *dualism* of body and intellect, and, as radical constructivism regarded epistemologically, is a form of rationalism, this version of constructivism could be assumed to be an atheistic and naturalized Cartesianism. In place of the deceiving demon, one is actually dealing with self-deceptions of the brain, and the doubt, as such, is no methodical procedure as it derives from a skepticism, but is insuperable.

6 The brain is not only able to assign a “meaning” to externally caused stimuli conditions, but also to its own conditions (Wendel 1990, p. 193). “‘Consciousness’ is a function of a system capable of recursive observations” (Knorr-Cetina 1989, p. 89). According to this assumption, the meanings of linguistic expressions and ontology represent nothing but assignments of the more or less random cognitive processes of the brain. If, in such a way, the reality is subject-dependent, the traditional differentiation between subject and object does not apply (Wendel 1990, p. 195; Rusch 1987, p. 218). Therefore, one does not live *in* the world but *with* one’s world (Rusch 1987, pp. 53, 218), and this is important, as the realistic definition of cognition is replaced by an instrumentalistic one: the emphasis is directed at the knowledge regarding the *how*, not the knowledge regarding the *what* (Glaserfeld 1992a, p. 13). The criterion for knowledge is not “truth” but the utility for survival (Rusch 1987, p. 203).

7 This criterion applies on two levels: On one hand, it refers to the constructs themselves. Ernst von Glasersfeld refers to their “viability”, if they are “not destructed by experience” and if they “survive under the restrictive conditions of an incognizable world” (Glaserfeld 1987b, p. 136; 1992a, p. 19). On the other hand, it refers to the whole organism. The knowledge constructs merely serve

the one purpose, to maintain the autopoiesis. If applied consistently, “cognition is [...] the realization of autopoiesis of the living system”, and consequently, the following is equally applicable: “For a living system, life stands for cognition.” (Maturana 1987, pp. 100f.) For this reason, “cognition” is primarily tailored to the options of action for the organism (Wendel 1990, p. 202). Epistemologically, this results in a *pragmatic falsificationism*: a theory may indeed not be correct in a realistic sense, but if it leads to failure, the reaction is to change it. However, unlike in “correspondence-theoretical falsificationism”, it is not assumed that new versions of the theory will become increasingly more truthful (Knorr-Cetina 1989, p. 90).

8 In the event of attempts to constitute a radical constructivism, phenomena of perception deceptions are of great significance (in particular for von Foerster). For Nüse et al. it rightly does not seem to be plausible “that the existence of perception deceptions reveals the actual nature of perception” (Nüse et al. 1991, p. 152). In their opinion, perception deceptions represent “side-effects of the highly specialized construction of the sense organs. Seen from this perspective, *the appearance of perception deceptions* not only makes sense, but, in addition, it is also possible to explain *why* they appear. In contrast, a radical constructivist framework theory, which assumes that ‘the experiential reality is exclusively a product of a self-organized structure development’, is not able to clarify these two issues satisfactorily. Within radical constructivism, it is neither possible to clarify why the sense organs are constructed as they are, nor is it possible to trace why deceptions should appear in the first place. [...] If the stimulus patterns, out of which the system produces structures, merely represent ‘unspecific stimuli’, there would subsequently not really exist the slightest reason for the system to perceive certain stimulus patterns as stable and others as instable (equivocal). [...] Exactly for the very reason of the existence of perception deceptions it is not possible to assume that the world is not recognizable, but rather the contrary. However, it is at least only possible to satisfyingly explain the existence of perception deceptions if one assumes that organisms are capable of recognizing the world” (Nüse et al. 1991, pp. 158f., italics in the original text).

9 The fundamental basis of radical constructivism seems to imply a certain ambiguity. On the one hand, it assumes a total independence from reality during the construction of reality, and on the other hand, it instrumentally refers to it, in the course of which, however, a realistic interpretation of the knowledge constructs is not supposed to be permitted. As an explanation for this, the concept of “structural coupling” is utilized. This comprises the spatio-temporal alignment of the “condition changes of the organism with the recurrent condition changes of the medium”, in the course of which the organism remains autopoietic (Maturana 1985, p. 144). The interactions between the entity and environment form “reciprocal perturbations. It is characteristic of these interactions that the structure of the environment only *triggers* structural changes in the autopoietic entities, they do therefore neither determine nor direct in any way, which also applies vice versa.” (Maturana & Varela 1987, p. 85, italics in the original text)

10 Even if the processing of the perturbations is merely determined by the systems, this does not *exclude* that the structural changes are performed at the ratio of isomorphism as this is implied above in Nüse’s argumentation. Insofar, the reality constructs are indeed capable of “imaging” reality.

11 The existence of an objective reality is assumed by radical constructivism as well (von Glasersfeld refers to the “unrecognizable world”, Luhmann to the “reality level in physical form”, see citations above), and it must indeed do so, because if it did not, the whole issue would imply that a seemingly real complete world would be simulated for everyone. This however, would in turn imply that the knowledge of its constructive nature would be completely *useless*. It would accord more to an instrumentalism, to assume a realism.

12 Radical constructivism therefore does not deny the *existence* of an outside world (Rusch 1987, p. 205; Glasersfeld 1995b, p. 42) with which the cognitive system is energetically connected; it does however deny that “knowledge” of this outside world should be regarded as *cognition*. The perception of an independent world, which is recognizable as such, is supposed to merely represent a function useful for survival (Wendel 1990, p. 201; Knorr-Cetina 1989, p. 89). What is considered to be progress within reality perception

by a realistic metaphysics, merely represents the “optimizations of the methods applied to realize our autopoiesis” (Rusch 1987, p. 220).

13 Regardless of this, it is not possible that the construction of the reality is performed on a merely random basis. Even though it is principally possible that identical stimuli conditions are allocated different significance by neurons depending on how they are linked (Wendel 1990, p. 192), certain allocations of significance are, however, preset by the anatomically predetermined “basic wiring” of the brain (ibid. pp. 196f.). Consequently, the neuronal processes, which originate from the same sense organs, are always interpreted in the same way (Roth 1995, p. 52).

Review of the theses

14 Now that the basic statements of radical constructivism have been presented, several objections will subsequently be discussed in the same order.

15 Firstly, it is necessary to point out again that the *skeptical conclusion* is exaggerated. The undisputed fact that it is impossible to “step out” of one’s cognitions does not, by itself, suffice to assume their insufficiency. It is merely never possible to *know* how appropriate human cognition actually is. To reach a final decision in this issue, only the plausibility of the arguments is decisive. In any case, Nüse et al. quite rightly state: “to draw the conclusion, out of the arbitrariness and the subject dependency of the *type* of cognition and categorization, that the perceived and categorized matters do not exist, would represent a confusion of concept and categorized matter, of percept and perceived object” (Nüse et al. 1991, p. 150, original text in italics). The conclusion that every cognition represents an interpretation does not, as such, contain any statement in regard to the *quality* of the interpretation. A principal doubt must be well founded. The rejection of realism, in any case, goes too far and also cannot be consistently maintained by representatives of radical constructivism. Although Luhmann dismissed the perception-critical question, “how is cognition possible, *even though* it does not dispose of any other access, independent from itself, to reality except itself” (Luhmann 1988, pp. 8f), in favor of the new guiding principle “cognition is only possible in the

first place, *because* it has no other access to reality except itself”, he declares that epistemology “reflects the uncertainty of cognition and provides respective reasons” (Luhmann 1987, p. 59). The mentioning of “uncertainty” presupposes a realistic paradigm in which a comparison of cognitive constructs and primary data (constructs of the second and first order) is possible.

16 Regarding the *neurophysiological arguments*, it appears either that a great part is too simplified or that the implications generated by the presented facts are not recognized. In the individual neurons, only the actual intensity of the stimulus is indeed coded, but the brain also receives further “reports” – the duration of a stimulus, the increase and decrease of the stimulation intensity and the local distribution of the stimulation intensity – because several neurons are always stimulated at the same time. What subsequently reaches the brain is not the individual stimulus, but always a whole pattern. The stimulations are therefore not completely without any order, but they dispose of a *structure*. For this reason, it is indeed plausible to state the assumption that the stimulations also comprise an *informational input* from the outside world, even though this is still far from being the *complete information*, which is constructed in the brain. This has also been detected by Gerhard Roth, for which reason he speaks of “primary information”, “raw data” and the “implied information” contained in the raw data (Roth 1995, pp. 52, 53, 58f.). His conclusions are therefore adopted here, and with these, a *critical realism* can at least be established just as well as a radical constructivism: “No cognition, *as such*, disposes of an order or specific form. The raw data that derives from the sense-data is overlapping and ambiguous, merely *implicitly informative*. It must be configured according to *internal criteria*, i.e. their information must be transformed to *explicit* information in the light of former experience. For this reason, cognition is never an image of sense-data, but always a construct.” (Roth 1995, p. 60, in italics in original text) Therefore, it is surely inappropriate to state “the flow of physical impulses, which reach the sense organs of the human being [could] principally be structured by an *infinite number of methods* and subsequently experienced” (Vaassen 1994, p. 91, italics by the author).

17 Although the concept of *autopoiesis* is surely very expedient, one should however refrain from regarding it as absolute. Living systems do not reproduce themselves, they produce themselves, however, everything they produce for reproduction is no longer part of *their* system, but part of *the next generation*. Even though it is possible to speak of the operational closeness of autopoietic systems, one should not equate this with autonomy. All systems must be energetically open and the intake of the energy is conducted via the absorption of molecules of varying size. These are of a certain chemical structure, which can only be degraded through a few certain fixed methods. Due to this, the internal operational structure is partially determined from the outside. In this regard, the following point should not be given too much emphasis but should, however, be taken into consideration: if the systems are necessarily open for molecules, would it consequently be that remote to assume that they are also open for (primary) information?

18 One false estimate in regard to the performances of cognitive systems is also generated by the fact that one has merely applied *one* model perception (“autopoiesis”) without differentiation between all different types of creatures (Plato: the tadpole and Protagoras). What should be given much more attention is the fact that human beings do not initially dispose of operational structures, but must first develop these by themselves. *At the beginning of life, the human brain constructs itself*. To clarify this using an old image: it is not perceptions, but *the possibility to make specific perceptions in the first place*, that is written onto the empty blackboard. For this purpose, stimuli are actively and repeatedly gathered in order to produce fixed links in the brain. These neuronal links are developed in the first few months of life and are almost impossible to change at a later stage. This strongly implies the conclusion that, in the course of this linking process, the construction is not conducted freely, but in realistic “interaction” with the outside world. Otherwise, the capability of the *organism* to survive (viability) would not be warranted later. Radical constructivism merely considers the genesis of knowledge constructs, *not the genesis of the cognizing subject*. Even if one does not wish to cling to old perceptions of the subject, one is, however, forced to make a statement in regard to the

relation of consciousness and bio-chemical processes, or to the ego and its relation to the cognitive constructs. What is it that perceives itself to be different from the perceptions, considered by this very self to be its own?

19 Even if one regards the organism and the brain as representing two different systems, it is still *not possible* to assume a *dualism*. After all, the objectives of cognition – autopoiesis and survival – both refer to the body and are not exclusively limited to the cognitive system. The brain, as such, serves no other purpose; it serves the autopoiesis of the body as a whole. The only option to ensure this is the close coupling of the sensory and motor system. The significance that actions have for the development of the primary links has already been indicated above. Even later, the brain is able to activate motor changes to its construct of the world in order to gain a different perspective or feedback (Nüse 1995, p. 189). Only the “correlation of action, together with the *change* of the sensory perception connected herewith, enables the construction of coherent and stable perceptions in the first place” (Foerster 1992, pp. 58f., in italics in the original text). This coherence between the action and perception is indeed emphasized by the representatives of radical constructivism. Maturana equates life and cognition (1987, pp. 100f.) and Varela states: “Cognition and action, the motor and sensory system, are linked to each other as emergent, interactive-selective patterns”. He therefore also refers to the “embodiment” of cognition (Varela, Thompson & Rosch 1992, pp. 225, 205). The equation of life and cognition is an expressive formula but logically unfounded in two respects: 1. If the cognitive system is not able to sustain itself (energetically), but is semantically closed at the same time, cognition *cannot* be equivalent to life. 2. For the very reason the brain is able to assign meaning autonomously, this goes *beyond* mere self-preservation and life-support.

20 Radical constructivists advocate a form of pragmatism but, due to their skeptical assumption, its realistic interpretation is rejected. The statement that cognitive constructs could merely “fit”, but not “match” with the world, only represents an argument against an *objectivism*, but not against a *critical realism*. It accords with the old cognition-critical comprehension that knowledge constructs can only be falsified but not verified. A

good example of how cognitions and practical actions interactively complement each other is the three-dimensional vision. One has the impression that two bodies running parallel to each other are converging. This impression changes, however, if one approaches them, and can additionally be corrected by measuring their distance from each other at different points. In spite of this, however, the optical and mathematical construct remain standing *side by side* on an equal footing. One version of pragmatism, where sensory-motor constructs are deemed to be real *matters-of-fact*, is the genetic structuralism of Jean Piaget, which was primarily assumed by several of the radical constructivists.

21 Also in regard to the relation of cognition and action and the *criteria of usefulness*, it is possible to express objections. If “true” constructed knowledge is evaluated in terms of its usefulness to secure the life-supporting reliability of action, the question must be raised of what this would exactly look like in situations where action is required. As it is not possible to assume that the situations (in particular critical situations) are purely constructed on a fictitious basis (this would only obstruct the autopoiesis and would be a waste of energy), their constructs must, however, if they have been mastered and the knowledge has subsequently been proven to be “true”, also have some correspondence with reality. In other words: a real situation is constructed by the self-referential *cognitive system* in such a manner that the *organism* is able to handle it and ensure its autopoiesis. But this is only warranted, if the constructed reality approximately corresponds with actual reality. The statement of the radical constructivists that this conclusion would not be justified is itself not justifiable by any means. In fact, it represents an epistemological assumption as much as the realistic assumption. Even if von Glasersfeld is right in assuming that one never perceives everything but always selects, there is an error in reasoning contained herein if one states that, in the respective context of the action, only that which “enables to act successfully” (Glasersfeld 1992a, p. 22) is of relevance. For one perceives a situation *before* one acts, whereby this perception often includes the realization that many options to act are open (including inappropriate ones or wrong ones, respectively such that could lead to

death). Only a realistic construct of the world allows that the situative and interest-oriented selected action does not interfere with the autopoiesis or even renders the same to be impossible. Two issues connected to this could not yet be clarified by the representatives of radical constructivism: 1. How is the brain, as a closed system, supposed to be aware of its organism's options to act? 2. Not only are organisms or cognitive constructs affected, but also *human individuals*, who also select options to act which rule out the possibility of autopoiesis, e.g. war, suicide and self-sacrificing altruism. This illustrates the inadequacy of the biologicistic idea of man.

22 It was pointed out above that the representatives of radical constructivism do indeed acknowledge the existence of the objective reality, because autopoietic systems are not autonomous and are forced to absorb matters and energy. In this case, however, all cognitive constructs can be regarded as a realistic perception without any logical objections, in particular if evaluated on the basis of pragmatism and instrumentalism.

23 With the mere assumption of conditions close to reality, the principle of the "failure" of cognitive constructs also makes sense. If the brain was indeed informationally closed, it would not be able to establish *what* caused it to fail. *On what basis* is it supposed to re-construct? If the construction is not intended to be conducted on a fictive, random basis, in addition to a second reassessment, the elements with which the constructs were constructed must again be reviewed. For this purpose, one takes a second glance or assumes a different perspective. This can however only lead to a reassessment if the triggered perturbations generate new basic information from which new information is constructed. It was already mentioned above that the principle of the *structural coupling* could be seen from this angle. The perturbations do not merely represent "malfunctions" but rather *specifically structured* malfunctions.

24 A further indicator for the possibility to interpret human reality constructs realistically derives from the *evolutionary theory of cognition*. If the intellect is indeed a product of evolution, it must be in alignment to nature, as only this would allow its specific performance, by comprehending nature. The evolution of the intellect could not have taken place any other way (as has already been noted by

Freud). It was the prudence of the intellect that was subject to selection. If one does not personalize nature in the course of this procedure, this means nothing else but that the intellect has selected itself during the contest with nature, in so far as constructs close to reality have paid off, whereas constructs far off from reality have led to death. Nevertheless, or exactly for this reason, human cognition is *species-specific* and *not absolutely realistic* in terms of an objectivism. Nothing, however, justifies the thesis that it is *absolutely not realistic*. The comprehension radical constructivists have of evolution is totally compatible with this opinion (see Glaserfeld 1995b, p. 41). Regardless of this fact, the only respective statement by them to be found is the stereotype indication that the adequacy to reality could never be *established* (ibid. p. 43). This is not at all necessary, but there are more plausible arguments that speak for it than against it.

25 A further point to be considered when dealing with radical constructivism is that reality can not be constructed alone (solipsistically) by the individual for the simple reason that the newborn is not able to reach the objective of autopoiesis by itself. It is initially totally helpless and dependent for survival on at first one, and, later, several social psychological parents. Therefore, the construct of the world is always conducted *in communication and interaction with others*, and this cannot be without any consequences for the interpretation of the world. Von Glaserfeld also attempts to consider the role of the others. He points out the increase of the viability experienced by models, "which proves itself in linguistic interaction with others" (Glaserfeld 1992a, p. 37). If this statement is supposed to make sense, the others must have been constructed in a realistic manner. If their construction was only dependent on own perceptions and interests, these could always only confirm. To construct them with a talented and contradicting own will would be inconsistent with the rest of the own comprehension of the world, and would, in addition, represent a waste of energy, as it would represent an unnecessary hindrance to autopoiesis. Subsequently, others disposing of an own will represent a construct that reflects a reality.

26 The fact (for the observers of the observers) that there are always two reality constructs running next to each other, a social

one and one relating to the individual, should also raise the question, at the very least, of whether their joint properties as such could in some way represent the reality. The "inter-individual conformity of the constructs", which can be detected by an observer, can hardly be sufficiently asserted if one assumes that these are exclusively dependent on the subject (Groeben 1995, p. 152). Even if one was not prepared to regard communication as an exchange of information, one is forced, as an observer of a connection of two human individuals, to provide an explanation for how they accomplish their coordination. This can only plausibly be accomplished with the assumption that the constructs of the individuals somehow realistically relate to the joint reality. Interactions succeed because the reality constructs of the individuals overlap and contain reality to a certain extent.

27 In this connection, it is necessary to point out a categorical error in reasoning in the argumentation of radical constructivism. It is not possible to write "an epistemology of observing" (Foerster 1992, p. 44; Rusch 1987, p. 199) without also including the consideration that oneself is "the observer of the observer". It is therefore a false conclusion, if one states that "from the point of view" of the brain, the brain represents a closed system. "From the point of view of the brain, an interior or exterior does not exist; from the point of view of the brain, there does not even exist a brain" (Nüse et al. 1991, p. 118). Nüse et al. for this reason refer to the way of thinking of the radical constructivists as "inconsequent change of perspective". Solely the observer of the brain can decide whether the system is open or closed. If, in contrast, one assumes the position of the brain, as the radical constructivists do, it becomes obvious that it is *impossible* to sufficiently consider the argumentation for the openness of the brain.³ A further inconsistency is generated by the fact that any conclusions drawn from an individual brain (its closedness) are assumed for all.

28 Epistemological conclusions are therefore not generated on the level of the brain, but on the level of the observer (Nüse 1995, p. 188), and these must then be verified for *plausibility*. The following conclusions are drawn out of the constructiveness of the human cognition and the fact that they can only be falsified in practice: (1) Knowledge is

not objective. This conclusion is formally correct and completely plausible. (2) It is impossible to always be sure, if knowledge corresponds with reality. This is also correct. (3) Knowledge cannot be appropriate to reality. This conclusion is not only not correct but also not plausible, as the review of the individual theses should have proven. If one does not want to make any statement in regard to reality, one should equally refrain from making one about realism!

29 Instead of asking, in a realistic way of thinking, whether radical constructivism is *applicable*, one could in accordance with its nature raise questions regarding its *usefulness* as a theory. Then it becomes clear that the same is not greater than the usefulness of critical realism, if not even less so. Gebhard Rusch states that the decisive fact is “what new thinking and actions *we* are able to do with the constructivist way of thinking and how these new possibilities to think and act affect the reachability of our objectives and the satisfiability of our desires” (Rusch 1987, p. 206, in italics in original text). This statement is acceptable as long as one actually exclusively thinks *constructivist* and not *radical constructivist*. One central problem which would totally disappear, if recognition was to be deemed as a type of invention, would be the issue “how one was to perceive the interaction between discovering and inventing within human thinking” (Groeben 1995, p. 158).

30 If one considers that a radical constructivism can only plausibly arise “if the theses regarding the self-referential nature of the neuronal system represent statements in respect of something real” (Wendel 1990, p. 212), the criticism of realism becomes totally implausible. One can hardly realistically interpret a part of the constructed human thinking to utilize this to argue that human knowledge as a whole is not realistic. Rusch (1987, p. 210) addresses this performative contradiction as a possible objection against radical constructivism, but does not offer any arguments which could challenge it.

31 If, in contrast, the statement is made that the biological theses are also only constructed instruments, there is no longer any reason for

the subsequent conclusions arguing for radical constructivism. More so, as this would be characteristic for the metaphysical approach, in the course of which the own theory to be verified (in this case the instrumentalism) is already presupposed, for which the realists are always criticized (Wendel 1990, pp. 215f.). Following Hans J. Wendel, it is possible to draw the conclusion that radical constructivism is not able to prevent the establishment of metaphysical theses, the truth of which is absolute and not determined relatively to a certain entity (ibid. p. 218). Ulf Dettmann, in his examination of radical constructivism, points out contradictions and inconsistencies apparent at two central postulates in the reasoning. He comes to the conclusion that the, more or less, clearly expressed main issue was neither situated in a theory of living systems (autopoiesis) nor in a naturalized theory of cognition, but in a relativism based on a metaphysical value assessment, which is able to protect the singularity of human life against the arrogations of universalistic rationality.

32 A final point is that the philosophizing natural scientists are merely repeating old theses and arguments, which, within the humanities, were pushed further a long time ago. Primarily, they rephrase the theory of Kant: a priori, synthetic assessments (information independent of experience) are possible as these have originated through syntheses (links) subject to a priori condition (semantically concluded). However, they only affect the reality constituted (constructed) by the transcendental subject (self-referential brain), and not the reality of matters as such (the real world). What does prevent the “cognition of reality” is the transcendental apriority (the absolute self-referentiality).

Conclusions

33 Many of the currently reviewed arguments illustrate the significance of an epistemological *constructivism* but *not*, however, that it could be a *radical constructivism*.

34 The radical constructivists fail to reason plausibly why human reality constructs may

not be *realistically* interpreted. They have yet to forward the plausible reasoning for why a pragmatic falsificationism is not supposed to be able to correspond with reality, even if the brain is semantically closed to a large extent. Human cognitive constructs refer to reality, even though they are not objective and a metaphysical definition of reality has rightly been discarded.

35 The issue of a self-reflective reasoning for the possibility to understand the foreign has lead me, in my dissertation, to plead for a *critical realism*, which indeed represents a naturalistic constructivism enlightened by sociology of knowledge which is *not founded instrumentalistically, but merely pragmatistically* (Saalmann 2005).

Notes

All translations from the German original are made by the author.

1. Gerhard Roth in particular has dealt with these questions more deeply (Roth 1995, pp. 50f.).
2. Those systems are autopoietic, “which produce and reproduce the parts out of which they consist, out of those parts out of which they consist of” (Luhmann 1987, p. 56).
3. Put differently: “The radical constructivist principle of the status of an observer stands in blatant contradiction to the principle of closeness of cognitive systems.” (Fröhlich 2000, p. 242).

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Open Peer Commentaries

Some Rash Conclusions

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1 Gernot Saalman freely admits that what he presents “as ‘radical constructivism’ is necessarily simplified and distorted, as there are considerable differences amongst the authors, who, in addition, have changed their opinions in the course of time.” (§3).

2 This is an ominous opening. Conflating the critique of the different views of individual constructivists makes it difficult for individuals to respond. Given that Saalman refers thirty-eight times to Wendel, Maturana/Varela, Rusch, and myself, and only sixteen times to four other delinquents, it would have made things easier, if he had dealt with the four principal ones individually.

3 I shall try to cope with statements that seem to refer to my work.

4 At the end of §1, Saalman quotes Nüse (1995, p.179), who claims that a fuel indicator is a case where “the phenomenal world...provides a statement relating to the natural world.” On the surface one might ask: In what language does the phenomenal world make the “statement” conveying its “information”? With regard to the suggested meaning, I would say that it’s something of a sleight of hand: the fuel gauge, the number it indicates, and the level in the fuel tank, are all constructs that we are happy to use because they turned out to be viable in our experiential world. They are just as far from reality as any other conceptual construct.

5 I do not think it is correct to say that the skeptics denied reality (§5). Most of them, starting with Xenophanes (Fragment 34), merely professed agnosticism.

6 With regard to “dualism” (§5), I can only say that I am not in the least ashamed of believing that the body and the mind are not the same. I make a categorical distinction between the models we create and our reflective consciousness that constructs them. I do not believe that we can know – in the sense of knowing how it functions – the agent that is

aware and enables us to reflect upon experience.

7 It is a rather rash conclusion that constructivism is not able to clarify the origin of perceptual illusions (§8). Both Piaget and Ceccato have sketched operational derivations of the Müller-Lyer Illusion. Most perception specialists agree that the illusions arise from how the perceptual apparatus operates, rather than from its structure, and as RC is an operationalist theory it has no difficulty agreeing with this expert opinion. In any case, illusions are illusory relative to what my other senses or other people experience: I do not need a reality to characterize them as illusions.

8 Even if it were the case that one cannot exclude some isomorphism, the statement that “reality constructs are indeed capable of ‘imaging’ reality” (§10) is hardly a logical conclusion. The fact that something cannot be excluded is not a justification of its existence. If I say I cannot exclude the existence of evil spirits, it does not mean that I accept their existence.

9 It is misleading to say that “[t]he existence of an objective reality is assumed by RC” (§11). Saalman refuses to accept agnosticism and disregards my repeated assertion that I stand with Berkeley, who said that we have no idea what “to exist” is supposed to mean in a domain beyond our experiential world.

10 Furthermore, I do not think any constructivist has ever claimed “...that the construction of the reality is performed on a merely random basis” (§13). In RC it is the experiential viability of constructs that determines their fate.

11 At the very beginning of his “Review” (of the theses he has formulated about constructivism) Saalman discusses “how appropriate human cognition actually is” and states that “only the plausibility of the arguments is decisive” (§15). This reveals the tacit presupposition from which the writer undertakes his review. The first two sentences respectively speak of “appropriate” and “plausibility.” Both the terms “appropriate” and “plausibility” require a context in order to become meaningful. For example the statement, “Per-

haps you should see your doctor,” may be *appropriate* if a belly ache has been mentioned, but not when you had been talking of politics or the receding glaciers of the Alps. Similarly, something may be considered *plausible* in a given set of circumstances, but nothing is plausible in itself. Saalman tacitly takes for granted that there is a structured independent reality against which the appropriateness or plausibility of statements can be checked.

12 I have always maintained that RC, as I see it, is not derived from neurophysiology or any other empirical science (§§16, 17). It is of course encouraging to find that the constructivist model turns out to be compatible with how neurophysiologists or quantum physicists think about the world, but their findings cannot give my model a factual solidity beyond the rational arguments from which it was developed.

13 The same goes for Maturana’s model of autopoiesis. I had the good fortune of being friends with Maturana for a long time and have made use of some of his brilliant formulations – for instance that everything said is said by an observer and that the living organism proceeds inductively. But there are parts of his model that I do not accept (e.g., the derivation of consciousness from language). Not accepting some of his ideas does not mean that I think they are *wrong*. His model is his model and my model is my model. RC does not claim to be considered a representation of ontic reality and therefore “true.”

14 RC has never made any bones about the problem of the subject that generates percepts, concepts, and the structure of the experiential world (§18). It is that mysterious spot where awareness arises and experience begins. From my point of view it lies at the interface of the rational and the domain of the mystical to which reason has no access.

15 Saalman’s remark about Piaget’s structuralism suggests that he is unaware of one of Piaget’s strongest statements about the construction of concepts, which he made in his monograph on structuralism: “What remains, then, are the constructions themselves and one cannot see why it should be unreasonable to think that the ultimate nature of the real is in continuous construc-

tion rather than being an accumulation of accomplished structures” (Piaget 1968, pp. 57–58).

16 Saalman seems to think that “usefulness” (§21) is the sole criterion of viability. Consequently he ignores the feedback model (which is essential to autopoiesis as well as RC) and the inherent assumption of goals. Instead he presents the actions of an organism as though they had to be *caused* by an “actual reality” rather than by “situations ... purely constructed on a fictitious basis.” Actually, RC holds that the construction of experiential reality is “invented,” but not “fictitious” in the random sense. It is always hemmed in by constraints; and experiential reality is just as unforgiving as any ontic reality you could imagine.

17 The three paragraphs 22–24 seem to be focused on autopoiesis, but they reveal a flaw that pertains to all of Saalman’s arguments. He seems unwilling to accept the notion of a reality of which there is no evidence except the fact that certain ways of acting and/or thinking do not succeed. The failures throw no light on the nature of the obstacle, because they can be characterized and described only negatively in terms of what does not work. There is no way of gaining insights about obstacles from malfunctions, even “specifically structured malfunctions,” because any specification is necessarily in terms abstracted from experience and therefore has no purchase on reality. Needless to say, this limitation pertains also to the theory of evolution.

18 In his remarks on communication and interaction with others (§§25, 26), Saalman again ignores that in RC the construction of “others” is no more ad lib or random than the edge of the coffee table against which I so often knock my shin. Consequently, what I conjecture to be their thinking, intentions, and meaning is not arbitrary but subject to continual tests of viability.

19 The assumption of an “inter-individual conformity of the constructs” is the starting point of any consideration of how others think. Differences, however, are constantly introduced by the fact that predictions based on this conformity turn out to be wrong.

20 There is the peculiar notion that the brain thinks and has a point of view (§27). I would say that the brain is a physiologist’s construct and, on being observed, shows changes of electrical charge in single neurons. A neuro-

logist may consider this to be correlated with a subject’s activity of thinking, but hardly with a particular thought, let alone a thought referring to itself.

21 The argument of “plausibility” used in the three paragraphs 28–30 disregards the fact that the scale of plausibility to which it tacitly refers is derived from experience, that is, from the reality we have constructed, not from a reality presumed to be independent of our ways of perceiving and conceiving. I remember explaining this in my review (Glaserfeld 1993a) of the 1991 book written by Nüse et al.

“Once more
into the breach...”¹

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Introduction

1 When a person’s understanding of a position does not fit the position in substantial ways, that person’s attempts to logically demolish that position uniformly fail. The real challenge is to find a flaw in radical constructivism (RC) from its own initial assumptions or some failure of these initial assumptions (Dykstra 2007).

The adjective “radical”: A problem in language

2 Gernot Saalman uses the term “radical” in the sense of something “extreme.” For example, in §1, he contrasts “radical” constructivists with “moderate” constructivists. This adjectival usage of the word “radical” as “extreme” is a slang usage from the American sub-culture called “Surfers” which originated in the late 1950s or early 1960s. “Radical,” in their slang means: “At or exceeding limits of control or safety...” (Oxford English Dictionary OED 2007).

3 While this meaning of the word “radical” may be the most frequent use of the word in U.S. English today, it is not the sense in which Ernst von Glasersfeld applies the term to categorize different types of constructivism. “Radical” as “extreme” occurs in the OED as the *last* of a long list of usages. All widely applied well before the existence of the Surfer culture in the U.S., these other adjectival uses

are variations of the idea: “Going to the root or origin; touching or acting upon what is essential and fundamental; thorough” (OED, Entry 3.a). For von Glasersfeld, “radical” distinguishes the idea of constructivism that he intends from other notions, whether these notions are labeled constructivist or not. From the target article, Saalman does not seem to realize that von Glasersfeld is using the sense of going to the root or origin of and acting on what he believes is essential or fundamental (Glaserfeld 1975, 1985).

The hegemony of the realist perspective

4 There are many cases in which authors criticize RC from realist assumptions about the nature of human knowledge. Saalman seems to belong to them. As von Glasersfeld has pointed out in many publications (e.g., Glaserfeld 1975, 1985, 1991, 1995a), RC starts with assumptions about the nature of knowledge that are fundamentally different from those of realism. The initial assumptions of realism seem to include the notion that the result of our thinking can be an increasingly accurate picture or depiction of a mind-independent reality (MIR), as expressed by de la Torre & Zamorano (2001): “[W]e postulate the objective existence of physical reality that can be known to our minds...with an ever growing precision by the subtle play of theory and experiment.” In RC the corresponding assumption is that the result of our thinking is explanations of experience that fit the experiences for which the explanation was constructed. Regardless of the degree of fit, such explanations cannot be claimed to match a MIR, since they cannot be compared to such a thing itself.

5 Hence, the radical constructivist acknowledges the challenge of the Skeptics (cf. von Glasersfeld’s 1992). The realist appears either not to acknowledge it or to be unaware of it. For Saalman the challenge is exaggerated. He concludes that: “It is merely not possible to know how appropriate human cognition actually is” (§15). The realist backed into this corner seems to hang on to a thread, hoping desperately that somehow, just as a stopped clock is “correct” twice a day, the result of our cognition *might* sometime match an “outside reality.” How would we know when these two times a day are, if we have no access to a “real” clock in that “outside

reality?" The realists' own initial assumption appears to mask the challenge of the Skeptics from them.

6 In §1, Saalmann has translated a passage of von Glasersfeld's that was originally in German as: "Instead of an iconic relation of conformance or reflectance we can apply the relation of matching." There is no example in any article in English by von Glasersfeld in which he uses the word "matching" in such a context. Von Glasersfeld goes out of his way to point out that he uses the word "fit" quite pointedly and words such as matching are not consistent with the idea he intends.² Is it possible that Saalmann made this error because he translated the original passage as a realist and not from an understanding of RC?

7 Later in the same paragraph, Saalmann suggests that while MIR and constructed truth may have different specific properties, the two are nonetheless covariate with each other. This is but a restatement of the realist *assumption*. One need only point out from the history of explanations that features of accepted explanations are covariate with sets of specific experiences with the phenomena. But when these sets of experiences have expanded, our explanations are no longer covariate with them. This disequilibrium between explanation and experience has moved us to construct new explanations. We must ask: "How would we know when there are no more expansions of the set of experiences to be explained?"

8 Still, the challenge of the Skeptics looms. How do we know that covariance with experiences also means covariance with an MIR, itself? In life we never get to see Nüse's (1995) fuel tank, how much is in it, or indeed that it is a fuel tank. We *only* get to see the gauge. This is the point of the Skeptics' challenge. Laboring under the hegemony of realism Saalmann *assumes* the fuel tank can be known. He appears to understand neither the nature of the Skeptics' challenge nor RC.

9 In §8, Saalmann refers to "perception deceptions." Such a characterization also exists nowhere in the English writings of von Glasersfeld. The possibility of a perception deception depends on the capacity to know a MIR itself. The capacity to detect a perception deception is implied by initial assumptions of realism. Such a capacity is specifically not possible from the initial assumptions in RC. Hence, the concept of perception decep-

tion is not one that makes any sense in RC. Here again, we have evidence of Saalmann working from initial assumptions of realism to formulate his critique rather than the initial assumptions of RC. By abduction, not understanding the distinction between these sets of assumptions means not understanding RC.

10 RC is accused of ambiguity (§9) and arbitrariness (§15). One notices in §11, that Saalmann concludes that a consequence of RC is that "a seemingly real complete world would be simulated for everyone" and that "this... would in turn imply that knowledge of" these worlds "would be completely *useless*" (emphasis in the original). Add these three items together and it is not hard at all to imagine that Saalmann's notion is that "knowledge" for a radical constructivist is some kind of "laissez-faire" entity. It need have no limits or constraints and still be acceptable for the radical constructivist. This is in spite of the explanation given in radical constructivist literature that our thinking is about constructing explanations of our experience. Our explanations are constrained by the fact that they have to fit our experiences.

11 Obviously, this all depends on what might be meant by the word "useless." As Saalmann himself points out several times in his piece, radical constructivists hold that they construct knowledge to fit experience, to be viable, and that, in the terms of Maturana and Varela, this constructed knowledge enables the maintenance of autopoiesis. But apparently this does not rise to the standard of usefulness for Saalmann, although it does for radical constructivists. One is left to imagine Saalmann's standard for usefulness is the achievement of a true picture of a MIR or the known approach to such. Nothing else is good enough because it does not meet realist criteria. Alas, this should come as no surprise since it is clear he is operating from the initial assumptions of realism and not those of RC.

Conclusions

12 I have pointed out that since no conclusion is logically valid outside of the initial assumptions on which it is based, we learn nothing new when realists criticize RC from realist initial assumptions. Also, given the evidence, Saalmann apparently does not fully grasp the essence of RC.

13 All of this is not to say that neither realism nor RC can be criticized. But the only net effect of a critique of RC by one who is still laboring under the hegemony of realism is to display some of the many ways RC is not commensurate with realism and not understood by the author of such a critique. To use another term from current slang in use in the U.S., *duh!*

Notes

1. From a monologue by Henry V in the play of the same name by William Shakespeare. "Once more unto the breach, dear friends, once more..."
2. Indeed, the passage should be translated as "Instead of the iconic relation of a perfect match or mirror image we may posit the relation of fit." (von Glasersfeld, personal communication).

Observations on an Observer's Attachment to the Idea of Reality

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1 As Maturana (e.g., 1987) has often reminded us, everything said is said by an observer. What I say here I say as an observer and reflects who I am, what I can perceive and what sense I am prepared to make of that. Similarly, what Gernot Saalmann says in his article is said by an observer and reflects who he is, what he can perceive and what sense he is prepared to make of that. I describe myself as an English speaking mathematics educator with a family background in neuroscience. Saalmann does not describe himself in his article but appears to be (to me as an observer) a German speaking sociologist. Given that we are different observers it is no surprise that we make different observations about radical constructivism.

2 One observation we agree on is made in §3. The authors he quotes would not all agree to be described as radical constructivist (or constructivists at all), there are important differences between them (for example in what is being constructed), and there are some significant reinterpretations of key ideas (for example, operational closure, autopoiesis,

information). I do not have space here to address all of these issues. Instead I will focus on the key point of whether an understanding of cognition can be based on the idea of “reality.”

3 I would like to focus first on the difference of language. The authors Saalmann considers radical constructivists (von Glasersfeld, Maturana, Varela, von Foerster, Luhmann) write in English, German, Spanish, Italian, and French (at least). I have read their work in English and Saalmann has read their work in German. This means that we have access to different subsets of the literature, and that some of what we read passes through translation. It is entirely possible that radical constructivism, as described in German texts, has the flaws Saalmann sees in it, while in the English texts these flaws do not exist. But I doubt it.

4 A more plausible theory to me is that Saalmann’s readings of the texts he reads are strongly influenced by his emotional attachment to the idea of reality. That his attachment is emotional rather than rational has been clearly argued by Maturana (1988). And I see some evidence that it influences Saalmann’s reading. In §9 Saalmann quotes a passage from Maturana and Varela (1987) which he has translated himself from German to English. Interestingly, he translates the German word “Einheiten” as “entities.” Now this is a possible translation, but a revealing one. In the original Spanish (Maturana & Varela 1984) the word is “unidades,” which the revised English edition (Maturana & Varela 1992) translates as “unities.” In the words “unidad,” “unity” and “Einheit” there is an emphasis on oneness. In Saalmann’s translation “entity” the emphasis has shifted to existence. Maturana and Varela are careful writers and so I suspect that if they chose words (and their translators chose words) that suggest oneness rather than existence, they meant to do so.

5 Looking carefully at what Maturana and Varela mean by “unity” reveals some possible reasons for their choice of words. “A unity (entity, object) is brought forth by an act of distinction” (Maturana & Varela 1992 p. 40). A unity is something perceived by an observer to be one thing. That they include “entity” as synonym should not be taken to mean that “unity” for them means what “entity” does in a standard dictionary (“something that has a

real existence”). Instead, Maturana and Varela are taking the opportunity to redefine “entity” in a way that removes any reference to reality.

6 That Saalmann translates “Einheit” as “entity” tells us something about Saalmann as an observer. While Maturana and Varela begin, as cyberneticists do, with an observer making a distinction, Saalmann begins with reality. So for him “Einheit” translates as “entity,” because for him in order for something to be perceived as a unit it must be real. As with all observers, he does not do this out of malice or foolishness, but simply because his structure, constructed over the history of humanity and himself, determines that he must perceive things in that way. As his history progresses he might learn to perceive things differently.

7 I believe that this belief in reality is a legacy of the history of humanity and so common to the structures of many people. It was perhaps my history as a mathematician, exploring worlds I know to be inventions but that seem as real to me as any, that left my structure open to perceiving all unities as not necessarily real.

8 Before I dismiss Saalmann’s observations on radical constructivism as constructed primarily on the basis of his attachment to the idea of reality, let me consider one point he makes where he almost, but not quite, touches on what I consider a key strength of the work of Maturana and Varela. In §27 Saalmann notes that we are all observers, even when we are observing the observations of others. This is the insight that forces a radical constructivist position on us (even if we do not call it that). If we begin to operate as scientists, systematically observing what we assume to be the real world in a reproducible way, we find ourselves observing the operational closure of the cognitive systems we observe. For example, Evan Thompson (1995) provides a useful summary of research related to colour vision and operational closure. Having observed operational closure to be a general feature of cognitive systems, we are forced to accept that it applies also to ourselves. This amounts to a proof by contradiction that observing reality is impossible. This was what brought Maturana and Varela to their position (Maturana & Poerksen 2004).

9 Finally, let me try to sum up Saalmann’s observations in a few sentences. He notes (§§11, 12, 22) that the radical constructivist position does not in fact deny the existence of

something outside of the cognition of all individuals (call it “reality”). He acknowledges that it is impossible to know how appropriate human cognition actually is to that reality (§15, 28), a fact that is central to a radical constructivism position. Where he parts company from radical constructivists is in how he responds to this necessary uncertainty. A radical constructivist would suggest that instead of studying cognition with reference to an unobservable external world, it would be a better use of our energies to try to learn about observers and how they construct the worlds they observe. In this the radical constructivism position echoes Wittgenstein’s (1922) “*Wovon man nicht sprechen kann, darüber muß man schweigen.* [Whereof one cannot speak, thereof one must be silent.]” Saalmann’s position seems to be instead: Upon which one can know nothing, one must establish a theory of cognition. And his basis for this, as noted above, seems to be an emotional attachment to the idea of reality, against which one cannot argue rationally.

Knowledge as Experiential Reality

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Lack of systemic wisdom is always punished
Gregory Bateson (1972)

1 I appreciate Saalmann’s recognition that “there are considerable differences amongst the authors” and that these “have changed their opinions in the course of time” (§3); but given this, what are the consequences for an outline of the theses of radical constructivism (RC)? Which approach is best for outlining a theory of knowing under these hindering conditions? My suggestion would be to use a method specifically developed for this kind of situation and to present it explicitly, or, if it does not yet exist, to develop one.

2 In §5, Saalmann writes about sensory stimuli as a basic assumption of RC. To support this claim he refers to a few concepts of the skeptics as well as to the biological systems theory of Maturana, Varela, and von Foerster. However, approaching RC with such a spe-

cific concept requires a clarification of some important RC basics, which, in my opinion, are more fundamental and hence should be considered as primary aspects.

1. First of all, as Maturana (1988, p. 25) emphasizes, “the most central question that humanity faces today is the question of reality.”
2. The radical difference between RC and traditional Western epistemology “concerns the relation of knowledge and reality” (Glaserfeld 1984, p. 20).
3. RC proposes to refuse and give up the notion that knowledge can be conceived as “copy-knowledge” (in analogy to what Saalman calls “non-trivial copy”), i.e. as a picture or representation of reality, and this proposal applies to any kind of copy theory.
4. This refusal is based on many considerations. One of them is the skeptical argument that the truth of “copy-knowledge” cannot be assessed because you can never compare a conceptual (intellectual) copy of reality – be it a simple or a non-trivial copy – with the original reality. Another consideration is Maturana’s argument that living systems cannot distinguish in experience between perception and illusion and as a consequence we, as human beings, have no way “to make any statement or claim about objects, entities or relations as if they existed independently” of us (Maturana 1988, pp. 29–30).

3 RC proposes to take seriously these primary aspects and to adopt the notion of knowledge (§6) as experiential reality, i.e. as (a system of) experiential coherences “that the organism builds up in the attempt to order the, as such, amorphous flow of experience by establishing repeatable experiences and relatively reliable relations between them” (Glaserfeld 1984, p. 39). What gives validity to this “autopoietic knowledge”: what makes it “true”? With this notion of knowledge as experiential reality, a statement is not validated through something independent from us but through coherences within experience (Maturana 1988, p. 33). Thus truth, in RC, is coherence within a domain of experience. One important consequence of such notions of knowledge and truth is that the relation of knowledge and reality must be radically changed. RC changes it from “representation” to “functional fit” and this has far reaching

consequences: they may seem to threaten human progress towards the Delphic “know thyself,” but in fact they promote it.

4 §8: A key idea of RC – unfortunately not addressed by Saalman – which can promote that progress is that of mental operations. Both Silvio Ceccato and Jean Piaget recognize Bridgman’s insight that the physical world, in order to be conceptualized, requires mental operations on the part of the observer. Silvio Ceccato developed Bridgman’s idea of operational definitions into a comprehensive system of mental operations that were conceived as constitutive of their contents, thus allowing the construction of an experiential reality without the need to *analyze representations* of the ontological reality. One important field of research in this operational approach to mind was that of the so-called “optical illusions” (for example Müller-Lyer, and other optical illusions to which Saalman refers as “perception deceptions” in §8) that Ceccato was able to describe in terms of the mental operations constituting them (Ceccato 1964, p. 22; Beltrame, Berbenni & Galassi 1965).

5 Regarding the denial of reality (§12), von Glaserfeld writes “I have never said (nor would I ever say) that there is *no* ontic world, but I keep saying that we cannot *know* it. I am in agreement with Maturana ... The crucial point is that we do not make claims of knowing what exists ‘in itself’; that is, without an observer or experienter.” (Glaserfeld 1991, p. 17). This is very different from and for me much clearer than the denial of “knowledge regarded as cognition” that Saalman attributes to RC.

6 I contend that the construction of experiential reality is not at all performed on a “merely random basis” (§13). On the contrary, it is performed on the basis of the attempt and of the ability to establish order and repeatable experiences which are coherent and fit. Thus it is not surprising that experiential reality will seem rather stable and reliable and not at all random.

7 The neurophysiological arguments supporting RC (§16) may in some cases seem too simplified, but there is relevant research where this critique does not apply, such as research by Walter J. Freeman, for example, who over the course of a half century has collected and analyzed experimental data on brain function (particularly the olfactory system of rabbits). In one of his last books he

comes to the following conclusion regarding sensation and perception: “All that brains can know has been synthesized within themselves, in the form of hypotheses about the world and the outcomes of their own tests of the hypotheses, success or failure, and the manner of failure.” (Freeman 2000, p. 90).

8 Contrary to the author’s rejection of the significant nature of RC (§33), I consider the great advantage of RC to be in its inherent “systemic wisdom” (Bateson 1972, p. 434), i.e., in its being wise enough to assume an ecology of mind in its explanations of knowledge as experiential reality. I claim that this characteristic of RC is based on its very different perspective on the relation between knowledge and reality. Here is where I see the importance of *radical* constructivism.

Realism and its Discontents

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1 Although supportive of many of the positions taken by constructivists, pragmatists, and instrumentalists against “metaphysical realism,” the author Gernot Saalman mounts arguments against all epistemological radicalisms, in favor of a critical realism. Ultimately he seeks “development of an anti-metaphysical, non-objectivist epistemology” rooted in pragmatism.

2 It seems on its face that the epistemology he seeks is incompatible with realism, indeed that “critical realism” itself is incompatible with (metaphysical) realism. This all depends critically on one’s definition of realism, which is never explicated. The author would have done well to simply lay out his conception of critical realism and his desired pragmatic, but non-instrumentalist, epistemology and then contrast these with radical constructivism.

3 Essentially there are two premises of all realist thought. The first is that there exists an external reality that is independent of observation and interpretation. The second is that the structure of this reality is absolutely knowable, such that truth values can be assigned to statements about it. A third, common, belief is that as observations multiply and hypotheses are

successively falsified, natural science asymptotically approaches the “true” description of reality. Even if perfectibility is rejected, it would seem that anti-metaphysical realism is itself a contradiction in terms. How does one evaluate the truth-value of a statement about aspects of “reality” that are independent of observations, except by invoking metaphysical, ontological, objectivist assumptions? How can one even claim that such truth-values exist if there are no means of evaluating them? What access, save through our observations, do we have to this reality? We are led to the question of whether our measurements can tell us anything more generally about the structure of reality beyond those very limited points of contact. Realists generally say yes, while pragmatists, operationalists, and constructivists generally say no.

4 Saalman distinguishes constructivism as a psychological theory from radical constructivism as a philosophy of knowledge, embracing the former, while rejecting the latter.

5 Constructivism considers the epistemological implications of material systems that construct themselves, thereby determining the nature of their interactions with external environments. One can see scientific models, adaptive, self-constructing devices, and biological organisms as such systems (Cariani 1989). In these systems, sensory interfaces (measurement devices, sensors, sensory organs) interact with environs, changing internal states contingent upon the joint properties of sensor/environ. In this manner linkages are created between changes in the environment and changes within the internal states of the self-constructing system. The self-constructing system has embedded goal-seeking mechanisms that steer behavior contingent on goals, past history, and sensory inputs. Sensory interfaces are then constructed and/or modified contingent on how well they perform (predict subsequent measurements, improve performance, permit survival and reproduction). The system need not have an internal model of how (or why) the sensory interface works in order to improve its performance. The sensory interface determines the nature of the sensor-environment interaction, but not the specific outcomes of measurements that are made with it

(specifying outcomes of measurements would render them useless as indicators of states-of-affairs in the external world). Epistemic autonomy and closure occurs at the level of choice of observables (or perceptual categories), not at the level of individual measurements. Constructivist systems are therefore organizationally closed, but informationally open. Constructivism in its descriptions of specific, limited epistemic systems is compatible with realist ontologies or anti-realist epistemologies, since it says nothing about the ultimate nature of truth or objective reality.

6 Radical constructivism generalizes the situation of the limited, but expansive, self-constructing observer to knowledge obtained by communities of observers (i.e. the scientific enterprise, human knowledge). The “unreasonable effectiveness” of science and mathematics comes about not because these automatically generate veridical descriptions of reality, but because of ratchet-like learning mechanisms that in effect “put everything to the test; keep hold of what is good” (Thessalonians). New measuring devices and schemas are constructed, and their performances in terms of prediction and effective steering of behavior are tested. Improvements in predictability and performance are indications that the selected sets of observables are congruent with the structure of the world and the task at hand, not that they necessarily mirror reality. Glaserfeld (1984, p. 21) offers the parable of finding lock-opening devices:

“If, on the other hand, we say that something fits, we have in mind a different relation [than that of matching]. A key fits if it opens the 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. The metaphor is crude, but it serves quite well to bring into relief the difference I want to explicate. From the radical constructivist point view, all of us – scientists, philosophers, laymen, school children, animals, and indeed, any kind of living organism – face our environment as a burglar faces a lock that he has to unlock in order to get at the loot.” [brackets are mine]

7 My reading of radical constructivism is that it accepts the first premise of realism, that there exists an external world (albeit an ill-defined one) that is independent of observers, but denies that we have access to any “objectively true structure of reality.” Thus I think a radical constructivist can consistently speak of an external world, and even its hypothetical structure, without making any claims that the posited structure is objectively true. I think radical constructivists can also argue for “progress” in the form of better predictability or performance as adaptive, self-constructing epistemic systems find observables that provide access to those aspects of the world that affect performance.

8 In the same way that constructivism says nothing about the status of objective reality, radical constructivism does not tell us anything specific about how nervous systems must work, only how we should (or should not) interpret what they do in absolute terms. Philosophical arguments based on current neuroscientific dogmas are notoriously prone to error, since there are few neural systems for which there exists firm understanding of how they work, in terms of the nature of signals and processing mechanisms. For example, assertions made here related to neural coding, (e.g. that magnitudes, but not qualities are encoded in spikes) are not necessarily true for temporal codes that are based on spike correlation patterns. Temporal codes can and do furnish the central nervous system with an iconic, image-like, internal “re-presentation” of the proximal stimulus. There is strong evidence that early auditory representations of pitch and tonal quality (timbre) are based on such time codes (Cariani 1999), and such stimulus-locked spike timing patterns exist in many other sensory modalities as well: vision, mechanoreception, proprioception, and electroreception. The precise natures of central, adaptively constructed neuronal assemblies and processing mechanisms that interpret these iconic, correlation-based sensory representations are still poorly understood, thus leaving open the status of distinctions between sensation, perception, and cognition and the location of informational boundaries between organism and environment.

Constructed Aspectual Reality

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1 Gernot Saalmann presents in his paper an exposition of radical constructivism that throws together such diverse thinkers as von Glasersfeld, Maturana, Varela and Luhmann. He presents their views as something of a unified front, although actually only Glasersfeld consistently represents radical constructivism. In his exhibition and critique of radical constructivism Saalmann fluctuates between ontological, epistemological and neurophysiological arguments that have often little bearing on the original ideas of radical constructivism. For example, his discussion on sensory coding (§16) is hardly relevant to the basic tenets of radical constructivism. “Sensory coding” entails that there is information in the environment that can be transmitted to the organism through senses; a model denied by radical constructivism (see e.g. Glasersfeld 1995a, pp. 115–116).

2 Saalmann criticises the anti-realism implied by radical constructivism and proposes that one should instead embrace critical realism. While anti-realism is, indeed, a problematic consequence of radical constructivism, Saalmann over-emphasises it. For example, the very sound claim that the impossibility to step out of one’s cognitions does not entail their insufficiency (§15) can probably be accepted by a constructivist. Then again, the claims “[the human cognition] is *absolutely not* realistic” (§24) and “knowledge cannot be appropriate to reality” (§28) are exaggerated. Radical constructivism is, rather, guilty of a matter-of-fact withdrawal from explicit ontological discourse. It “makes no claim to describe an independent reality” (Glasersfeld 1995a, p. 1). This does not mean that the idea of non-verifiability of one’s subjective experience would entail its being erroneous. It simply means that, in a rather Wittgensteinian fashion, the constructivist abstains from speaking of that which cannot be spoken about.

3 Saalmann is, however, right when claiming that the rejection of realism goes too far (§15). Detachment from ontology is problematic in many senses. Even when no ontology is explicated, some implicit ontological commitments are made. There must certainly exist someone who does the construction, and this someone consists of something that has made the act of construction possible. The right approach to this problem is not, however, to embrace a classical approach to ontology, such as Saalmann proposes. We should not regress back to a theory of representations.

4 The problem is that the very moment we commit to a theory of cognitive representation – to “human cognitive constructs [referring] to reality” (§34) – we commit to an ontology of discrete objects with observer-independent existence. While realism may be “critical,” it still implies that deep down there exists some ontological correlation between the “pictures in the mind” and the “furniture of the world.” This, however, spells trouble. We should be able to compare “the furniture” with “the pictures,” but this we simply cannot do (cf. Glasersfeld 2004). Picturing the pictures would, of course, result in just more pictures. Knowledge is not a picture of the world (Glasersfeld 1995a, p. 14).

5 As a solution to the problem of anti-realism in constructivism, the commitment to a theory of cognitive representation is unacceptable. The epistemological problem we face in cognising the world is not that of whether our cognitions are right, but the fact that the variety of viable cognitions is so huge that there is simply no sensible way of saying which of our cognitions would be the primary or “correct” ones. Viability is determined pragmatically and context-dependently: a viable cognition is one that works in a given context of action.

6 There is, however, some truth to the notion that viable cognitive constructs must have some correspondence with reality (§21). Without accepting the dubious idea of correspondence, we can commit to the constructivist views and yet maintain a degree of reality. We should acknowledge that while the world is epistemologically inexhaustive, we can deduce from experience that the world – whatever it *is* – exhibits certain structurality which limits our constructions of it. (For a more detailed account, see, e.g., Järvillehto 2007.)

7 The construction of the reality is *not* “performed on a merely random basis” (§13). As Glasersfeld (1990, p. 6) claims: “All action, be it physical or conceptual, is subject to constraints.” The nature of these constraints is out of our epistemological reach and thus “we cannot even imagine what the structure of the real world might be like” (Glasersfeld 1990, p. 3). But the world *exists*, in all of its unknowability, and it is, of course, very much real. Cognition does not represent the world, or deliver us pictures thereof, but rather establishes a functional fit with the world. We do not need pictures of the world because we already have the world. This is the sense in which the constructed reality is indeed very real. It is, however, problematic, if not impossible, to absolutise any single view on reality in the ontological sense. Experience teaches us that pretty much everything can be approached, perceived and interpreted differently under different circumstances and by different living beings.

8 The reality that constructivism implies is *aspectual* as concerns the cognising subject. Whatever we construct is an aspectual and functional relation in the world: it is not a picture or a representation but a particular way to act in the world according to the needs of the specific situation. All these aspects *are* the world, but they simply aren’t the whole world. Thus Saalmann is right in claiming that “[i]nteractions succeed because the reality constructs of the individuals overlap and contain reality to a certain extent” (§26). What is constructed *of* is the reality, with no other, “deeper” reality behind this. The actual resulting construct is, however, always context-dependent, conceptual and practice-laden, and thus cannot be expressed as an ontological entity. And that is where the limits of our cognition and the limits of our knowledge are drawn.

Reality and People

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1 My remarks are based on the view that mind-and-world structures of subject-inclusive experience (the only available starting-point for thinking) are created by individual and collective subjects, and are not derived

from pre-existing subject-exclusive structures (zero-derivation (0-D) structuring; see my papers in CF and the Karl Jaspers Forum). I will comment on two points.

Reality with and without subjects

2 Gernot Saalman accepts “cognitive constructivism,” but objects to the denial of reality by constructivists (§§5, 15, etc.); instead he advocates a structuring realism: “Human constructs refer to reality” (§34).

3 The word “reality” means a reliable structured background for thinking and living. But although the terms “realism” and “reality” are frequently used in the paper, and are variously characterized as anti-metaphysical, non-objectivist, critical, and pragmatic, their operational (subject-inclusive) meaning remains unclear.

4 Specifically, one would need to know whether or not Saalman proposes that reality is mind-independently pre-structured.

5 If yes, and it appears at times that Saalman implies objectivity and mind-independence (subject-exclusion) for reality, this amounts to ontic-metaphysical reality in the traditional sense (although he writes that he wants an “anti-metaphysics”). And in that case one would also have to know whether that implies theistic creation, non-biological autopoiesis (such as events following the presumed Big Bang), or something else.

6 If not, as may be implied in his endorsement of “cognitive constructivist” principles (Saalman also agrees (§15) that it is “impossible to step out of one’s cognition”), “reality” has an operational meaning which does not clearly differ from the “working-reality” proposed in 0-D.

7 The latter means within-experience structuring and positing of working-structures that are not derived from any pre-structured entities. This is followed by feedback-testing of their suitability and reliability (viability) during use. Like the more general term “working metaphysics-ontology,” working-reality is extrapolated from the “working-hypothesis” concept of science; it implies no instrumental reference (§9) to a postulated mind-independent reality. It also obviates the need for “anti-metaphysics.” Traditional objectivity similarly becomes the tool of “working-objectivity.” 0-D offers no absolute certainties, but instead a working-reliability which needs monitoring. This suffices for

dealing with perceptual deceptions (§8) and action (§21).

8 Rather than having to choose between acceptance and rejection of “reality” (or, thirdly, an agnostic attitude), 0-D means a change from a postulated fictitious un-testable mind-independently pre-structured reality to a human mental tool of working-reality that is structured within individual-and-collective experience. It can be analyzed and modified as needed, similarly to other tools such as language or mathematics.

Objects within subjects

9 Related to this is another difficulty in Saalman’s paper: an apparent random switching between (a) phenomenological reasoning, which respects the constructivist emphasis on primacy of subject-inclusive experience, and (b) traditional objective reasoning, for instance neuro-physiological or cybernetic, which disregards it and thereby causes subjectivity to vanish. The switching presumably expresses an assumption on the part of Saalman that (a) and (b) are identical. This suffices for time-correlation studies between variables, but obscures the epistemic relations.

10 Concepts arise and remain within the mind; so, therefore, do all objective considerations. This confinement of objectivity to the bubble of individual-and-collective subjective experience determines the nature of reality and of the mind-brain relation. But that is often neglected because it is difficult to work with, with no external guarantors being postulated. The (a) = (b) conflation in Saalman’s paper hides it, and so do notions such as “the mind-brain” or “the embodied mind.” Workers in psycho-physiology and second-order cybernetics may also neglect it. Two (probably not always intended) implications of this view are that the mentioned conceptual difficulty is dealt with by denying that it exists, and that which Jaspers has called “brain-mythology” is promoted to the standard of discourse for the mind-brain question.

11 “Brains” and “systems” are objects of thinking, “objects” are structured mental tools within experience. But experience cannot become an object of thinking, because its center cannot become structured, and furthermore, even if completely structured it would have to be an object within itself, which is impossible.

12 One can observe a cat observing a mouse, either its behaviour or the relevant brain functions, or formalize or model the informational aspect of this activity as an observing system; but none of these objective functions is what the cat experiences.

13 A subject (subject-inclusive experience) cannot become an object, not even in the same person. In principle I can observe my own brain function. I might watch my hippocampal region light up on a screen when I try to remember something new – this lighting-up shows that hippocampal activation occurs when I do this – but neither the observation nor the activation are identical with my memorizing effort. My brain can produce epileptic seizures, and it works (in a limited way) when I am under general anaesthesia, but that is not “me.” I am not neuronal activity (though I need it for being me) or an informational system (though I process information in order to be me); no system is me.

14 Neuro-physiology and cybernetic studies of observing systems are important areas of research. But they are (working-)objective in type; not what the subject being examined experiences, nor the experience of the subject doing the analysis and within which the studies take place. Subjective experience is at the center of phenomenology and constructivism, but not of objective studies.

Conclusion

15 If we keep ourselves in the picture, the role of reality in constructivism, which emphasizes the centrality of subjective experience, is clear. Working-reality, and working-metaphysics-ontology more generally, are needed as a central part of everyone’s structuring of experience. To decide between affirmation and rejection of reality of an unspecified type, or of absolute metaphysical reality, is redundant. Working-reality includes the subjects; it is operational, critical, and pragmatic. Working-reality and working-objects are structured by structuring subjects, not by themselves; observations are not made by themselves, but by observers. In practice it is not possible to structure the world continuously at every moment, and temporary reliance on posited (working-) agencies is required. However, we should remain aware that in principle we can and have to remain the responsible cybernetes.

Arguments that Miss the Mark

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1 The article argues that radical constructivism is flawed, and should be rejected in favour of an alternative version of constructivism: critical realism. It is my aim here to demonstrate that the arguments do not hold, for at least two reasons:

- They are directed against a mistaken conception of what radical constructivism is about.
- They are essentially “criticisms from the outside”: i.e., radical constructivism is criticised for what it *is not*, and not for what it *is*.

2 What is radical constructivism? Saalman remarks (rightly) that there are differences in viewpoint between different authors. My considerations here are based on arguments presented by the originator of the theory, Ernst von Glasersfeld (see, e.g., 1993b, 1995a, 2000); a more detailed discussion is given elsewhere (Quale 2007).

3 One major issue, around which much of the discussion turns, is that of the *existence of reality*, i.e. of an outside world. Here, somewhat confusingly, Saalman appears to be of two minds: he acknowledges that radical constructivism assumes the existence of an objective reality (§§11,12, 22, ...), but also denies this (§§5, 8, 15, ...). So, let me recapitulate briefly the radical-constructivist position on this issue:

1. The outside world does exist, as a *shared* source of our sense perceptions: i.e. individuals are able to agree that they experience the same world.
2. However (and this is crucial), it is not possible for an individual to obtain *cognitive* knowledge of it.

4 Note that these are *ontological* preferences: logically, an individual person cannot exclude *solipsism*, i.e. the possibility that all his individual experiences of the outside world are just hallucinations in his mind. But this is rejected by the person as being *existentially irrelevant* for him in the way he conducts his life. It is in our nature as human beings to

assume that the world that each of us experiences is in fact there, for us to experience and share. In other words, the outside world is accessible for us to act on, and to interact with each other in – indeed, to seriously call this into question would generally be considered a sign of mental aberration..!

5 The term *cognition* is defined (see, e.g., the OED) as: “...knowing, perceiving or conceiving, as an act or faculty distinct from emotion or volition.”

6 This activity may then lead to cognitive knowledge, which has the important characteristic of being *communicable* between individuals. On the other hand, non-cognitive knowledge (based on emotion, such as personal belief or preference) is not thus communicable, as is explicitly acknowledged by Saalman (§15). And note that this kind of knowledge is not precluded by radical constructivism. The rejection of solipsism on ontological grounds, as described above, is an example of non-cognitive knowledge: I cannot prove that the outside world exists, but I nevertheless choose to assume it! In fact, *any* knowledge of the experiential world (whether cognitive or not) must be based on whatever ontological position is adopted by the knower, i.e. on his conception of how the world *is*.

7 Indeed, such an ontological assumption lies at the base of Saalman’s critical realism: he admits that we cannot attain cognitive knowledge of the outside world (§15), but still insists (i.e., prefers to believe) that “it must be there”! And that is, of course, his privilege. He then goes on to argue that it is possible to obtain knowledge of this outside world. And this too is quite permissible, even in radical constructivism, provided one recognises that such knowledge is (and must be) *non-cognitive*. However, it appears that Saalman does not accept this provision, cf. his distinction (§1) between “cognitive” and “radical” constructivism.

8 In his search for knowledge of the outside world, Saalman makes extensive use of arguments of *plausibility*, to support the theory of critical realism, and to repudiate what he sees – sometimes mistakenly, as indicated above – as the content of radical constructivism. (Indeed the term “plausible,” with derivatives, appears at least fifteen times in the article.) However, such arguments can carry little weight in the academic discourse: what is plausible to one person is not necessarily

plausible to another! For instance, an isomorphy between a construct and its assumed “real counterpart” is proposed (§1), to boost the plausibility that the construct provides “true information” about reality (viz. the fuel indicator example). But this can readily (and, to my mind, just as plausibly) be expressed within the epistemic framework of radical constructivism as expressing *viability* of the construct in the knowledge of the individual, with no need to invoke any real counterpart. In any case, knowledge based on arguments of plausibility is highly subjective, and hence non-cognitive.

9 To conclude: radical constructivism features a *epistemic relativism*, in which a proposition of cognitive knowledge cannot be objectively true in itself, but can only be true relative to some subjectively given context. Now, one may choose to favour an alternative viewpoint of *epistemic realism*, which purports to offer objectively true propositions about the real world; this is a matter of personal preference. But such a realist perspective cannot by itself invalidate the relativist stance of radical constructivism – it is an empty exercise to find fault with relativism solely for not being in conformity with realism..! It seems to me that what is lacking in critical realism is a way to demonstrate some objectively true cognitive propositions about the outside world. I cannot see that the arguments presented by Saalman accomplish that.

Forgotten Distinctions in the Critique of Radical Constructivism

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1 Gernot Saalman applauds radical constructivism’s (§35) use of human constructs “to understand the foreign,” but bemoans its refusal to accept any additional claim that these may “correspond with reality” (§§33, 34). The author seems to forget, unfortunately, that the refusal was meant to solve a problem – that of the absence of an observed referent in social research. His plea for a replacement by “critical realism” does not deal with that problem, and thus falls flat.

2 To re-specify the problem, I distinguish three “worlds” that nicely characterise our “understand[ing] of the foreign.” The first world is that of daily life. Here we may navigate or act in any way we want. We know what “real” butter is or love; we recognise “things.” We may step out into the second world, however – for example to add understanding to the first, or knowledge, or to help increase our ability to act effectively in daily life.

3 We also may step into the third world. This is the place of “isms.” It is where we decide which concepts to import into the second world – for example first world recognitions of butter or love. Here we determine whether to use this import (or data) as a referent to discover how the second world relates to the first. This check is not part of the second world, as researchers will operate only on what is coming in and cannot decide which inputs “correspond with reality” (§35).

4 The absence of this check is, I think, well known to anyone sufficiently privileged to act within the second world. He or she will search for links among its input that satisfy the criterion of closure, that is, whether data can be identified given other data and vice versa (the data involved constitute an autopoietic system (§7, §17)). Such links are not based on the authority of a church, a government or of any “ism” in the third world.

5 As an example, consider how Kepler moved beyond Tycho Brahe’s cosmological model (in his *Astronomia Nova* written in 1609). Brahe agreed with Copernicus that the sun was not a planet like Mars (although he still assumed it turned around the earth), but rejected his helio-centrism. He preferred to equate the universe’s centre with the “average

sun,” the average of the (first world) positions of the centre of the earth’s trajectory – rather than with the sun.

6 Kepler did not like the way Brahe tried to order the input from his first world. He considered the choice of the average too arbitrary. Eventually he noticed that the link led to predictions that deviated 5 arcminutes from what was observed. He was able to correct this by replacing the average, the referent to Brahe’s predictions, with data on the sun. Later authors took this to show that the ability to correct deviations requires increasingly realistic models.

7 Unfortunately, this interpretation is wrong as, firstly, Kepler could not assume his data on the sun to “corresponded [more] with reality” than his data on the planets. Both were just imports from the first world. Secondly, he chose to link to the data on the sun because of their usefulness in correcting the deviations from Brahe’s model. Thirdly, his new referent (the sun) forced him to replace circles by ellipses – a notion he did not import from his first world.

8 The example shows that some level of closure may occur even if one links to a construct like a (non-observable) average (as in Brahe’s model), and that the level of closure of a link may be increased by a suitable choice of what to link to. Neither depends on a correspondence with reality, however. In a well-known essay, the physicist Wigner (1960) recognised this. He refers to closure as a miracle, a mystery for which “we should be grateful.”

9 This brings us back to the problem that, in my reading, radical constructivism originally tried to solve. What it did not attempt was to summarise what active researchers all know –

that reality has no special role in the second world. Its problem was that it had proved incorrect to expect that closure in social research could be facilitated, à la Kepler, by the choice of an observable referent. Here, it is necessary to construct the referent, i.e. revert to Brahe’s approach.

10 An example is the growth of collectives as autonomous entities that fit their environment (De Zeeuw 2001). Their referent has to be a collective’s next stage of development, which it (or its researchers) should construct as a preferred stage, as in design research. As this referent is not an input from the first world, it does not support “critical realism” – which appears limited to the study of what “is” in the first world, for example participation in teamwork.

11 My comments above emphasise that activities in the second world (that of research) are not based on any “correspondence with reality.” Any results that researchers achieve are a miracle that does not need explanation. Alternatively, there is good reason to explore how they come about. This is where activities in the third world become important, for example the development of theories or philosophies of cognition (§4).

12 I agree with the author that radical constructivism still needs some work. Its advantages are that it quite nicely identifies what goes on in the second world and that it supports social design research. These are not sufficient to accept it unconditionally, obviously. There is still space for alternatives – even to the “left” of radical. Tymieniecka argues in favour of “creative imagination” as a referent to achieve closure in the development of collectives (Mardas 2005).

Author’s Response

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First Impression

1 One of the striking aspects of the commentaries is that radical constructivists try to evade confrontation. For example, they concede that “only Glasersfeld consistently represents RC” (the *Järvilehtos* §1), which can be

interpreted such that dealing with other proponents isn’t worth the effort. A central point for any constructivist theory – namely the cogitating subject – is left to mysticism by *Glasersfeld* (§14). For similar reasons the famous ending of Wittgenstein’s *Tractatus* is evoked time and again (the *Järvilehtos* §2, *Reid* §9). As if the logical positivism of the early Wittgenstein could be convincing for a critical realist! Furthermore they maintain that the decision between epistemic relativism or epistemic realism is said to be a matter of personal preference only (*Quale* §6, cf. Maturana’s value statement cited in *Bettoni*

§2), which is the reason why realists and radical constructivists cannot understand each other (*Dykstra* §13, *Quale* §9). So is there any chance for a real discussion and understanding?

Sociology of scientific knowledge

2 What happens if we observe how two scientists exchange texts with one another? Do we have to admit that they receive written symbols that they have to interpret or may we think these symbols only exist in the reality constructions they have? Our observation of the two scientists is in itself a construction,

but this does not imply that they do not exist. This would lead to an endless regression and therefore, strictly, to nowhere. Isn't it plausible then, to think that our construction of the scientific exchange tells us something about the persons, the symbols and the interpretations involved? Wouldn't it be absurd to believe that we could not at least *in part* grasp the interpretations as they were really meant, but are imprisoned in our own interpretations? This would render *any* discussion useless, which directly pertains to our present discussion on RC.

3 Any debate on such basic epistemological statements as realism, constructivism or RC is connected to world views as a whole. About these we cannot argue purely rationally – we hold to them emotionally too (Dykstra §13, Quale §6, and Reid §4 hint at this). As the sociology of knowledge shows, a paradigm shift bears resemblances to religious conversion (Kuhn 1970). This surely does not occur often in one's life. Although a "conversion" or "re-conversion" seems improbable then, we can nevertheless try to further understanding.

Thesis

4 All I tried to argue for in my paper was, that (1) naïve realism or objectivism is inadequate and that we therefore should embrace a critical realism (which is a variant of constructivism), as well as (2) that the radical step to complete subjectivism or relativism (cf. Quale §9), which means anti-realism, is (a) not necessary, (b) not even plausible from the existing arguments, and (c) useless.

5 To make the case for RC strong, I combined the arguments from different traditions or models so that they could support each other, which on the other side was valid for the counter-arguments as well. Many of the commentators pointed to the fact that this combination is not without problems (Bettoni, Glasersfeld, the Järvillehtos, Quale) but none answered the argumentation in its entirety. Instead different points have been picked out. Some even used the occasion to promote their own theory (Müller, de Zeeuw) so that the discussion ignored the original argument.

6 It is remarkable how many argued in favor of Glasersfeld and not of others. His school seems tightly organized and his call to arms has been successful. "Once more into..."

Antithesis

7 As the commentators touched on too many points to answer them all, I have to focus on some of the central concepts.

8 *Radical.* My use of the term radical is questioned by Dykstra §§2 and 3 by reference to the OED. However, we only have to consult another dictionary to get different definitions. So for example on www.websters-online-dictionary.org, we can find the meaning "far beyond the norm" in first place.

9 Of course "to the roots" is one important meaning of the term, but we should consider that it is very often used in an ideological fashion to disguise the fact that people propose extreme conclusions from simple statements. Indeed I maintain that RC draws radical conclusions in the sense of being too extreme.

10 *Reality.* Cariani §2 points out that I do not define my concept of realism. I object to this criticism since I stated that I am interested in a non-objectivist epistemology and this should have made clear that I surely do not embrace a naïve realism and objectivism (cf. §1 of my text). Nevertheless Cariani goes on to build up objectivism as a counterposition, as his second premise of realism reads "reality is absolutely knowable" (§3). Only a naïve realist would make such a claim. I also would not deny the possibility of a realist version of pragmatism (§3). A good case in point is Glasersfeld's example of the key that fits the lock (Cariani §6): because it fits, the fit not only describes a capacity of the key, but tells us something about the lock as well. From our experience we learn about reality, but never gain absolute knowledge. What Cariani describes in §7 as RC is identical to a critical realist position if we simply omit the term radical: "a (radical) constructivist can consistently speak of an external world, and even its hypothetical structure, without making any claims that the posited structure is objectively true." But he can claim a certain reality for them and to do this we do not need to be able to compare our constructions to the "real reality" – as the Järvillehtos §4 and Dykstra §4 imply. But the Järvillehtos also state a position that is fully compatible with critical realism: "Cognition does not represent the world, or deliver us pictures thereof, but rather establishes a functional fit with the world. We do not need pictures of the world..." (§7) and

pragmatism: "Whatever we construct... is not a picture... but a particular way to act in the world..." (§8). There is no argument given as to why we are not entitled to claim a relation between our constructions and reality. We do not need to think that there is anything in reality that objectively conforms to our constructions, but we can always build new hypotheses and test them. If we succeed they tell us something about reality – and, in contrast to Glasersfeld, I think we can and should still speak of reality.

11 I appreciate very much that von Glasersfeld took the time to comment on my paper. Unfortunately he does not seem to present new arguments. He still cannot give an argument as to why it should not be possible to gain "insights about obstacles from malfunctions" (§17). Why shouldn't our hypotheses be interpreted to tell us something about reality? How can Glasersfeld argue that "any specification is necessarily in terms abstracted from experience and therefore has no purchase on reality"? How can he know this if we cannot have knowledge from reality? To paraphrase his words they only say: "If there is no objectivity possible, you cannot be realist," which seems very narrow minded to me. Whether we strictly confine ourselves to our experiential reality in the end depends on the plausibility of the arguments against a realist position – and here we should be able to distinguish between a naïve and a critical realism.

12 *Structured.* I indeed think that all our constructed knowledge implies that reality is mind-independently pre-structured (Müller §4). The world is out there and for the present epistemological discussion it is of no interest how it came to be. So I cannot recognize any metaphysical claim here, except for physical existence. I go with the Järvillehtos §6 then, that "we can deduce from experience that the world – whatever it is – exhibits certain structurality which limits our constructions of it." Connected with this is the next point:

13 "At random." Making use of Donald Davidson's (1973) principle of charity (i.e., always to assume rationality and coherence in the utterances of a speaker), I simply re-stated in §13 what RC (in this case brain physiology) does not say, just to make the argument of Roth more evident. From this context it should be

clear that it does not relate to a philosophical argumentation for RC. So **Bettoni** §6, **Glaserfeld** §§10 and 18 “not ‘fictitious’” or **Dykstra** §10 describing knowledge as “some kind of ‘laissez-faire’ activity” all miss the point.

14 Internal. **Glaserfeld** §7 holding that RC is an operationalist theory, **Quale**’s discussion of solipsism (§4) and **Bettoni** §4 stressing mental operations all hint at the same point. I agree that we can describe mental operations without taking them to represent reality, but there is no way to deny this possibility – just because we cannot know. If one argues from the perspective of phenomenalism one does not need to deny matter and in fact could not do so. But if one can make no statement on its existence one cannot deny a relation of our constructions to it as well. I cannot find any plausible argument for this.

15 It is exactly because everything is a construction that it seems highly unreasonable to use one model only for the process of construction – be this phenomenology, Spencer Brown, cybernetics, autopoiesis or genetic structuralism. The more so because they all are very rationalistic and mechanistic which seems inadequate for life and emotional beings such as humans in particular. This lead me to combine the arguments from different models so that they could support each other. But a closer look showed the gaps in the argumentation. A good example for such a flaw is given by **Reid** §8 where he states that “we find ourselves observing the operational closure of the cognitive systems we observe.” In which way should we be able to observe the closure? We only can infer it!

16 Viability. To go on with life we do not need objective certainty for our “knowledge”; some pragmatic possibility is enough. Even if we concede that all our inferences from practice are mere interpretations and constructions, this does not tell anything about their quality. But if we live on thanks to our constructions, are we not allowed to infer that they are not too bad in the end? The only supposition that we have to make is that we exist – and to doubt this is futile, as the history of philosophy tells us.

17 For me it makes no sense to discuss the viability of knowledge constructions without their connection to the viability of the organism, consisting of the brain and the body. Only if we assume a realism can this connection be explained. Our reality constructions are somehow related to reality. This does not imply that knowledge is objectively true (even if many claim this still), or that we could ever test how far our subjective constructions fit to the objectively existing reality. That we (our brain, our conscience and our identity construction) can make a decision that enables us to survive proves the relation of our knowledge constructions to reality (but not that they mirror reality, to be sure).

18 Plausibility. This concerns epistemological conclusions against realism, not those in favor of constructivism (after all I am constructivist, too). **Glaserfeld** §21 mentions that the plausibility refers to the reality we have constructed, not to any independent reality (to my regret, in the text to which he refers I can not find any argument dealing with plausibility). I agree with this, but it only means that the argumentations should stand the test of logic, which is valid in both worlds and irrespective of what kind of theory we hold. Otherwise we could not argue with one another. **Bettoni** §3 hints at coherence to explain plausibility, which is quite right. But he presupposes a certain conception of experiential reality which I find problematic, as argued above (cf. “Internal”, §14). Even if we accept a social theory of coherence there remain problems (cf. the discussion on the theory of Habermas).

19 The point I argue for is made by **Quale** §6 against me: “I cannot prove that the outside world exists, but I nevertheless choose to assume it!” If this is “non-cognitive knowledge,” RC is non-cognitive, too.

20 “What is plausible to one person is not necessary plausible to another” (**Quale** §8) is right, but what is academic discourse about except plausibilities and the endeavor to make things more plausible to others – especially if we are not naïve realists or cling to a theory of objectivity?

21 Use. A statement or theory is of use when it makes us to see things differently or “better” than before. With respect to the radicalism of RC I do not see any use (**Dykstra** §11). Considering future epistemological discussion I would like to draw attention to the point that we should not argue with respect to ends and usefulness only (instrumentalism), but by reconsidering the whole range of our actions and what these actions might tell us about ourselves and the world (pragmatism). Looking back we see that many actions do not have any definite end or purpose, e.g., social action or communication. The philosophy of the 20th century has said a lot on this, but RC seems almost never to refer to it (with the exception of the *Tractatus*).

Synthesis

22 I argue for an epistemological position between objectivism and radical relativism. In variation of **Müller** §7 I hold that there is a mind-independently structured reality *as well as* a working-reality. All our actions contribute to refine the working-reality so as to *seemingly* match the mind-independent reality ever better. The only criterion we have to assess this is viability, but that is enough to be realist – albeit a critical one.

23 In the end the “stubborn” critical realist can respond to the “stubborn” radical constructivist:

1. Reality out there exists.
2. We can never know for sure whether our reality constructs are *true out there*.
3. But this is not necessary. Even if they only are *true for us* (and the “us” differs), we are entitled to think that our reality constructs are related to reality, because we experience that they work. Therefore we can stick to a version of realism which is critical with respect to our capacity as knowing subjects.
4. To claim the viability of constructs, without the environment to live in, does not lead to any knowledge that critical realism does not already embrace.
5. If RC is not able to present better arguments for its radicalism, it will have disappeared within a few years, whereas constructivism will live on.

Collected References

- Bateson, G. (1972) Steps to an ecology of mind. Ballantine Books: New York.
- Beltrame, R., Berbenni, A. & Galassi, G. (1965) Contribution to the studies on the movements of the eyeballs, during optical perception by means of high speed motion photography. In: Helwich, O. (ed.) Kurzzeitphotographie. Bericht über den VII. Internationalen Kongress für Kurzzeitphotographie und Hochfrequenzkinematographie. Zürich, 12–18 September 1965. Helwich Verlag: Darmstadt.
- Cariani, P. (1989) On the design of devices with emergent semantic functions. Ph.D. dissertation at the State University of New York at Binghamton (now Binghamton University).
- Cariani, P. (1999) Temporal coding of periodicity pitch in the auditory system: An overview. *Neural Plasticity* 6(4): 173–189.
- Ceccato, S. (1964) A model of the mind. *Methodos* XVI (61): 3–68.
- Davidson, D. (1980) Radical interpretation. In: Davidson, D., *Inquiries into truth and interpretation*. Oxford University Press: Oxford, pp. 125–140. Originally published as: Davidson, D. (1973) Radical interpretation. *Dialectica* 27: 313–328.
- de la Torre, A. C. & Zamorano, R. (2001) Answer to question #31. Does any piece of mathematics exist for which there is no application whatsoever in physics? *American Journal of Physics* 69(2): 103.
- Dettmann, U. (1999) Der Radikale Konstruktivismus. Anspruch und Wirklichkeit einer Theorie. Mohr: Tübingen.
- Dykstra, D. I., Jr. (2007) The challenge of understanding radical constructivism. *Constructivist Foundations* 2(2–3): 50–57.
- Fischer, H. R. (1995) Abschied von der Hinterwelt? Zur Einführung in den Radikalen Konstruktivismus. In: Fischer, H. R. (ed.) *Die Wirklichkeit des Konstruktivismus. Zur Auseinandersetzung um ein neues Paradigma*. Carl Auer: Heidelberg, pp. 11–34.
- Foerster, H. von (1992) Entdecken oder Erfinden. Wie lässt sich Verstehen verstehen? In: Gumin, H. & Meier, H. (eds.) *Einführung in den Konstruktivismus*. Piper: München, pp. 41–88. Originally published in 1985.
- Freeman, W. J. (2000) How brains make up their minds. Columbia University Press: New York.
- Fröhlich, G. (2000) Ein neuer Psychologismus? Edmund Husserls Kritik am Relativismus und die Erkenntnistheorie des Radikalen Konstruktivismus von Humberto Maturana und Gerhard Roth. Königshausen & Neumann: Würzburg.
- Glaserfeld, E. von (1975) Radical constructivism and Piaget's concept of knowledge. Paper presented at the 5th annual symposium of the Jean Piaget society, Philadelphia. Reprinted in: Murray, F. B. (ed.) (1979) *The impact of Piagetian theory: On education, philosophy, psychiatry, and psychology*. University Park Press: Baltimore, pp. 109–122.
- Glaserfeld, E. von (1984) An introduction to radical constructivism. In: Watzlawick, P. (ed.) *The invented reality: How do we know?* W. W. Norton: New York, pp. 17–40.
- Glaserfeld, E. von (1985) Reconstructing the concept of knowledge. *Archives de Psychologie* 53: 91–101. Reprinted in: Glaserfeld, E. von & Larochelle, M. (eds.) (2007) *Key works in radical constructivism*. Sense Publishers: Rotterdam, pp. 21–29.
- Glaserfeld, E. von (1987a) Siegener Gespräche zum Radikalen Konstruktivismus. In: Schmidt, S. J. (ed.) *Der Diskurs des Radikalen Konstruktivismus*. Suhrkamp: Frankfurt, pp. 401–440.
- Glaserfeld, E. von (1987b) Wissen in der Sicht des Radikalen Konstruktivismus. In: Glaserfeld, E. von, *Wissen, Sprache und Wirklichkeit*. Vieweg: Braunschweig, pp. 131–136. English original published in 1977.
- Glaserfeld, E. von (1990) An exposition of constructivism: Why some like it Radical. Retrieved from <http://www.oikos.org/constructivism.htm> on 8 September 2007.
- Glaserfeld, E. von (1991) Knowing without metaphysics: Aspects of the radical constructivist position. In: Steier, F. (ed.) *Research and reflexivity*. Sage: London.
- Glaserfeld, E. von (1992a) Konstruktion der Wirklichkeit und des Begriffs der Objektivität. In: Gumin, H. & Meier, H. (eds.) *Einführung in den Konstruktivismus*. Piper: München, pp. 9–39. Originally published in 1985.
- Glaserfeld, E. von (1992b) Das Ende einer großen Illusion. In: Fischer, H. R., Retzer, A. & Schweitzer, J. (eds.) *Das Ende der großen Entwürfe*. Suhrkamp: Frankfurt, pp. 85–98. English version: The end of a grand illusion. In: Glaserfeld, E. von & Larochelle, M. (eds.) (2007) *Key works in radical constructivism*. Sense Publishers: Rotterdam, pp. 101–110.
- Glaserfeld, E. von (1993a) Book Review: Nüse et al., *Erfindungen des radikalen Konstruktivismus*. *Soziologische Revue* 16 (3): 288–290.
- Glaserfeld, E. von (1993b) Questions and answers about radical constructivism. In: Tobin, K. (ed.) *The practice of constructivism in science education*. AAA Press: Washington DC, pp. 23–38.
- Glaserfeld, E. von (1995a) Radical constructivism. A way of knowing and learning. Falmer Press: London.
- Glaserfeld, E. von (1995b) Die Wurzeln des "Radikalen" am Konstruktivismus. In: Fischer, H. R. (ed.) *Die Wirklichkeit des Konstruktivismus. Zur Auseinandersetzung um ein neues Paradigma*. Carl Auer: Heidelberg, pp. 35–45.
- Glaserfeld, E. von (2000) Problems of constructivism. In: Steffe, L. P. & Thompson, P. W. (eds.) *Radical constructivism in action: Building on the pioneering work of Ernst von Glasersfeld*. Routledge / Falmer: London, pp. 3–9.
- Glaserfeld, E. von (2004) The constructivist approach: Toward a theory of representations, Karl Jaspers Forum, TA73. Retrieved from <http://www.kjf.ca/73-TAGLA.htm> on 8 September 2007.
- Groeben, N. (1995) Zur Kritik einer unnötigen, widersinnigen und destruktiven Radikalität. In: Fischer, H. R. (ed.) *Die Wirklichkeit des Konstruktivismus. Zur Auseinandersetzung um ein neues Paradigma*. Carl Auer: Heidelberg, pp. 149–159.
- Järvilehto, L. (2007) Cats, ducks and rabbits: Superposition and the object of perception, Karl Jaspers Forum, TA96. Retrieved from <http://www.kjf.ca/96-TAJAR.htm> on 8 September 2007.
- Knorr-Cetina, K. (1989) Spielarten des Konstruktivismus. *Soziale Welt* 40: 86–96.
- Kuhn, T. S. (1970) *The structure of scientific revolutions*. Second Edition. University of Chicago Press: Chicago.

- Luhmann, N. (1987) Die Autopoiesis des Bewusstseins. *Soziale Welt* 36: 402–446. Reprinted in: Luhmann, N. (1995) *Soziologische Aufklärung* (Bd. 6). Westdeutscher Verlag: Opladen, pp. 55–112.
- Luhmann, N. (1988) *Erkenntnis als Konstruktion*. Benteli: Bern.
- Luhmann, N. (1995) *Probleme mit operativer Schließung*. In: *Soziologische Aufklärung* 6. Westdeutscher Verlag, Opladen, pp. 12–24.
- Mardas, N. (2005) A new Copernican Revolution: Moving beyond the Husserlian epoche to a new critique of reason: Tymieniecka and the role of the creative imagination. *Analecta Husserliana* LXXXVIII: 87–101.
- Maturana, H. (1985) *Erkennen: die Organisation und Verkörperung von Wirklichkeit*. Vieweg: Braunschweig.
- Maturana, H. (1987) *Kognition*. In: Schmidt, S. J. (ed.) *Der Diskurs des Radikalen Konstruktivismus*. Suhrkamp: Frankfurt, pp. 89–118.
- Maturana, H. R. (1987) Everything is said by an observer. In: Thompson, W. I. (ed.) *Gaia: A way of knowing. Political implications of the new biology*. Lindisfarne Press: New York, pp. 11–36.
- Maturana, H. R. (1988) *Reality: The search for objectivity or the quest for a compelling argument*. *The Irish Journal of psychology* 9(1): 25–82.
- Maturana, H. R. & Poerksen, B. (2004) *From being to doing. The origins of the biology of cognition* (translated by W. K. KoECK). Carl Auer: Heidelberg. German original: Maturana, H. R. & Pörksen, B. (2002) *Vom Sein zum Tun: Die Ursprünge der Biologie des Erkennens*. Carl Auer: Heidelberg.
- Maturana, H. R. & Varela, F. J. (1984) *El árbol del conocimiento: Las bases biológicas del entendimiento humano*, Editorial Universitaria: Santiago.
- Maturana, H. R. & Varela, F. J. (1987) *Der Baum der Erkenntnis*. Scherz: Bern.
- Maturana, H. R. & Varela, F. J. (1992) *The tree of knowledge: A new look at the biological roots of human understanding*, Revised edition. Shambhala/New Science Library: Boston.
- Nüse, R. (1995) *Und es funktioniert doch: Der Zugang des Gehirns zur Welt und die Kausaltheorie der Wahrnehmung*. In: Fischer, H. R. (ed.) *Die Wirklichkeit des Konstruktivismus. Zur Auseinandersetzung um ein neues Paradigma*. Carl Auer: Heidelberg, pp. 177–198.
- Nüse, R., Groeben, N., Freitag, B. & Schreier, M. (1991) *Über die Erfindung/en des Radikalen Konstruktivismus. Kritische Gegenargumente aus psychologischer Sicht*. Beltz: Weinheim.
- Oxford English Dictionary (2007) available on-line at: <http://dictionary.oed.com/>
- Piaget, J. (1968) *Le structuralisme*. Presses Universitaires de France: Paris.
- Quale, A. (2007) *Radical constructivism, and the sin of relativism*. *Science & Education* 16: 231–266.
- Roth, G. (1995) *Die Konstruktivität des Gehirns: Der Kenntnisstand der Hirnforschung*. In: Fischer, H. R. (ed.) *Die Wirklichkeit des Konstruktivismus. Zur Auseinandersetzung um ein neues Paradigma*. Carl Auer: Heidelberg, pp. 47–61.
- Rusch, G. (1987) *Erkenntnis, Wissenschaft, Geschichte: von einem konstruktivistischen Standpunkt*. Suhrkamp: Frankfurt.
- Saalmann, G. (2005) *Fremdes Verstehen. Das Problem des Fremdverstehens vom Standpunkt einer "metadisziplinären" Kulturanthropologie*. Shaker: Aachen.
- Thompson, E. (1995) *Colour vision: A study in cognitive science and the philosophy of perception*. Routledge Press: London.
- Vaassen, B. (1994) *Die narrative Gestalt(ung) der Wirklichkeit. Grundlinien einer post-modern orientierten Epistemologie für die Sozialwissenschaften*. Difo-Druck: Bamberg.
- Varela, F., Thompson, E. & Rosch, E. (1992) *Der mittlere Weg der Erkenntnis*. Piper: München. English original: (1991) *The embodied mind: Cognitive science and human experience*. MIT Press: Cambridge MA.
- Wendel, H. J. (1990) *Moderner Relativismus*. Mohr: Tübingen.
- Wigner, E. (1960), *The unreasonable effectiveness of mathematics in the natural sciences*. *Communications in Pure and Applied Mathematics* 13(1): 1–14.
- Wittgenstein, L. (1922) *Tractatus logico-philosophicus* (translated by C. K. Ogden). Routledge and Kegan Paul: London. Retrieved on 14 September 2007 from <http://www.kfs.org/~jonathan/witt/tlph.html>
- Zeeuw, G. de (2001) *Constructivism: A "next" area of scientific development?* *Foundations of Science* 6: 77–98.