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What Does the Future Hold for Radical Constructivism?[1]

Alexander Riegler

In the light of its heterogeneous nature, radical constructivism (RC) was recently referred to as a tool for problem solving. Can it re-invent itself to have a future as a major paradigm? To answer this question, RC is defined in terms of three increasingly larger sets of theoretical core principles and then aligned with possible empirical, methodological, and programmatic content to check its applicability for Gerhard Schurz's definition of paradigms. Based on Peter Cariani's list of intellectual, organizational, and social factors that help intellectual movements to sustain themselves and grow, it is pointed out which elements are already present and which still need to be developed. I argue that RC must be defined as paradigm rather than as a problem-solving tool in order to attract the researchers necessary to make it a self-sustaining community. As such, I believe it has a future in a variety of disciplines, including those that are traditionally linked with it such as communication science and family therapy, as well as new research domains such as quantum mechanics and computational theory.

The Past

History is full of examples where a movement seeks to dominate others. If successful, this group defines mainstream thought, thereby establishing an intellectual hegemony that suppresses plurality. Penalties for disbelieving in reigning orthodoxies have ranged from execution and exile, to public ridicule, exclusion from particular professions, and loss of funding.

Radical constructivism has always followed a different and inclusive strategy that forgoes "absolutism." It was never meant to be another "grand narrative" seeking to indoctrinate others. Rather, it is a constructive and—as I will point out—pluralistic proposal to think about crucial aspects in a different way, and then leave it to others to make up their minds.

> Radical constructivism is a subversive way of thinking that might change a person's ways of being in the world—but never a truth for all to adopt and apply to all circumstances, and especially not an instrument for the oppression of non-believers. (Tobin 2007, p. 295)

It is subversive because it calls into question "how we are in the world, how we relate to others, what we regard as worth knowing, and how we can come to know and assist others to know" (Tobin, 2007, p. 297).

So what is the future of a philosophical position that despite its sophistication does not insist on being the explanation for everything? Has history not shown that any such non-aggressive group eventually perishes under the pressure of others who violently fight non-believers? I suggest an answer to the question of how RC should comport and organize itself going into the future by drawing on insights I have gained as the editor-in-chief of the journal *Constructivist Foundations* (at http://www.constructivistfoundations.info). In particular, I draw on the papers Andreas Quale and I collected for a special issue on "Can Radical Constructivism

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Become a Mainstream Endeavor?" (Quale & Riegler, 2010), which appeared three days after the death of Ernst von Glasersfeld, who founded the term "radical constructivism" in 1974.

Which Radical Constructivism?

There are at least three ways to understand the term "radical constructivism:" (a) as the specific philosophy of Ernst von Glasersfeld; (b) as an extended interdisciplinary paradigm; and (c) as a pluralistic paradigm.

In it most narrow version, RC refers to the theoretical edifice von Glasersfeld had been building since 1974 (cf. Glasersfeld, 1974). He understood it as a conglomerate of various predecessors including, among others, the cognitive constructivism of Jean Piaget, the philosophical skepticisim of George Berkeley, the fictionalism of Hans Vaihinger, the transcendental philosophy of Immanuel Kant, and the Renaissance philosophy of Giambattista Vico.

The theoretical core of von Glasersfeld's original radical constructivism can be defined by two principles (Glasersfeld, 1995, p. 18). The first principle maintains that knowledge cannot be passively received but is actively built up by the cognizing subject. According to the second, less intuitive and readily acceptable principle, the function of cognition is adaptive, and it serves the organization of the experiential world rather than the discovery of ontological reality. Since these are *conjunctive* principles, he rejected the idea of any non-radical or "trivial constructivism" that embraces only the first principle but rejects the second. He insisted on calling his constructivism "radical" because reality construction is ubiquitous, and there is nothing in one's reality that is not the result of a construction process.[2] This is in sharp contrast to any "traditional theory of knowledge," which for so many is difficult to give up, i.e., the idea that our conceptual constructions represent in some way a mind-independent external reality, that "knowledge ought to be a veridical 'representation' of a world as it 'exists' prior to being experienced (that is, ontological reality)" (Glasersfeld, 1991, p. 15).

Unfortunately, von Glasersfeld never founded any larger research group (cf. Müller, 2010) that would assemble under the RC label. So although his impact on other disciplines, in particular educational research, was immense (Quale, 2008; Tobin, 2007), philosophically RC was marginalized. This did not even change after the Siegen school of radical constructivism in Germany, headed by Siegfried J. Schmidt, masterfully enlarged the definition of radical constructivism to include related approaches in an effort to introduce RC as a "new paradigm in the interdisciplinary discourse" (Schmidt, 1987, p. 11, my translation).

These related approaches are Heinz von Foerster's second-order cybernetics and Humberto Maturana and Francisco Varela's theory of autopoietic systems. They derived from different premises but overlapped in many details, most notably in the emphasis on cognitive closure. In Riegler (2001), I characterized the theoretical core of this *extended version of radical constructivism* as a set of *conjunctive* principles: (a) cognitive systems are organizationally

[2] While in everyday use the word "construction" may allude to the idea of arbitrarily fabricating something out of thin air, for von Glasersfeld, experiences (and empirical evidence) are at the root of reality construction, which therefore cannot be arbitrary (see also the "non-arbitrary" principle below).

closed systems[3]; (b) because they are closed, cognitive systems entertain an agnostic perspective with regard to an external reality, and any statement about the latter is mere metaphysical speculation[4]; (c) also due to the organizational closure, cognitive processes are circular such that they form a network of relations; and (d) reality construction is not arbitrary because constraints arise from inherent properties of the relational network. In particular, the last principle is a clear refutation of solipsism, with which RC has sometimes been reproached.[5]

When amalgamating the respective theories of von Glasersfeld, von Foerster, and Maturana and Varela, Schmidt focused on a rather small subset of related approaches. Historically, the second-order cybernetics movement included many more theoreticians such as Gordon Pask and Stafford Beer (see also below). Also, in more recent years a variety of new approaches has emerged, such as Varela's neurophenomenology, or first-person approaches, as well as enactivism, certain flavors of embodiment, non-dualism, and so on. In an effort to embrace all these approaches as variations of radical constructivism, the theoretical core of *radical constructivism in a broad pluralistic sense* was described in the inaugural issue of *Constructivist Foundations* (Riegler 2005) in terms of *weakly disjunctive* principles: (a) it rejects the separation between objective world and subjective experience; (b) the observer must always be included in explanations; (c) it rejects representationalism, i.e., the idea that there is a mapping of the states of the external reality onto the states of the cognitive system; (d) it maintains an agnostic relationship with reality; (e) the focus of research is moved from the world that consists of *matter* to the world that consists of *what matters*[6]; (f); it emphasizes that it is the cognitive system that organizes her experiences, resulting in an "individual as personal scientist" approach; (g) it focuses on self-referential and organizationally closed systems that strive for

[3] In the radical constructivist sense, closure refers to the quality of a cognitive system in which the changes of its states are propagated solely within the network of processes that constitutes them. As such, it is related to the notion of closure in mathematics and does not mean that cognitive systems are isolated from the environment and thus unresponsive to environmental perturbations.

[4] In other words, RC cannot deny the existence of an external reality to the observer any more than it can confirm it; rather it denies that it is knowable in some sort of absolute sense that is independent of the observer and her senses or measuring devices.

[5] Unfortunately, a great deal of the radical constructivist literature keeps itself busy with refuting this and similar allegations. Perhaps this should not be its primary goal. Instead, demonstrating the effectiveness of the RC paradigm in scientific practice may prove more fruitful. Already, Thomas Kuhn has pointed out that in times of normal science, researchers are not bothered with epistemological questions. For example, the initial upheaval Niklas Luhmann's constructivist theory created in sociology has ebbed away to "business as usual" and his followers are now busy with the details of his theory in sociological settings.

[6] This, however, does not mean that RC abandons "theories of matter" such as physics. Quite on the contrary, many physicists such as Heinrich Hertz, Ernst Mach, Percy Bridgman, and Nils Bohr held epistemological positions that are compatible with RC, i.e., that any mind-independent reality is inaccessible.

control over their inputs rather than their outputs; (h) process-oriented explanations are preferred over substance-based ones; and (i) it asks for an open and undogmatic approach to science. Applied disjunctively, these principles can be used to define a wider range of acceptable radical constructivist theories. It is my conviction that this diversity makes RC stronger, not weaker, as long as the core ideas are made explicit.

So if we want to talk about the future of RC, its three versions should be considered differently. Defining RC in terms of core principles also raises the question of whether these principles portray RC as a paradigm or as a more or less loose set of insights and methodological patches. In other words, how cohesive and mutually supporting are the various intellectual components of RC? The more we see RC as a coherent set of interrelated beliefs, the more it is like a paradigm. The more we see it as a collection of tools, the less it seems like a coherent, unified way of thinking.

Is Radical Constructivism a Paradigm or a Tool?

Some authors may argue that radical constructivism is a mere style of thinking, an efficient instrument, and a tool that lends itself to solving very specific problems only. Such a revised understanding of RC may appear interesting because it seems easier to defend the future of RC if it is not considered a paradigm. For example, Schmidt (2010), in contrast to his writings in the 1980s, is no longer convinced that RC is a new paradigm because it has been branching out of the one original RC into different versions (cf. also his description of RC as "multiply differentiated/refined discourse without systematic center" [Schmidt, 1993, p. 330, my translation]). Similarly, Vincent Kenny (2010) compares the unfolding development of constructivist approaches with a river delta. He is concerned at the way constructivism continually and inevitably splits and divides, making a mainstream constructivism impossible. As listed in Riegler (2005), this plurality includes not only the approaches mentioned so far (von Glasersfeld, von Foerster, and Maturana and Varela) but also Jean Piaget's genetic constructivism, Ulrich Neisser's cognitive theory, Kevin O'Regan and Alva Noë's theory about sensorimotor dependencies, Rudolfo Llinas's and Gerhard Roth's neurophysiology, Herbert Müller's epistemic structuring of experience, Varela's enactivism and neurophenomenology, Olaf Diettrich's constructivist epistemology, Paul Watzlawick's therapeutic theory, George Kelly's personal construct psychology, Niklas Luhmann's operational constructivism, and so on.

In view of this plurality, instead of calling it a paradigm, Schmidt argued in favor of defining RC as a tool, a "problem-solving instrument" that has been demonstrating its usefulness in various disciplines.[7] Can this demotion be justified by the fact that RC is heterogeneously spread over various disciplines (rather than constituting a focused paradigm on its own that is represented in university faculties)? Can the relatively small size of its community be used as a reason to refrain from defining it in terms of a paradigm, much as Pluto is no longer considered a

[7] Schmidt does not provide any explicit list of problems RC-as-a-tool has solved and remains rather vague: "in the fields of ontology, truth theory or ethics" (Schmidt, 2010, p. 10).

planet? Clearly, much of radical constructivism's future depends on which weight class it is in when it enters the prize ring: tools come and go while paradigms usually have a much longer lifespan.

The answer also depends on the definition of "paradigm." Ever since it was popularized by Thomas Kuhn, it has always been a problematic notion. Many sought to replace it with similar theoretical structures such as Imre Lakatos's "research programme" or Ludwik Fleck's "Denkkollektiv." A rather stringent characterization was provided by Schurz (1998), who defined a paradigm as a "multi-component cognitive system" consisting of (a) the theory core; (b) an empirical component, i.e., exemplars; (c) a methodological component, i.e., tools; and (d) the explanatory promises as its programmatic component.[8]

Can this definition of a paradigm be applied to RC? Above, we have already established various *theoretical* cores of the radical constructivist paradigm. So it seems appropriate to turn to the other components that are indispensible for the *practical* success of RC in the future.

The Secret of Success

In his commentary, Cariani (2010) provided a list of components an intellectual movement needs in order to be successful in terms of persistence and growth. Many of them apply directly to radical constructivism so they can be regarded as ingredients of its future.

The first issue is the assertation that a theory must be intellectually acceptable and accessible and provide for certainty. In particular for RC, this can be a major obstacle as some of its basic assumptions are counterintuitive and therefore difficult to understand and to embrace. So what can be done to prevent new generations of scholars turning their back on RC just because it refers to concepts such as "the cognitive system is organizationally closed" and "reality is a construction"?

Volker Gadenne (2010) identified both concepts as problematic because they contradict the beliefs of many scholars. The closed-system hypothesis implies epistemological solipsism, which many people seem to conflate with ontological solipsism, and this makes radical constructivism utterly unattractive for them. The rejection of realism means not only parting company with naïve and common sense realism but also with the great number of sophisticated versions of realism in the history of philosophy, which in turn does not sit well with professional philosophers, who have carefully reflected upon them.

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[8] Examples of the theoretical component are operant conditioning in behaviorism, mutation and selection in Darwinian evolutionary theory, and the existence of the unconscious in Freud's theory. The empirical content of a theory is the set of successful explanations and anomalies as well as the prognostic excess of theory, i.e., whether more or fewer of its prognoses can actually be empirically observed. For example, Schurz refers to behaviorism as being "empirically progressive" until it was observed that learning problem solutions does not occur incrementally, as predicted by behaviorism, but that it occurs saltatorily, as predicted by the cognitive paradigm. Methodologically, behaviorism refrained from hypotheses about the internal mind, Darwinism used standard empirical natural science, and Freud a hermeneutic-interpretative approach.

In order to secure the future of RC, it is important to depict these counterintuitive concepts not as truths in themselves but rather as *inevitable* consequences of intuitively acceptable and intelligible situations. For example, von Glasersfeld tried to derive the statement that we must remain agnostic about any mind-independent reality (something most philosophers let alone scientists find too eccentric to accept) from the intuitive argument that whatever our senses supposedly report on, such a reality cannot be independently verified. Compare this with the situation in a legal context, where such a requirement makes a great deal of sense: there one has to prove a statement by independent means. In the case of human senses, there are no such independent channels and hence no ways of independently verifying the existence of that which the sense organs supposedly perceive. There is no means of verifying anything except through some measurement process that involves sensors, be they human senses or human senses augmented by artificial sensors. Even a consensual construction of reality is at first a con*sensual* construction rather than the proof of the existence of an external world. As a consequence, epistemological realism can be considered an over-interpretation of a conclusion from the consensual construction of reality to the ontological existence of this reality. This and similar strategies that allow reasoning from the intuitive to the counterintuitive must be applied to all concepts used by RC in order to find acceptance in terms of comprehension and certainty.

Furthermore, a theory should be open to new ideas and lend itself to enlargement. It is probably a weakness of many non-mainstream schools that they rather tend to secure their intellectual heritage and try to defend it from attempts to change and expand it. This is a risky strategy because while it keeps the idea pure it also means being unwilling to adapt dynamically to changes. Radical constructivism must not make this mistake for it must not be at odds with its own principles, i.e., the central role the concept of adaptation plays in von Glasersfeld's second principle. Dynamic adaptation motivates the pluralistic definition of RC. It is implemented in *Constructivist Foundations*, where von Glasersfeld's heritage is taken beyond its original boundaries to include movements such as enactivism and neurophenomenology, which each on their own terms may complement and expand the original ideas of RC. Also, it keeps the door open for new generations of researchers who are willing to sail under the constructivist flag, provided they are granted the latitude necessary to formulate their own ideas, conduct their own experiments, and arrive at their own conclusions, which are not determined by any narrow constructivist paradigm. However, this does not mean that just anything goes. Some flavors of radical constructivism such as social constructionism or Roth's neurophysiological approach may run into difficulties as they accept ontological premises. This makes it indispensable to sharpen the radical constructivist profile in terms of an all-embracing set of principles.

Further on the list is the requirement that a theory should be measured in terms of being able to attend to, clarify, and solve problems, whether intellectual ones or problems with regard to society. Radical constructivism has shown its usefulness in a variety of contexts, including education research (e.g., Dykstra, 2005), sociology (e.g., Riegler & Scholl, 2012), literature, communication, and media science (e.g., Scholl, 2010), and family therapy and psychotherapy (e.g., Kenny, 2010). However, it has had little or no impact on what Karl Müller (2010) calls its "core domains," i.e., cognitive science and neuroscience, biology and evolutionary theory, and organizational theory. Still, RC's impact so far is by no means a mediocre success: which other philosophical movement has had so much influence on and has proven its usefulness in so many disciplines?

In any scientific discipline, the number of publications is a measure of its practitioners. In the radical constructivist literature, many references relate to first generation constructivists, most of whom have already passed away. Their importance has been recognized in many publications and festschrifts. However, in order to stay alive, RC needs to replenish its member pool. This goal is severely hampered by the fact that there are no official institutions that could take care of that. While university departments are the life-lines of academia, we do not find any radical constructivist departments in universities today, no radical constructivist curricula, and no organization in general that would provide the means necessary for teaching new generations of scientists and philosophers. While part of the blame goes to the disciplinary structure of academia that makes it difficult for cross-cutting transdisciplines such as cybernetics, systems theory, semiotics, and constructivism to establish themselves, there was only one larger institute in recent academic history, Heinz von Foerster's Biological Computer Laboratory at the University of Illinois at Urbana-Champaign (cf. Müller & Müller, 2007), that provided a home for the *predecessors* of constructivist thought. However, it was disbanded before the radical constructivist movement could take off (Müller, 2010). Neither of the other, now aging luminaries founded departments at universities or other academic organizations that would have, by now, attracted and taught a larger number of young radical constructivists.

An important first step to attract new generations of radical constructivists and keep the community together are events and platforms in which to participate. Over recent years, a constant number of constructivists have been gathering at the Heinz von Foerster conferences in Vienna and the conferences of the American Society of Cybernetics. In addition to that, radical constructivism needs many more avenues and focal events that help participants to create a sense of belonging to the radical constructivist community. There are mainly two publication platforms that help radical constructivists publish their ideas and insights, i.e., *Constructivist Foundations* and *Cybernetics and Human Knowing*. However, there is little done in the area of social media, which has become so important not only for private purposes but also for commercial and even academic ends. Here, much more engagement is needed from radical constructivists, not only to draw attention to the field and coordinate its future, but also simply to increase its recognizability among the vast number of other philosophical and interdisciplinary movements. While in the past the first generation of radical constructivists, most notably von Foerster and Maturana, had ingenious ideas for how to summarize key concepts in distinctly recognizable phrases, recently there has been little "branding" of that sort. Examples of those early slogans were Maturana's "Everything said is said by an observer," von Foerster's "Truth is the invention of a liar," and Piaget's "The mind organizes the world by organizing itself." They not only helped to draw attention to radical constructivism but also served as exemplars of the paradigm. Naturally, there are drawbacks with slogans that at first sight seem to contradict the uninitiated's intuition: How can everything said be said by an observer? How can the truth be a lie? How can the mind organize the world? These thus create misunderstandings, which discredit the scholarly nature of radical constructivism if presented out of context.

Still, exemplars such as these serve an important function, i.e., to counter the tendency of RC to dissolve into various flavors. While such plurality is certainly important and must not be suppressed, a movement that is divided into various small sub-movements easily falls prey to other competing theories to the point of becoming entirely marginalized, non-mainstream groups. An equilibrium has to be established that does not undercut the independence of

movements summarized under radical constructivism while at the same time defends the common theoretical core, methodology, exemplars, and predictive promises against competing movements. This, however, defines RC as a (pluralistic disjunctive) paradigm rather than a tool. Being a paradigm not only strengthens the reputation of radical constructivism as a serious scientific movement but also helps to create a strong identity pulling together researchers whose research has always had a constructivist foundation without them knowing it. As Cariani writes, "as it turns out, I have long agreed with all of the fundamental tenets of RC. . . . However, I did not realize this complete agreement until I recently saw that simple list of core principles" (Cariani 2010, p. 129).

Providing such core principles is as important as describing radical constructivism in extended texts, in particular in books in which the reader can explore the details of the theory. Unfortunately, such books are rare among radical constructivists: von Foerster, for example, has never published a monograph on this topic, and von Glasersfeld wrote just one book. Here, the talent of radical constructivists is in high demand as books are needed in greater numbers, both at the level of introductory texts and books for the advanced expert in which new problems and their solutions are explored in great detail. While not all these books will ever get the same amount of attention, a high number of book publications serves an important aspect, i.e., forestalling the impression RC is an unproductive and thus negligible movement with little scientific output.

Books and publications in general, as well as events and educational efforts, all contribute to helping radical constructivists grow the necessary internal motivation to go on with their research. Only if they can develop for themselves the feeling of being able to express their insights in front of and discuss them in a larger group of peers will they have the incentive to make the necessary efforts. This has two dimensions: an individual one and a social one.

On the individual level, self-generated reinforcement is of utmost importance. Von Glasersfeld (1983) explained its importance in the context of education. For the constructivist, instructionally designed education is plainly wrong and pupils must rather be taken to situations where they can discover the rewarding nature of increasing their knowledge on their own, comparable to the "mathematician's satisfaction in doing mathematics." It is not by rewarding their success with "certain well-known commodities, such as cookies, money, and social approval" that they develop this attitude but with "one thing that is often by far the most reinforcing for a cognitive organism: to achieve a satisfactory organization, a viable way of dealing with some sector of experience" (ibid). This can be greatly facilitated by providing radical constructivists with a helpful environment of peers. Without it, radical constructivism is doomed to stagnate, being self-satisfied with the insights reached so far and unwilling to take the baton any further.

On the social level, groups and networks can easily provide concrete and pressing incentives that both encourage and discourage authors. An example of the latter may be Alan Gross. In the early 1990s, he became well-known for his anti-realist criticism claiming that "the end product of science was a web of words and that its claims were secured by the various means of persuasion" (Gross, 2013). This led to the publication of his book *The Rhetoric of Science*

(Gross 1990). Back then, he was in the company of social constructivists[9] who brought forward similar claims, most notably Steve Woolgar and Bruno Latour's (1979) *Laboratory Life.* By the time of his 2013 article, however, he had undergone an "alteration" in his course. As he frankly writes in this article, the many criticisms his book received from realists made him change his views such that he now claims that "some theories of science seem beyond argument," i.e., that some parts of scientific reality are not constructed but independently verifiable elements in science (including diseases caused by bacteria and viruses, the periodicity of the elements, and the conversion of mass and energy as described by Albert Einstein). While cognitive flexibility, adaptability, and the ability to reflect academic opinions in one's own theories is certainly appreciated, one may wonder what result a supportive and encouraging constructivist surrounding might have yielded instead?

It clearly shows the necessity for radical constructivism to create and fill institutional anchors where "ideas can be developed, refined, and written about endlessly" and where students "can be educated, earn degrees, find jobs in academia" (Cariani, 2010, p. 130) in order eventually to provide the intellectual support for each other such that radical constructivists do not need to succumb to pressure from realists for fear of ridicule and/or their career. In other words, the future of RC goes hand in hand with its ability to create faculty positions at university and scholarly institutions. Some remedy can be expected from the permeation of academic structures by radical constructivists, as is the case with communication science in Germany. Even though there are no dedicated radical constructivist research facilities, RC is already so widespread that candidates with a constructivist background stand a chance in appointment procedures (Armin Scholl, personal communication).

In Müller's (2010) analysis, in its "early years" radical constructivism failed to create the widespread network among scientists that would guarantee a self-sustaining expansion in the 1970s. According to Müller, this applies to all main RC proponents back then. None of the relevant actors involved in von Glasersfeld's personal network had the necessary means to promote network formations, and he therefore never assembled a larger research group (and it did not help that von Glasersfeld never obtained a Ph.D). Von Foerster, who retired in 1976, was too late to assemble a number of scientists "to work on second-order cybernetics in a normal research environment" (Müller, 2010, p. 34). On the autopoietic front, Maturana, Uribe, and Varela stopped their collaboration in the 1980s. Other relevant proponents were Gordon Pask, who had developed a constructivist conversation theory but failed "to create a sufficiently strong research environment," and Stafford Beer, who introduced second-order concepts in organization and management theory but confined himself to teamwork with small groups only. A rather unfortunate strategy was pursued by Kelly, who tried to form a movement in the UK even though he lived in the US, where he not even taught his theory in his own classes in clinical psychology. As a result, he was never recognized by the American Psychological Association (Vincent Kenny, personal communication). Müller concluded that due to its weak network back

[9] It is important to note, though, that radical constructivism should not be confused with social constructivism as they differ significantly with respect to their theoretical principles. For RC, reality construction starts in the cognitive being while the premise of SC is that it is society that fabricates scientific truths.

then (which was in stark contrast to its strong theoretical output), RC failed to become mainstream in cognitive science, artificial intelligence or complexity science. Clearly, this had a major impact on the further development of the movement. Not being part of the mainstream meant being excluded from the intellectual security offered in academic and other research institutions and networks. RC found itself in a situation where it "has not been involved in any serious activities in mainstream journals or in debates with mainstream groups" (Müller, 2010, p. 37).

So another conclusion to be drawn from Gross's alteration of epistemological perspective is that for many authors, if not for an entire movement, the question is often of whether to go with the mainstream of the scientific community and entertain the reader with popular topics or whether it pays to swim against the tide and cling to core principles. In the case of radical constructivism, one conviction on this is von Glasersfeld's claim that you either have to take the idea of reality construction seriously at all levels (hence the adjective "radical," meaning making no exceptions) or you "are still caught up in the traditional theory of knowledge" (Glasersfeld, 1991, p. 16) because you believe that at least a few of our ideas and theories "represent an independent, 'objective' reality" (Glasersfeld, 1991, p. 16). Considering only some of our theories "constructions" while others are "true representations of reality" means giving up RC altogether.

While the scientific community is certainly a major target for radical constructivism, there is a still bigger community, i.e., that of human society. RC (or any scientific or philosophical movement) must ask itself the question: What are the implications for society? Does it help to make society better? Can it create "killer apps" that attract the attention of the masses and of funding? Cariani (2010) names a few such targets within the reach of RC, including enhanced educational technologies and autonomous robots, as well as better psychological and social theories. Another important field could be that of knowledge management. It is the transformation from an information-based to a knowledge-based society that results in an increased need for knowledge discovery and knowledge management. In this context, RC replaces the concept of absolute and mind-independent information "out there" in favor of asking how knowledge comes about. It therefore provides a framework for alternative forms of knowledge management that excel traditional approaches that have proven insufficient as solution strategies for complex problems and the demands of a faster moving global economy, science, and culture. Such a radical constructivist knowledge society would be characterized by its ability and willingness to revise knowledge continuously rather than to cling to traditional habits.

The Future

As stated at the beginning, the future of radical constructivism should be considered for each of its three versions.

The future of von Glasersfeld's original radical constructivism is certainly assured in educational research (Tobin 2007). In addition, as von Glasersfeld always emphasized that his theory is a theory of rationality, the question arises of whether it can account for a wide spectrum of cognitive processes, including non-conscious and emotional aspects. Questions such as "Who does the reality constructing?" must be attended to in the light of recent insights in consciousness

research, in particular Benjamin Libet's (1985) claim that what we call free will is but an illusion as all our deliberate decision-making is dictated by the non-consciousness. Given the nature of the limbic system, which not only works outside conscious control but in fact may be the ultimate authority for any conscious action, the relationship between cognition and emotion needs to be addressed in radical constructivism.

The future of the extended interdisciplinary version of radical constructivism has recently been boosted by attempts to rejuvenate the research program of the 1960s and 1970s. The main proponent is the group around Karl Müller on Second-Order Science (see also a forthcoming issue of *Constructivist Foundations*). The goal is to re-invent its "rich cognitive tradition for the emerging science landscapes of the 21st century" (Müller 2010, p. 37). Six steps are proposed including the accommodation and adaption of early years RC to fit the current research landscape; the promotion of RC in new areas such as situated cognition, computer-mediated learning environments, self-reflexive economic modeling or cognitive psychology; and a "small number of highly active research nodes within the radical constructivist network in its current application domains of media sciences, the social sciences, family therapy, architectural design or organizational learning" (ibid). Furthermore, mainstream publications must be dramatically increased and RC courses be implemented. To have a future in the mainstream, RC must also define open problems and conflicting views, which would make it possible to enter into a scientific debate with mainstream groups.

The future of the third, pluralistic version of radical constructivism is linked with the question of plurality in science. It was Karl Popper who introduced falsificationism in philosophy of science, claiming that in science, testing alternative theories must be possible at any moment. This leads to a methodological pluralism of theories (Popper, 1970). However, according to Popper, pluralism as a method does not imply pluralism as a goal because for the non-constructivist Popper there is only one truth that can be the superior goal of science. For him, it all boiled down to searching for an all-encompassing theory that explains as many empirical phenomena as possible based on as few theoretical assumptions as possible. Clearly, this cannot be the goal of RC for there is no place for an absolute observer-independent conception of truth. In other words, RC subscribes to Popper's ideal of theory pluralism (and as this paper has shown, there are plenty of radical constructivist approaches to choose from) without buying Popper's ontological monism. However, as pointed out above, the large number of constructivist approaches and the partial incompatibility that comes with this fragmentation could easily lead to a heterogeneous radical constructivist landscape in which scholars lack mutual support and understanding from peers. So, plurality in RC *without* defining it as a paradigm, which unifies theoretical, methodological, empirical, and programmatic aspects, would certainly lead to disagreement and incompatibility among the participating constructivist approaches.[10] Characterizing RC as a mere problem-solving tool would eventually weaken the movement.[11]

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[10] Here, RC clearly parts from postmodernist movements, which like to deconstruct all paradigms because coherent theories are considered as totalizing.

[11] A case in point is Kelly. Most of the published research related to Kelly's PCP was done using his methodology (repertory grid technique), but lacked reference to the theory itself. So separating tools from

Conclusion

In order to have a future, radical constructivism must go beyond the problems of philosophical acceptance (cf. Gadenne, 2010), i.e., it must overcome the aversion towards it due to deeply-rooted intuitive convictions. Armin Scholl (2010, p. 54) aptly pointed out that discussions such as whether or not RC denies reality reduces RC "to epistemological questions only and ignores the self-referential logic of second-order cybernetics." Rather, it must aim at replenishing its followers and practitioners by showing its usefulness in various disciplinary contexts and in specific empirical research questions. Educational science is a good case in point as it has developed practical concepts from a constructivist perspective. It is the daily puzzle-solving of normal science that is convincing. While it cannot and must not replace the big epistemological debates' painstaking and detailed work in daily research, it is necessary to show that these debates are not an end in themselves. In the case of radical constructivism, these efforts must continue to address traditional areas such as communication science, life sciences, learning environments, organizational studies, media science, social science, family therapy, architectural design, and organizational learning (Müller, 2010). However, new empirical territories need to be added as well:

- Quantum mechanics, where RC provides an alternative to realist-based interpretations of QM that includes Bayesian, Neo-Kantian, phenomenological, anti-realist information theoretical, and quantum cognition approaches showing that quantum structures do not just apply to a mind-independent physical world. A special issue of *Constructivist Foundations* on Constructivist Interpretations of Quantum Mechanics is in preparation.
- Cognitive science (Riegler, 2007), artificial intelligence and autonomous robotics (Ziemke, 2001), and computational theory in general, where RC can assess the philosophical and conceptual significance of the computational approach, e.g., whether it is possible to formulate computational models of constructivist processes, and whether computational models can ever create something new. In particular, the specific question of whether computer models are useful heuristics for stimulating an individual's construction of reality needs to be explored. Actual computational models of constructivist concepts and processes and results from conducting experiments with them will significantly contribute to detailing the empirical component of the radical constructivist paradigm. Cf. also the forthcoming special issue in *Constructivist Foundations* on Computational Constructivism.

In all these disciplines, traditional and new, it is important to find exemplars and make predictive promises against which the usefulness of radical constructivism can be measured. Together with the theoretical cores described at the beginning of this article and its reflexive, observer-including methodology, RC will constitute a large paradigm that is ready to conquer current and future problems.

So on the one hand, radical constructivism must demonstrate its usefulness as a "power tool." The goal must be to find wide acceptance in academia (in particular by accounting for

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theoretical principles does nothing to help the model to evolve (Vincent Kenny, personal communication).

counter-intuitive aspects of RC in terms of intuitive premises), which in turn will help to find greater acceptance with more followers who can work on empirical ways to prove its usefulness.

However, on the other hand, radical constructivism must also define itself as a *pluralistic paradigm* in order to create a stable, self-sustaining network of researchers and institutions that allows new generations of constructivists to develop and research constructivist concepts and experiments without being exposed to peer pressure to water down their radical constructivist position.

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