GLANVILLE R.
RADICAL CONSTRUCTIVISM = SECOND ORDER CYBERNETICS

CEPA.INFO
e-print 2695

Cite as: Glanville R. (2012) Radical constructivism = second order cybernetics. Cybernetics & Human Knowing 19(4): 27–42. Available at https://cepa.info/2695

The purpose of this paper is to give evidence to support the idea that second-order cybernetics and radical constructivism are "opposite sides of the same coin." Although this has long been asserted, especially by second-order cyberneticians, I am unaware of any attempt to demonstrate this point by rigorous argument, at least in English. The paper is developed by listing each of the seven core concepts of radical constructivism as stated by Ernst von Glasersfeld, and exemplifying these points with evidence taken from second-order cybernetics. Along the way, there is a sub-theme of the development of cybernetics and the difference between first and second-order cybernetics. The paper concludes with a similar list of the core points of second-order cybernetics, and an invitation for researchers to carry out a similar analysis by placing radical constructivist evidence under these headings.

Why the Equation?

The title of this paper includes an equation sign. This sign is the heart of the argument presented here. It is such a common view that equating second-order cybernetics and radical-constructivism (the equal sign distinguishes them as opposite sides of the same coin) is common among second-order cyberneticians. 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 an equation of some form, for two reasons.

First, Glasersfeld began his professional career (in 1947) as a translator for Silvio Ceccato, the father of Italian cybernetics (the Italian Operationist School, as they called it), and progressed (1959) to working 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 Glasersfeld as part of my tour of significant cybernetic thinkers, although we could not arrange to meet then. Glasersfeld's first writing specifically on radical constructivism dates from mid 1974, when *radical constructivism* is first named in "Piaget and the Radical Constructivist Epistemology" (Glasersfeld, 1974). [Note 2] At this time, his work was focussed on Page 28 education, in collaboration with Dr Jack Lochhead, at the University of Massachusetts, Amherst. [Note 3]

Second, Glasersfeld was a good friend of Heinz von Foerster, who named second- order cybernetics (as Wiener had named [first-order] cybernetics), and of many of the others involved in what was, at the time, presented as the shift from first to second- order cybernetics: [Note 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 August 2nd, 2010 at the ASC conference "Cybernetics: Art, Design, Mathematics – A MetaDisciplinary Conversation" held at Rensselaer Polytechnic Institute (RPI), Troy, NY, near his home. He gave a wonderful after dinner address in which he declared "my life has turned out to be an illustration of a cybernetic principle." [Note 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 Glasersfeld himself prepared in his paper "Aspects of Constructivism: Vico, Berkeley, Piaget" (English translation in Glasersfeld, 1992b / 2007), to show how these core ideas exist in second-order cybernetics. [Note 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 is already prepared, 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 Glasersfeld's work is always concerned with the epistemological, the work I refer to in second-order cybernetics comes from 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, 2003). 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. 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) Page 29 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 this alternative: First-order cybernetics is interested in the observer of the system, second-order cybernetics is interested in the observer in the system. [Note 7]

In the body of my argument in this paper, *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 (Note 8)

The key ideas of this post-epistemological approach [Note 9] *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 organize the world of our experience. [Note 10] (Glasersfeld, 1992/ 2007, p. 97)

Cybernetics originates as much from the Macy Conferences, 1946–1953 (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." [Note 11] 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 Page 30 to a possible world throughout his work. Bateson is one of the early cyberneticians who takes a position that informed and shapes cybernetics as second-order cybernetics. For Bateson, the observer was always present, and the world was always constructed through experience (see the opening of "Pathologies of Epistemology" [Bateson, 1969b/ 2000], in his collection *Steps to an Ecology of Mind*, 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, 1976/ 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 ...And Wiener is inside the box; I'm inside the box ... (Kleiner & Brand, 1976/ 1986, p. 34)

To which Mead replies, "I'm inside the box ..." (Kleiner, & Brand, 1976/ 1986, p. 34) 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 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" [Note 12] : 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 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/ 2000). According to Bateson, it is one cybernetic understanding that provides a mechanism for bringing into effect Glasersfeld's much favoured Piaget assertion: "Intelligence organizes the world by organizing itself" (quoted in Glasersfeld, 1992b , p. 23).

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 found the notion of representation of the real world in the nervous system 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 Page 31 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. Glasersfeld explains this, with admirable clarity, in Glasersfeld (1974).

Apart from 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 Glasersfeld (1992a , p. 3), 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." [Note 13]

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. (Glasersfeld, 1992/ 2007 , p. 97)

What I take this core comment to say, along with Vico (as articulated by Glasersfeld in the paper in which this core list is presented [Glasersfeld, 1992/ 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 Heinz 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). 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 chose to act as if there is a mind independent reality, or we may chose not to. The choice is ours, as are the consequences of that choice.

At more or less the same time Glasersfeld coined the term radical constructivism, and never having heard of Vico, I stated a similar position in my PhD thesis Page 32 (Glanville, 1975). [Note 14] In the second statement at the beginning of the argument, I assert the following:

> 0.0 In order to know something exists we must be able to observe it.
> 0.0,1 If we cannot observe it, we cannot know it exists. We cannot necessarily affirm its non- existence, either" [Note 15] (Glanville, 1975 , p. 15; Glanville, 2012 , p. 233).

This thesis is often considered the "lost document" of second-order cybernetics, 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 (1997). Self-observation is an explanation, not a truth (see Bateson, 1969a/ 2000).

Second-order cybernetics, through understanding and accommodating the observer's essential presence, accepts we cannot attain a God-made world.

3. It [Radical Constructivism] *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" (in Popkin, 1951 , p. 230).* (Glasersfeld, 1992/ 2007 , p. 97)

I believe Norbert Wiener (popularly credited with the invention of contemporary cybernetics, though it would be more correct to say he named it [Note 16]) made a massive tactical error when he published *Cybernetics, or Control and Communication in the Animal and the Machine* (Wiener, 1948) before the revised version of *The Human Use of Human Beings: Cybernetics and Society* (Wiener, 1950, rev. ed., 1954). [Note 17] *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*, *The Human Use of Human Beings* [Note 18] 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: Page 33

> 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 , p. 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. This position is supported by, for instance, a paper by Bernard-Weil (1994) questions the placing of Wiener in the first-order cybernetics camp.

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

> 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.19 (Conway & Siegelman, 2005 , p. 334)

Remember, second-order cybernetics, in 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 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 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. (Glasersfeld, 1992/ 2007 , p. 97)

One of the best known early texts of second-order cybernetics is 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. Foerster begins his paper by quoting the initial command of Spencer Brown's (1989) *Laws of Form*: "Draw a distinction!" [Note 20] 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 Glasersfeld attributes to both Vico and Piaget. Spencer Page 34 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 PhD 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 this journal (e.g., Glanville, 2006). In a short piece originally published for the journal *The Radical Designist* (Glanville, 2006) and published in a slightly revised version in Corte-Real's book *The Triumph of Design* (Glanville, 2010), 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 theory (see below).

An earlier, foundational cybernetic concept is the black box, borrowed by Ashby from James Clerk Maxwell. [Note 21] I have worked extensively on understanding the black box within a second-order cybernetic framework, starting from Ashby. 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 previous outputs) 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 also understood cybernetics in an explicitly second-order manner. In his 1958 paper on the black box (Ashby, 1991), 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 Glasersfeld also wrote extensively about the black box. In a statement that might have come from Ashby's paper, Glasersfeld (1974, p. 9) remarked that the world "is a black box with which we can deal remarkably well." Here is an obvious crossover between radical constructivism and second-order cybernetics. Page 35

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. (Glasersfeld, 1992/ 2007, p. 97)

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

First, it seems that this point is already 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, because it is viable. This is the position Popper has argued for the status of scientific knowledge (the context into which Popper wishes the knowledge he is 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 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. However, human frailty should not be taken as an excuse not to aim for the best! In this manner, Popper can be seen as a constructivist (albeit not a radical one). Be that as it may, I do not think he saw himself as a cybernetician of any kind!

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 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) specify 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 arrangement of subsystems that are 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 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 Page 36 BART is 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 "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 realization 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. (Glasersfeld, 1992/ 2007, p. 97)

Ernst von Glasersfeld was a cybernetician before working on constructivism. He continued to work in cybernetics until his death. He wrote an essay characterising cybernetics for the American Society for Cybernetics, where he asserted "Cybernetics is a way of thinking, not a collection of facts" (Glasersfeld, 1992a, p. 1).

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 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. [Note 22] 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.

Gordon Pask's work [Note 23] 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) is already second-order cybernetic: interaction is a concept both central and well handled in second-order cybernetics. Page 37

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 two central aspects of conversation theory which are relevant here, demonstrating 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. Pask's mesh contains a vast number of 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. Learning, as Pask intends it, means the responsibility and the understanding is primarily the learner's, not the teacher's. 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 Glasersfeld, who, when I told him of Pask's death, said that Pask had been an enormous influence on him and his thinking.

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," (1977, p. 61) 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. (Glasersfeld, 1992/ 2007, p. 97)

In her 1968 paper "Cybernetics of Cybernetics," [Note 24] Margaret Mead, who contributed crucially to the founding of cybernetics, invited members of the American Page 38 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 Gordon Pask's preferred *new cybernetics*) for what we have come to call second-order cybernetics. Mead demands we do cybernetics 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, and so forth.

When Foerster described second-order cybernetics as the cybernetics of observing systems (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.

The notion of a subject reflecting his approach to the world in its approach to itself, or as Apostel puts it in Glasersfeld's translation, that a system should always be applied to itself, is thus the central concept at the origin of second-order cybernetics. Recent consideration has shown that this notion was not new in cybernetics. Other authors (e.g., Bernard-Weil, 1994) have either argued or stated that the first generation of cyberneticians understood this insight. The daughter of Margaret 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 (2006, pers. comm.) agreed that Mead and Bateson never mentioned second-order cybernetics because that's what they were doing all the time, so it was assumed. Under these circumstances, we can take it that all of cybernetics is, or should aspire to be, second-order in spirit.

Second-order cybernetics is powerful, but it is not everything. Even within the world in which cybernetics can be appropriately (and viably) used, first-order cybernetics is sometimes more helpful than second – for a number 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 concepts 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 Page 39 that radical constructivism has 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 Glasersfeld in the cybernetic camp (where I believe, following his final public statement, he saw himself (Glasersfeld, 2010)), developing a deep epistemological understanding that acknowledges the key concepts 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 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, 2003 , §4.2), that might be taken as the core of second-order cybernetics. [Note 25]

1. 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.
2. Ethics. Second order Cybernetics provides an essentially ethical understanding.
3. 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.
4. 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.
5. 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.
6. Mutual Reciprocity. Arguments in second order Cybernetics depend on the Principle of Mutual Reciprocity, which requires that when a quality is Page 40 attributed to one system, there must be a potential for the same quality to be attributed to the system it is distinguished from.
7. 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.
8. 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.
9. Circularity. Circularity is to be taken seriously.

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

Post Script

Some who have read drafts of this paper consider it a belittlement of and attack on Glasersfeld. I cannot see this, and this is certainly far from my intent. I doubt I am saying anything Glasersfeld would not have said, himself, should he have been inclined. He was quite explicit about the centrality of cybernetics in his thinking, and of the connectedness of cybernetics and constructivism, in the forms in which he was interested in them. What I fear, in this sort of criticism, is the feeling that, when a great master dies, the chapter is closed on the ideas he or she played with. The opposite should be the case: The ideas remain alive while people work on and with them. Our fields already suffer from too much hero worship and looking backward. We need to cease this behaviour and inappropriate veneration, and to work to keep ideas alive because they continue to develop – as our masters would have done.

Acknowledgements

In writing this Paper, I tapped the minds of a number of distinguished colleagues to enrich the material presented and to check and correct errors and misapprehensions. Each has contributed greatly to the result, as I know when I look at earlier drafts. Nevertheless, I claim as my own each and every error that may be found. On that basis, I thank (in alphabetical order): Dr Graham Barnes; Ms Aartje Hulstein; Dr Albert Müller; Dr Alexander Riegler; Dr Bernard Scott.

References

Apostel L. (1977) Le role du sujet dans la connaissance. In: B. Inhelder R. Garcia & J. Voneche (eds.) Epistemologie genetique et equilibration (p. 61) Neuchatel: Delachaux et Niestle.

Ashby W. R. (1991) General systems theory as a new discipline. In: G. J. Klir (ed.) Facets of systems science (pp. 249–257) New York: Plenum Press. (Originally published in 1958 in General Systems 3: 1–16)

Bateson G. (1972) Steps to an ecology of mind. New York: Ballentine Books.

Bateson G. (2000) Pathologies of epistemology. In: Steps to an ecology of mind (2nd ed.: 486–495) Chicago: University of Chicago Press. (Originally published in the report on the Second Conference on the Mental Health in Asia and the Pacific, by the East-West Center Press, Honolulu, 1969.)

Bateson, G (2000) Metalogue: What is an instinct?: In Steps to an ecology of mind (2nd ed.; pp. 38–58) Chicago: University of Chicago Press. (Originally published in T. Sebeok (ed.) Approaches to animal communication, The Hague: Mouton, 1969)

Beer S. (1972) Brain of the firm. Harmondsworth: Allen Lane.

Bernard-Weil E. (1994) The presence of Norbert Wiener in both order cybernetics. Kybernetes 23(6/7): 133–143.

Cariani P. (2010) Onwards and upwards, radical constructivism. Constructivist Foundations 6(1): 127–132. http://constructivist.info/6/1/127

Conway F. & Siegelman J. (2005) Dark hero of the information age. New York: Basic Books.

Foerster H. von et al. (1974) Cybernetics of cybernetics. Urbana IL: Biological Computer Laboratory, University of Illinois, Champaign-Urbana.

Foerster H. von. (1973) On constructing a reality. In: F. Preiser (ed.) Environmental design research: 2 (pp. 35–46) Stroudsberg PA: Dowden, Hutchinson & Ross. http://cepa.info/1278

Foerster H. von. (2003) Ethics and second-order cybernetics. In: Understanding understanding (pp. 287–304) New York: Springer-Verlag. (Originally published in French in Y. Ray & B. Prieur (eds.)

(1991) Systeme, Ethique, Perspectives en therapie Familiale (pp. 41–55) Paris: ESF Editeur.)

Glanville R. (1975) A cybernetic development of epistemology and observation, applied to space and time (as seen in architecture). Unpublished PhD thesis, Brunel University, London. http://cepa.info/4221

Glanville R. (1997) A ship without a rudder. In: R. Glanville & G. de Zeeuw (eds.) Problems of excavating cybernetics and systems (pp. 131–142) Southsea U. K.: BKS+. http://cepa.info/2846

Glanville R. (2003) Second-Order Cybernetics. In: Parra-Luna F. (ed.) Systems Science and Cybernetics, Encyclopedia of Life Support Systems, developed under the Auspices of the UNESCO. EoLSS Publishers, Oxford: electronic. http://cepa.info/2326

Glanville R. (2006) Construction and design. Constructivist Foundations 1(3): 103–110. http://constructivist.info/1/3/103

Glanville R. (2010) Design and mentation. In: E. Corte-Real (ed.) The triumph of design (pp.344–351) Lisbon: Livros Horizonte.

Glanville R. (2012) The Object of Objects, the Point of Points, – or Something about Things. In: The black b∞x: Volume 1. Cybernetic circles (chpt. 2.01) Vienna: Edition echoraum.

Glasersfeld E. von. (1992a) Declaration of the American Society for Cybernetics. In: C. V. Negoits (ed.) Cybernetics and applied systems (pp. 1–5) New York: Marcel Decker. [Originally published in 1981] http://cepa.info/1355

Glasersfeld E von (1992b) Why I consider myself a cybernetician. Cybernetics and Human Knowing 1(1): 21–25. http://cepa.info/1428

Glasersfeld E. von (1974) Piaget and the radical constructivist epistemology. In: C. D. Smock & E. von Glasersfeld (eds.) Epistemology and education: The implications of radical constructivism for knowledge acquisition (Report #14; pp. 1–24) Athens GA: Follow Through Publications. http://cepa.info/1324

Glasersfeld E. von. (2007) Aspects of constructivism: Vico, Berkeley, Piaget. In: Key works in radical constructivism (pp. 91–99) Rotterdam: Sense. (Originally published in Italian as: Glasersfeld E. von (1992) Aspetti del costruttivismo: Vico, Berkeley, Piaget. In M. Ceruti (ed.) Evoluzione e conoscenza (pp. 421–432) Bergamo: Lubrina.) http://cepa.info/1569

Glasersfeld E. von. (2007) Key works in radical constructivism. Rotterdam: Sense.

Heims S. J. (1991) The cybernetics group: Constructing a social science for post-war America. Cambridge MA: The MIT Press.

Kelly G. (1955) A theory of personality. New York: Norton.

Kleiner A. & Brand S. (eds.) (1986) For God's sake, Margaret: Conversation with Gregory Bateson and Margaret Mead. In: Ten years of CoEvolution Quarterly: News that stayed news 1974–1984 (pp. 26–44) (Reprint of CoEvolution Quarterly 10: 32–44 (Summer 1976); see also an online version at http://www.oikos.org/forgod.htm)

Lettvin J., Maturana H., McCulloch W. & Pitts W. (1959) What the frog's eye tells the frog's brain. Proc. Inst. Radio Engr. 47: 1940–1951. http://cepa.info/518

Maturana H. (1980) Biology of cognition. In: H. Maturana & F. Varela, Autopoiesis and cognition: The realization of the living (pp. 5–58) Dordecht: Reidel.

Maturana H. & Varela F. (1998) The tree of knowledge. Boston: Shambala.

Mead M. (1948) Coming of age in Samoa. Harmondsworth: Penguin Books.

Mead M. (1968) Cybernetics of cybernetics. In: H. von Foerster et al. (eds.) Purposive systems (pp. 1–11) New York: Spartan Books. http://cepa.info/2634

Müller K. H. (2010) The radical constructivist movement and its network formations. Constructivist Foundations 6(1): 31–39. http://constructivist.info/6/1/031

Pask G. (1975) Conversation theory. London: Hutchinson.

Pias C. (ed.) (2003) Cybernetics – Kybernetik: The Macy conferences 1946–1953. Zürich: Diaphanes.

Popkin R. (1951) Berkeley and pyrrhonism. The Review of Metaphysics 5(2): 244–246.

Popper K. (1963) Conjectures and refutations. London: Routledge and Kegan Paul.

Riegler A. (2001) Towards a radical constructivist understanding of science. Foundations of Science 6: 1–30. http://cepa.info/1860

Saussure F. de (1966) Course in general linguistics. New York: McGraw Hill.

Spencer Brown G. (1989) Laws of form. London: George Allen and Unwin.

Varela F., Maturana H. & Uribe R. (1974) Autopoiesis. BioSystems 5(4): 187–196. http://cepa.info/546

Wiener N. (1948) Cybernetics, or communication and control in the animal and the machine. Cambridge MA: The MIT Press.

Wiener N. (1954) The human use of human beings: Cybernetics and society (2nd ed.) Boston: Houghton Mifflin Company.

Endnotes

2 I make this claim after consulting Alexander Riegler, far better qualified than I to make this assertion.

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 great, 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 convenient 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, and also for pointing me to Karl Müller's 2010 paper connecting to many German sources.

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

8 This paper can be found on pages 91-99 of Glasersfeld (2007), which is the version quoted.

9 Peter Cariani (2010) made an interesting analysis of these seven core points in a recent issue of *Constructivist Foundations*, *6* (1), 127-132.

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

11 This phrase was used both to define the theme of this particular set of Macy Conferences, and as the thematic title of the five volumes of proceedings that were produced, appearing on the title page of all five volumes. The Josiah Macy Jr Foundation funded several workshop conference series, but the series that seems to have become associated with the simple title *The Macy Conferences* is this cybernetic series. The production of proceedings was unique to this series, too, and started later on as a way by which Mead and Tauber could improve Foerster's English. The prefix *Cybernetics* was proposed by Heinz von Foerster as a simplification of the original and rather long theme title. It is possible this was a misnomer and the cause of several problems. For a description and evaluation of The Macy Conferences see Heims (1991).

12 I use the term used by the late Herbert Mueller on his Carl Jaspers discussion list.

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

14 The main text and its accompanying commentary text have finally been published, as parallel texts, in Glanville (2012).

15 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.

16 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.

17 Graham Barnes points out to me that the 1954 and the 1950 editions of *The 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 are also much more considered, especially to contemporaries.

18 Throughout this text, I refer to the 1954 revised edition.

19 Actually, they are quoting me. I reported Pask saying this in Glanville (2003), which is their source.

20 This book has a difficult publication history. It was initially published (in 1967) privately. There was a small edition in 1968, but the first "big" publication was in 1969, which is often given as the date of first publication.

21 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.

22 I prefer knowing to knowledge, since it better reflects the presence of the knower.

23 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 were based around the particular problems within his developing theoretical and experimental framework he was struggling with at the time; and the workshop seminars, also at Brunel, he shared with Laurie Thomas.

24 The paper was given this name by Heinz von Foerster.

25 This list is quoted directly and without modification from Glanville (2003). 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.
