Radical Constructivism and Second order Cybernetics

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Why the equation?

It is so common that it may be considered almost universal among second order cyberneticians, to identify second order cybernetics and radical constructivism, distinguished as opposite sides of the same coin. It is perhaps not so common that radical constructivists make this equation: they seem much more interested in the influence of radical constructivism in other subjects, especially education. However, no one should be surprised that there might be a strong similarity of some form, for two reasons.[2]

First, von Glasersfeld, who began his professional career (in 1947) as a translator for Silvio Ceccato, the founder of the Italian Operationist School, progressed (1959) to working as a cybernetician with Ceccato in his laboratory in Milan. When, in 1967, he left for the United States he had had a very good training and long experience in cybernetics and was equipped with deep cybernetic understandings, particularly concerning language. I remember when I first went to the US, my professor Gordon Pask advised me to visit von Glasersfeld as part of my tour of significant cybernetic thinkers, although we could not arrange to meet then. Von Glasersfeld's first writing specifically on radical constructivism dates from the mid 1970s, when "radical constructivism" is first named in "Piaget and the Radical Constructivist Epistemology" (Glasersfeld 1974). At this time, his work was focussed on education, in collaboration with Jack Lochhead, at Amherst.[3] In fact, a couple of months before his death, at his last public appearance (at the ASC conference in Troy NY on 3rd August 2010), von Glasersfeld insisted "my life has turned out to be an illustration of a cybernetic principle." (von Glasersfeld 2010). We perhaps need his reminder that he was, and remained, first and foremost a cybernetician.

Second, von Glasersfeld was a good friend of Heinz von Foerster, who named second order cybernetics (as Wiener had named (first-order) cybernetics), as well as of many of the others involved in what was, at the time, presented as the shift from first to second order cybernetics:[4] and he regularly attended meetings of the American Society for Cybernetics. He was awarded the ASC's Wiener Gold Medal in 2005, and his last public appearance was on 3 August 2010 at the ASC conference "Cybernetics: Art, Design, Mathematics – A MetaDisciplinary Conversation" held at RPI, Troy NY, near his home. He gave a wonderful after dinner address in which he made the statement quoted above.[5]

Late in his life, he was feted in Vienna by the Austrian Government and the City of Vienna, through the efforts of the Austrian philosopher Joseph Mitterer, and the (Viennese) Heinz von Foerster Society.

Given these two reasons, it would be surprising if there were not a significant connection between (second order) cybernetics and radical constructivism. It is my intention in this paper to explore what this relationship might be, or, at least, some of what it might be. I do this by taking the list of core ideas of radical constructivism von Glasersfeld himself prepared in his paper "Aspects of Constructivism. Vico, Berkeley, Piaget." (English translation in Glasersfeld 2007), to show how these core ideas exist in second order cybernetics.[6] Perhaps, some time, someone will do the same in reverse – take the key ideas of second order cybernetics and show how they exist in radical constructivism. My list of core ideas prepared already a decade ago, is ready and waiting, and may be found at the end of this paper!

My hope is to demonstrate there is substance in the equation of the two. Since von Glasersfeld's work is always concerned with the epistemological, the work I refer to in second order cybernetics comes from

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[2] Alexander Riegler points out that SJ Schmidt brought together radical constructivism and second order cybernetics in 1987. This work is in German and there is no English translation. As I do not speak German I have not read this. I therefore take Riegler at his word. Schmidt's article is referred to by Karl Müller (2010) in his critical assessment of radical constructivism, where Müller points out that Schmidt's selection of cybernetic thinkers was very particular, and excludes several figures who are important in my account.

[3] Since this paper is not primarily concerned with the working relationship between Glasersfeld and Lochhead, I do not try to unpick it here. It is clear Lochhead's contribution is considerable, and awaits proper scholarly explication.

[4] The reader will find more about the relationship of first and second order cybernetics within the paper. I have come to believe that all cybernetics is essentially second order, first-order cybernetics being a simplification,

[5] http://www.asc-cybernetics.org/2010/?p=2700, visited 1 January 2011.

[6] I thank Alexander Riegler for pointing me to this particular list.

the more philosophical of its adherents: the reader should not take the sources used in this paper as a balanced sample!

Cybernetics and Human Knowing is a journal for second order cybernetics, and the relation between first and second order cybernetics has been explored here on a number of occasions (e.g., Glanville 2002),. Therefore, I do not provide a section summarising first and second order cybernetics in this paper (although there are explications in the body of the text), nor will I cover the transition between the two although relevant aspects of these stories appear under the headings of the rest of the paper. However, to help us start, we can borrow a distinction: von Foerster et al. (1974) created the name and described second order cybernetics as "the cybernetics of observing systems," in contrast to first-order cybernetics "the cybernetics of observed systems." I have recently suggested the alternative, first-order cybernetics is interested in the observer of the system, second order cybernetics is interested in the observer in the system.[7]

In the body of my argument in this paper, von *Glasersfeld's text is in italics*: my commentary, consisting of examples central to and coming from second order cybernetics, is in plain face.

Ernst von Glasersfeld: The core of radical constructivism

The key ideas of this post-epistemological approach[8] to the questions what is knowledge and how do we come to have it, can be summarised as follows:

1. What we call "knowledge" does not and could not represent a world that is supposed to be beyond our experiential interface with it. In this, constructivism agrees with the sceptics. But, like pragmatism, constructivism introduces a modified concept of knowledge. Knowledge pertains to the way in which we organise the world of our experience.[9]

Cybernetics originates as much from the Macy Conferences (1946–53) (Pias 2003) as from Wiener (1948). In fact, Wiener was a member of the Macy Group. The Macy Group had as its mission the study of "circular causal and feedback mechanisms in biological and social systems." Thus, the origins of modern cybernetics are less in the mechanical and mathematical (which Wiener presents in *Cybernetics*) and more in what we think of as softer sciences (Heims 1991). These are often so called because it is hard to apply Newton's mechanical model, which remains the ideal of much scientific research, because of the unavoidable and changing presence of the observer. The observer's presence means that observations made are particular and specific, requiring us in turn to modify how we think about repeatability. Acceptance of the presence of the observer in the system is central to second order cybernetics.

Another member of the Macy Group was Gregory Bateson. Bateson had a strong philosophical bent. He discussed matters of knowledge and its possible relationships to a possible world throughout his work. Bateson is one of the early cyberneticians who takes a position that informs and shapes cybernetics in the second order mold. For Bateson, the observer was always present, and the world was always constructed through experience. See the opening of "Pathologies of Epistemology" (Bateson 1969b), in his collection *Steps to an Ecology of Mind* (Bateson 2000), where he explains to the audience that they do not see him (i.e., their knowledge of him is not representational).

Bateson's position is explicitly explained in a conversation between him, Margaret Mead (his former wife) and Stewart Brand (Kleiner & Brand 1986). Here, Mead and Bateson discuss the inevitability of being inside the system. On page 34, Bateson insists to Mead: "and you are part of the bigger circuit."

After a short exchange, he continues

> "… And you're not really concerned with an input-output, but the events within the bigger circuit, and you are *part of* the bigger circuit. It's these lines around the box (which are just conceptual lines after all) which mark the difference between the engineers and …
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> "And Wiener is inside the box; I'm inside the box …"

To which Mead replies, "I'm inside the box …"

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[7] For instance, in my inaugural lecture "Freedom and the Machine" given at University College, London, March 10, 2010 (Glanville 2010b).

[8] Peter Cariani made an interesting analysis of these 7 core points in a recent issue of Constructivist Foundations (Cariani 2010).

[9] This point is very clearly argued in Riegler (2001), whose account of the key points of constructivism was very helpful in establishing the arguments in this paper.

We should not forget Mead's background and research in anthropology, in particular her early adoption of the participant observer – surely a second order cybernetic concept – mode of research (Mead 1948).

One of Bateson's notions is particularly relevant to von Glasersfeld's core: the Explanatory Principle. Bateson denied that gravity, for instance, existed per se: he saw it as an explanatory principle. Gravity is not something that exists in a "mind independent reality"[10]: rather, it is a construct invented to help us explain our experience. It is not representative of anything in that world, but it is invented, pragmatically, in order to explain. Thus, it allows us to organise our experience and to fit von Glasersfeld's first constructivist requirement.

Bateson's Explanatory Principle is invoked in the Metalogues (stylised dialogues that do what they discuss) he held with an imaginary daughter, possibly modelled on dialogues held with his daughter Mary Catherine Bateson – especially the seventh metalogue, "What is an Instinct" (Bateson 1969a). It is one cybernetic understanding that provides a "mechanism" for bringing into effect von Glasersfeld's much favoured Piaget assertion "Intelligence organises the world by organising itself" (quoted in Glasersfeld 1992b).

Another view which removes representation from being part of the equation is that put forward by Humberto Maturana. From his early work on the "What the Frog's Eye tells the Frog's Brain" (Lettvin, Maturana, McCulloch & Pitts 1959), Maturana showed the notion of representation of the real world in the nervous system was untenable: there is no small chair in our brain that a worldly chair we perceive can be associated with – and there is no small fly in the frog's brain. The nervous system does not work through representation. Maturana developed this understanding, through the *Biology of Cognition* (1980) and "Autopoiesis" (Varela, Maturana & Uribe 1974), the cybernetic statement of the organisation and functioning that comes into being and then maintains itself – which they argue is life – to *The Tree of Knowledge* (Maturana & Varela 1998), where he discusses the biological basis of knowing, and the complementarity of evolution and cognition. Maturana's way of dealing with the problem of the non-connection of experience and the nervous system is to talk of co-ordination, and the co-ordination of co-ordination, in a manner that brings to mind Saussure's (1966) discussion of the relationship between the representing and the represented as the bringing together of arbitrary items in temporary synchrony. Von Glasersfeld explains this with admirable clarity, in Glasersfeld (1974).

Apart from von Glasersfeld himself, Bateson and Maturana are the two second order cyberneticians who most clearly argue that what we know is not a representation of the world, but rather a way of organising (explaining) our experience. This interest in existing in experience is a strong theme in second order cybernetics, as one would expect in a subject that takes as given the presence of the observer, observing. As von Glasersfeld (1992a), wearing his cybernetician's hat to write the Declaration of the American Society for Cybernetics, liked to say, objectivity is "…a subject's delusion that observing can be done without him."[11]

2. Radical constructivism does not deny an ulterior reality; it follows Vico in that it denies that human rational knowledge can attain a God-made world or produce anything that could rightly be called a representation of it.

What I take this core comment to say, along with Vico (as articulated by von Glasersfeld in the paper in which this core list is presented in Glasersfeld 2007)), is that we cannot either assert or deny the existence of a mind independent reality (we cannot attain a God-made world).

One of the most quoted aphorisms of von Foerster concerns situations we can neither assert nor deny. He said, "Only those questions which are in principle undecidable we can decide" (Foerster 2003).

The question "Is there a reality independent of the mind?" is clearly an undecidable question (in the technical sense). Von Foerster's aphorism reminds us that, under the conditions of undecidability, if there is a decision to be made, we must make it according to our own judgement. We are, therefore, responsible for this decision. We may choose to act as if there is a mind independent reality, or we may choose not to. The choice is ours, as are the consequences.

At more or less the same time von Glasersfeld coined the term radical constructivism, and never having heard of Vico, I stated a similar position in my PhD thesis (Glanville 1975: 15). In the second statement at the beginning of the argument, I assert the following (where, according statement 0. 0, preceding, "it" is something that might exist):

[10] I use the term used by the late Herbert Muller on his Karl Jaspers discussion forum, http://www.kjf.ca.

[11] This quote has been attributed to von Foerster by almost every author in the field, including myself. However, careful research by Albert Müller has shown that von Foerster did not write this; von Glasersfeld did.

"0. 0,1 If we cannot observe it, we cannot know it exists.

We cannot necessarily affirm its non-existence, either."[12]

This thesis may be considered a "lost document" of second order cybernetics,[13] concerned to answer the question: how, given that the experience (which we come to believe is of something) is distinct for each observer, we (different) observers can believe we are dealing with the same something ("Object," as I call it). The first move is to propose that, for something to exist in this universe of observation, it must observe itself. This observation is, of course, invisible, being self-referential and not open to the view from outside. I explore the possibilities of observing and being observed inside, outside and across the boundary of any Object in Glanville (1994). Self-observation is an explanation, not a truth (see Bateson, above).

Second order cybernetics, through understanding and accommodating the observer's essential presence, denies we can attain a God-made world.

3. It agrees with Berkeley that it is unintelligible to attribute existence to anything that cannot or could not at some time be perceived, because, as he said, "there is no rational evidence for the existence of an independent reality."[14]

I believe Norbert Wiener (popularly credited with the contemporary invention of cybernetics, though it would be more correct to say he named it[15]) made a massive tactical error when he published *Cybernetics, or Control and Communication in the Animal and the Machine* (Wiener 1948) before (the 1954 revised version of) *Human Use of Human Beings* (Wiener 1954).[16] *Cybernetics* is a very technical book, leading people to see the subject as a technology. For some it remains just that – almost control engineering. Subtitled "Cybernetics and Society," *Human Use of Human Beings* is a much more philosophical book concerned with the consequences of the ideas on which cybernetics was founded. Here, talking of the significance of Einstein's Relativity and Gibbs' statistical mechanics, Wiener is quite explicit:

> "…a shift in the point of view of physics in which the world as it actually exists is replaced in some sense or other by the world as it happens to be observed, and the old naïve realism of physics, gives way to something on which Bishop Berkeley might have smiled with pleasure." (Wiener 1954: 20)

Normal arguments about second order cybernetics have placed Wiener firmly in first-order cybernetics, and have talked about second order cybernetics as a reaction to this. However, *Human Use of Human Beings* shows Wiener in a different light. Thus, a paper by Bernard-Weil (1994) published in a volume celebrating the centenary of Wiener's birth, questions the placing of Wiener in the first-order cybernetics camp.

Furthermore, Flo Conway and Jim Siegelman's biography of Wiener makes a related point which they attribute to a comment made by Gordon Pask in the 1950's:

> "Wiener …realised there was another step to take, but did not know how to do so. He was waiting for others to pick up the baton and run with it, to complete the forming of the subject he had begun." (Conway & Siegelman 2005: 334)[17]

Remember, second order cybernetics, in von Foerster's (1974) initial description, concerns "the cybernetics of observing systems." This is in contrast to first-order cybernetics "the cybernetics of observed systems" – or my observer in/observer of distinction. Here the emphasis on observing clearly places second order cybernetics in Berkeley's camp, with the choice of observing (rather than observed) systems emphasising the importance and role of the (unique) observer, and of observing as an act with

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[12] As so often, there is a terminological problem here. I am using observe with an abstracted meaning, indicating sensing an experience. The vocabulary of my PhD is always difficult, yet, no matter how unsatisfactory, in over 35 years I have not been able to find better words.

[13] Pask and Von Foerster each, independently, remarked on this to me. In the 1980s, when a publisher was intending to publish this thesis, both wrote introductions to this effect. However, the publication project fell through, and so the texts were never used.

[14] Popkin (1951: 230), quoted in Glasersfeld (2007).

[15] This assertion is one found on a page of quotes collected by Paul Pangaro. See http://cyberneticians.com/cybernetic-quotes.html, visited 5 February 2011.

[16] Graham Barnes points out to me that the 1954 and the 1950 editions of "Human Use of Human Beings" are very different. The earlier edition is shrill and bellicose. In the 1954 edition, Wiener is much calmer and more rounded in what he states. His references, especially to contemporaries, are also much more considered. Throughout this paper, I refer to the 1954 revised edition.

[17] Actually, they are quoting me. I reported Pask saying this in Glanville (2002), which is their source.

precedence: we occupy and define a cybernetic world as a result of observing and we study it by studying observing in a manner developing and reflecting cybernetic understandings.

Finally, I remind the reader of von Glasersfeld's comment about objectivity, already quoted. Objectivity is "…a subject's delusion that observing can be done without him."

4. It takes from Vico the basic idea that human knowledge is a human construction, an idea which Piaget – who, I believe, did not know the Neapolitan philosopher – developed very much further by minutely mapping the constructive conceptual operations by means of which human subjects furnish their experiential worlds.

One of the best known early texts of second order cybernetics is von Foerster's (1973) "On Constructing a Reality," a title that asserts the second order cybernetic position on knowing and experiencing: that we (necessarily) construct our realities. Von Foerster begins his paper by quoting the initial command of Spencer Brown's *Laws of Form* (1969): "Draw a Distinction!"[18] Von Foerster argues the inevitability of the observer's involvement in experience, and from that experience, the construction of reality (and knowledge of that reality) that von Glasersfeld attributes to both Vico and Piaget. Spencer Brown's Logic is, itself, a logic of construction, rather than a construction of relation, argument or truth. It is concerned with bringing into being – by drawing distinctions.

In my Ph.D thesis, I take a similar position (which I have continued to develop ever since). One stream I have developed concerns design, which I see as being an essentially constructivist act, well described as holding a conversation with the self through paper and pencil. I have rehearsed many of the major elements of this position in Glanville 2006. In a short recent piece republished as (Glanville 2010a), I pushed this argument to insist that design is the basic cognitive act: that we design our concepts and we design the ways we compose our concepts together, after the manner of George Kelly (1955). In this, I reflect Piaget's assertion that "Intelligence organises the world by organising itself" providing a mechanism based firmly in Pask's second order cybernetic conversation (see below).

An earlier, foundational cybernetic concept is the Black Box, borrowed by Ashby from James Clerk Maxwell.[19] I have worked extensively on understanding the Black Box within a second order cybernetic framework, starting from Ashby, and have published summaries recently in this journal (Glanville 2007, 2009). The Black Box is a marvellous device, often misunderstood. It is a construct, a thought experiment put in place by an observer where a change is observed, in order to explore this change.

A Black Box is inserted where an observer observes change. The inserted Black Box treats change as occurring between two elements, an input, and an output believed to be consequent. The observer observes the change as if created in the Black Box and puts new inputs (usually the output) into the Black Box, seeking to construct regularities that account for these observed changes in behaviour, taken to be caused by the Black Box (a nonsense, since the Black Box is a conceit). Engineers treat the Black Box as openable, but in the second order cybernetic understanding, the Black Box cannot be opened. The regularities are constructed by the observer, so the knowledge acquired is a construction, based on a profound ignorance (not only can we not get into the Black Box, but "it's not really there"). It is worth commenting that, on occasion, Ashby understood cybernetics in an explicitly second order manner. In his 1958 paper on the Black Box, he talks of the Black Box system as containing the observer: the performance of the Black Box is more correctly understood, says Ashby, as the performance of the Black Box together with its observer – which is the form in which we have analysed it.

My route to understanding the Black Box was through Ashby. But von Glasersfeld also wrote extensively about the Black Box. In a statement that might have come from Ashby's paper, von Glasersfeld (1974) remarked "The world is a Black Box too, with which we deal remarkably well." Here is an obvious crossover between radical constructivism and second order cybernetics.

5. Constructivism drops the requirement that knowledge be "true" in the sense that it matches an objective reality. All it requires of knowledge is that it be viable, in that it fits into the world of the knower's experience.

I have found this core statement the hardest to write about in terms of second order cybernetics, for, I believe, two reasons.

[18] This book has a difficult publication history. It was initially published (in 1967) privately. The first "big" publication was in 1969, which is often given as the date of first publication.

[19] Almost all early cyberneticians quote the Black Box. But Ashby was the one who made most use, and who claimed early on that the Black Box might be a model for understanding everything – a position I share.

First, it seems that this point is already anyhow covered in the other points.

Second, it does not seem particular to radical constructivism (or second order cybernetics): rather, it just seems obvious!

However, in order to complete my undertaking (to write under each core point) I offer the following.

If we cannot know objective reality (the God-made world), what option have we but to rely upon the test of viability: something remains knowledge until we disprove it. This is the position Popper argues for the status of scientific knowledge (the context into which Popper wishes the knowledge of his interested to fit). In *Conjectures and Refutations* (Popper 1963), he argues that scientific knowledge is always provisional: we construct it as explanation and then we continue to test it. While it continues to pass the tests it is held to be what von Glasersfeld refers to as viable. When (provisional) knowledge fails, we either improve it to accommodate the failure, or we completely rework it (a more revolutionary act). Thus, scientific knowledge is provisional, and it is continuously tested to breaking point when it is rejected, to be replaced by "better" knowledge. These views of Popper's are often thought of as over-optimistic, failing to fully recognise that science is a social activity carried out by human scientists, themselves frail. Nevertheless, human frailty should not be taken as an excuse not to aim for the best!

However, the notion of viability that Popper espouses and which seems to me to be inescapable when a radical constructivist position is taken, is central to one of the major developments in cybernetics, Stafford Beer's "Viable Systems Model" (VSM) (Beer 1972). Beer invented what became known as "management cybernetics," and many believe VSM is a pinnacle in his work.

What Beer means by a viable system is one that can sustain its own autonomy: much the same requirement as Varela, Maturana and Uribe (1974) require for their autopoietic systems (Beer worked with the Allende government in Chile, and was associated, there, with Maturana and his colleagues). VSM has a whole technology associated with it, and is part of a very sophisticated organisation of subsystems that organised to accommodate different aspects of the realities Beer understands us to face within society. This organisation remains valid because it is viable, not because it is true. Equally the behaviour that results from employing VSM is also viable: it works.

A final, short anecdote: I asked von Foerster why, given his philosophical position, he believed so strongly in mathematics? He replied "Because it works." He likened mathematics to the BART transit system in San Francisco: you can walk, but where BART available, it gets you where you want to go, quicker. In this sense mathematics is viable. I take this anecdote as indicating something of the mindset that a second order cybernetician takes: we use tools because they work for us now, not because they are eternally "right."

Viability is a pragmatic quality. For all its occasional theoretical strangeness, second order cybernetics is born out of a deeply pragmatic consideration: how on earth can we cope with the absurdity of believing that observing can be done without us?

6. Inherent in radical constructivism is the realisation that no knowledge can claim uniqueness. In other words, no matter how viable the solution to a problem might be, it can never be regarded as the only possible solution.

Ernst von Glasersfeld was a cybernetician before working in constructivism. He continued to work in cybernetics until his death. He wrote an essay characterising cybernetics for the American Society for Cybernetics (Glasersfeld 1992a), where he asserted "Cybernetics is a way of thinking, not a collection of facts."

It is a way of thinking. That is, it is one way of understanding. Ways of thinking are chosen. The way of thinking that is cybernetics is, and the ways of thinking that are cybernetics are, not the only possible way(s) of thinking. The realisation that no knowledge can claim uniqueness in von Glasersfeld's sense is already built into his characterisation of cybernetics.

In a cybernetics concerned (as second order cybernetics is) with observing systems, the way of observing can always be seen as a choice. And while most second order cyberneticians are interested in the generality of this understanding, all insist that it depends on the uniqueness of each observer, and of each occasion. It is probably not unreasonable to claim that knowledge depends on observation: and it is certainly very second order cybernetic to claim this, so the qualities of observation are part and parcel of knowledge.[20] Just as observation depends on the unique observer (and the unique occasion), the knowing equally depends on the knower – and the constructions that the knower makes.

[20] I prefer knowing to knowledge, since it better reflects the presence of the knower.

Gordon Pask's work[21] was based in knowledge and its relationship to the learner, and played a major role forming second order cybernetics. Indeed, his early work on truly interactive machines (MusiColour, SAKI – Self Adaptive Keyboard Instructor, Eucrates) is already second order cybernetic: interaction is a concept well handled in second order cybernetics.

Pask's interest always veers towards education: although he had important remarks to make concerning epistemology and the structure of knowables, he was more interested in the creation of knowledge through learning than in knowing this knowledge (which is why I have not mentioned him earlier). His major contribution is summarised in what he called "Conversation Theory" (e.g., Pask 1975). There are 2 central aspects of Conversation Theory which are relevant here, demonstrating von Glasersfeld's core point 6.

First, that which might be learnt (the collection of learnables (he called them knowables, which I take to be an unfortunate slip)) is organised in a vast, richly connected mesh Pask called an Entailment Mesh. This has a very special structure which I will not discuss here.[22] Pask's mesh contains a vast number or routes by which a learner may learn a subject. Each route is a different, but viable, way of knowing. The success of a student in learning is tested through a process of teachback, in which the student presents in their own way what (s)he learned in an expression of his/her own understanding.

Second, Pask insists that education is about learning rather than teaching. In my understanding, Pask intends that the responsibility and the understanding in learning lies primarily with the learner, not the teacher. Each learner will learn what is learnable in their own way: the understanding will be theirs, as will the route they took to learn it in the Entailment Mesh.

Pask was an important figure to von Glasersfeld.[23] One example of Pask's importance can be found in a short memorial piece, "Remembering Gordon Pask" (Glasersfeld (2001)), where the significance of the conversational insight (of modelling the other as well as the self) and of the conversational approach is extolled.

My own PhD Thesis (Glanville 1975) develops a set of concepts and a formalisation that accommodates, expresses and explores this position, starting from a consideration of the presuppositions contained in such a remark as "I know this."

From this simple statement, the presence of the active knower (and the active observer) is established. Given the uniqueness of each knower/observer, what each knows/observes is necessarily distinct from each other knower/observer. This difference is a difference in principle.

Thus, in the second order cybernetic world view, at base everything known/observed is distinct. There is no "right" view, although (using conversation) there can be agreed knowledge, for which the only conceivable test is that it is, and continues to be viable.

7. This last consideration, together with Leo Apostel's admonition that "a system should always be applied to itself,"[13] leads to the conclusion that radical constructivism cannot claim to be anything but one approach to the age-old problem of knowing. Only its application in contexts where a theory of knowing makes a difference can show whether or not it is a viable approach.[24]

In her paper "Cybernetics of Cybernetics"[25] (1968), Margaret Mead who contributed crucially to the founding of cybernetics, invited members of the American Society for Cybernetics to consider the functioning of their own society through the lens of cybernetics (she also reported that she had earlier suggested something similar to the Society for General Systems Research, now the International Society for Systems Science). This term was used as a synonym (along with Pask's preferred "new cybernetics") for what we have come to call "second order cybernetics." Mead demands we do cybernetics

[21] Pask worked through a research company (System Research Ltd) he founded with his wife Elizabeth and Robin McKinnon-Wood, in 1953. The work attributed to him is often the outcome of close collaboration. In the case of Conversation Theory, the main collaborators were Bernard Scott and Dionyssius Kallikourdis, along with Pask's doctoral students at Brunel University, where his fortnightly seminars focussed on particular problems within his developing theoretical and experimental framework that he was struggling with at the time; and the workshop seminars, also at Brunel, he shared with Laurie Thomas.

[22] For some key aspects of the construction logic for an Entailment Mesh, see Pangaro's "A Model of Entailment Meshes" at http://pangaro.com/entailments/entailing-v2.htm visited 28 March, 2011.

[23] On being told of Pask's death, Glasersfeld told me Pask had been an enormous influence on him and his thinking.

[24] Apostel (1977: 61), quoted in Glasersfeld (2007).

[25] The paper was given named by Heinz von Foerster.

cybernetically: and a key feature of cybernetic systems is that they are circular and involve interaction between the observer and the observed, the controller and the controlled, etc.

When von Foerster described second order cybernetics as the cybernetics of the observing system (Foerster et al. 1974), he was referring to this notion. For him, as for others, the notion of observing that is central within a cybernetic system, had to be applied to the processes of observing the cybernetic system itself: it is not just a matter of consistency, but of respecting the fundamental value of the field. Nor it is simply a matter of consistency, but of remembering that observing is central to the cybernetic way of viewing.

The notion of a subject reflecting his approach to the world in its approach to itself, or as Apostel puts it in von Glasersfeld's translation, that a system should always be applied to itself, is thus the key concept at the origin of second order cybernetics. Recent consideration has shown that this notion was not new in cybernetics. Several authors (e.g., Bernard-Weil (1994)) have either argued or stated that the first generation of cyberneticians understood this insight. The daughter of Mead and Gregory Bateson, Mary Catherine Bateson, who used to deny the value of second order cybernetics (because, she said, Gregory had never spoken about it) recently came to share this view. She agreed that Mead and Bateson never mentioned second order cybernetics because they were doing it and it was presumed, so it did not need to be mentioned (Bateson, personal communication in 2006). Under these circumstances, we can take it that all of cybernetics is, or should aspire to be, second order cybernetics.

Second order cybernetics is powerful, but it is not everything. Even within the world in which cybernetics can be appropriately (and viably) used, the first-order cybernetic formulation is sometimes more helpful than the second – for a variety of reasons. I like to draw a parallel between this, and the American moonshots. The Lunar Excursion Modules were sent to the moon using the mechanics devised by Newton. While Einstein's may be more up to date and more general, his mechanics are certainly neither needed nor appropriate (and only questionably viable) for moon landings! Second order cybernetics is viable where it is viable, but is not viable everywhere. It is appropriate where it is appropriate, but is not appropriate everywhere.

Thus, second order cybernetics satisfies this final core point of radical constructivism.

Conclusion

I have shown that the items von Glasersfeld places at the core of radical constructivism can be taken as headings under which important concepts of second order cybernetics can be placed. In this sense, I have shown that second order cybernetics has concepts to match all von Glasersfeld's core points of radical constructivism. I have not shown that radical constructivism had the concepts to place under similar core points of second order cybernetics.

In this sense, I believe I have shown that second order cybernetics and radical constructivism might be understood as opposite sides of the same coin, or, more precisely, that radical constructivism expresses at least an aspect of second order cybernetics. This leaves von Glasersfeld in the cybernetic camp (where I believe, following his final public statement, he saw himself (von Glasersfeld 2010)), developing a deep epistemological understanding that acknowledges the criteria proposed by second order cybernetics. Radical constructivism, then, is seen as an important perspective within a general (second order) cybernetic way of viewing. From my own knowledge of von Glasersfeld, I would say that he would be happy with that positioning.

The way I have developed my argument has been to place second order cybernetic arguments and observations under the headings of Glasersfeld's own core concepts of radical constructivism. To fully complete the argument, it would be necessary for someone whose background is in radical constructivism to attempt to show how radical constructivism might fit under headings that describe second order cybernetics. Doing so might create an identity between the two subjects. However, this is beyond the scope of the paper. But, in order to leave the matter open, I end with a list I made of characteristics of second order cybernetics (Glanville 2002), that might be taken as "the core of second order cybernetics."[26]

- Application of understandings to self. Second order cybernetics is developed when the understandings developed in cybernetics are applied to the subject itself, thus enhancing the subject.
- Ethics. Second order cybernetics provides an essentially ethical understanding.

[26] This list is quoted directly and without modification from Glanville 2002. I might wish to slightly develop it, but for the sake of consistency and academic propriety, I have chosen not to make any changes in the quote used.

- Observer included. No observation can be made without an observer (i.e. "Everything said is said by an observer"), and each observer is different. Therefore, what each observer observes must be thought of as different. So each observer is responsible for his own observations, for only he can make them.
- Stability from within. In second order cybernetics, stability, understood as continuing-to-be, is a quality that comes from within the system and its ability to sustain itself, not from comparison to an external reference.
- Self-reference. The quality of continuing-to-be, of stability coming from the sustaining of the self, is self-referential. Self-reference is at the heart of second order cybernetics, and brings with it autonomy and identity.
- Mutual reciprocity. Arguments in second order cybernetics depend on the Principle of mutual reciprocity, which requires that when a quality is attributed to one system, there must be a potential for the same quality to be attributed to the system it is distinguished from.
- Conversational communication. Within second order cybernetics, communication is conversational and meanings are personal: meanings are not communicated, but individually constructed by the participants, who are therefore responsible for them.
- Improvement, not perfection. Second order cybernetics does not claim to be right or truthful, in an old positivist sense. It claims that it accepts and works from some "truths" (such as that the inclusion of the observer); and that it is an improvement, but not that it is perfect.
- Circularity. Circularity is to be taken seriously.

Some of these clearly parallel von Glasersfeld's core. Others will be more demanding!

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