Towards A Dynamic Heterarchical Ecology Of Conversations[1]

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A conversation about conversations

As the head of the Biological Computer Lab (BCL), in both his theory and scientific practice, Heinz von Foerster exhibited a holistic multi-perspective approach to the body and knowing. This took form through an overarching embodied attitude toward knowledge production. Von Foerster, through conversation, collaborative research, advanced publication, and focused symposia, functioned as an exceptional organizational vehicle for knowledge production across a series of widely differing domains. He sometimes did this by playing the "contrarian" – exploring language inversions, humor and playful linguistic game strategies which I will expand on. He was deeply interested in metaphor and the ideas of Wittgenstein concerning language. He thus became a living nexus for conceptual dances that played out across a multiplicity of conversations.

This paper will function as a springboard for recouping many of the ideas that have become lost and/or displaced over time, yet are still potentially essential to the development of new forms of computation, circular causal relations, as well as human interaction and Understanding Understanding. According to Gordon Pask's Conversation Theory I will point at conversation as a means to shared understanding and learning. A heterarchical approach to these conversations allows me to form a dynamic compendium. In each case I will announce a new section with a pointed title.

Von Foerster stated "I want to keep it so that the connection between the person and the science remains central"[2] and this was often explored via 'language games' (drawing from Wittgenstein's definition of this concept in his text Philosophical Investigations). Wittgenstein states:

> Here the term "language game" is meant to bring into prominence the fact that the speaking of language is part of an activity, or a form of life.[3]

Von Foerster was deeply interested in including the feeling, knowing observer in his science, much to the chagrin of traditional scientists interested only in the scientific method. Yet it is clear that conversation was central to him as a working practice. Von Foerster stated that "The game of language consists of both parties having the intention of making something, inventing something, constructing something out of the grunts and sibilants that the other produces. Now both are designers, making something of the utterances of the other."[4]

A conversation about Neosentience and its relation to the BCL

In my long conversation with Otto Rössler, we talked on the phone once a week for over an hour, over the period of 10 years! These conversations came together in a book entitled *Neosentience, The Benevolence Engine*.[5] "Neosentience" describes a new branch of scientific inquiry related to artificial intelligence, robotics and learning systems, finding many contemporary parallels to research at the BCL.

We gave it an operative definition:

We consider a sentient robotic entity to be a system that could exhibit well defined functionalities: It learns; It intelligently navigates; It interacts via natural language; It generates simulations of behavior (it 'thinks' about potential behaviors) before acting in physical space; It is creative in some manner; It comes to have a deep situated knowledge of context through multi-modal sensing; It displays mirror competence. We have entitled this entity The Benevolence Engine. The interfunctionality is complex

enough to operationally mimic human sentience. Benevolence can in principle arise in the interaction of two such systems.

A conversation about the relation between the quantitative and qualitative

In my talks with Otto Rössler, I sometimes lamented not being able to do the math that Rössler did. He told me that the qualitative approach was equally valuable and that I often used creative ways of seeing things, where learning the math might limit me. Von Foerster also valued the interplay between the qualitative and the quantitative. He stated:

> I simply maintain that there are disavantages for a culture if it concentrates on only one view of numbers, of numerality, while dismissing the others as inferior. Because the two areas, the qualitative and the quantitative perspectives, should be seen as complementary. One needs the other to form a totality.[6]

Here Von Foerster exhibits a drive toward a form of multi-perspective holism. It also speaks to the potentials of people bringing different kinds of skill sets and approaches to the table through collaboration and team based research. i.e together Rössler and I came up with some exciting ideas surrounding Neosentience (my coin) by holding this very long conversation.

A conversation about databases

In terms of contemporary knowledge production, the question becomes how can we make new computational devices that enable the navigation of databases which include a variety of media elements and processes, to empower new modes of conversation, research and invention? My “Insight Engine” project, like this paper, is just such an expanded “conversational” mechanism. I call this combinatoric exploration of media - Recombinant Informatics,[7] enabling the playing out of the search potentials of poly-association (my term). Recombinant Informatics was invented as a way to bridge the hundreds of micro-chapters in the *Neosentience* book (which are represented on the cover). The idea was that one could choose any two chapters and this would suggest a new research potential, by building a bridge between them. I see this also in the nature of human proximity at the BCL, and the potential to draw on the large ecology of research agendas in a generative manner, which of course Von Foerster humanly did.

My system of bundled interactive systems, pragmatically functions as a mid-wife to new ideas where the user is part of the cybernetic circular causal system, empowering an ongoing multi-perspective approach to knowledge production. Von Foerster suggests: “Through the dynamics of speech, through the dynamics of our being together, through the dynamics of our conversations about life, life emerges.”[8] I am interested in how new technologies like the *Insight Engine* can perhaps extend this definition, empowering new forms of transdisciplinary search, and human association working in concert with computational linguistic processes, learning systems, AI, and distributed research potentials, where researchers might talk about and/or annotate media materials that arise though the ongoing use of the system.

Drawing from Arthur Koestler’s notion of bisociation from his book **The Act of Creation**[9], and now extending that concept to poly-association (my term), one can use this generative environment to bring disparate knowledge bodies and researchers together to tackle difficult problems. The system seeks to be a universal one that can be applied to many different areas of study. So far, we are working on one database system related to Neosentience research. Alternately we are seeking to use the system for the articulation of new forms of CyberArchaeology. The idea is that one can use the system to do a poly-associational search, choosing multiple topics and using computational linguistics, find the most relevant relationalities. There are direct links to the papers and books so one can instantly decide if the

relationality was helpful. The digital media results can also be brought into relational proximity in a linked virtual environment. Think of this as a form of contemporary memory theatre, working much in the spirit of von Foerster across many research fields.

It is interesting to note that von Foerster himself was interested in such systems which he describes in his 1971 text *Technology, What Will It Mean To Librarians*… I am also developing a major historical database with MIT Press/Leonardo/ARTECA called S_Works. This database will hold many of my own works, documentation of works, poetic texts and papers, as well as other relational texts and will be navigated via the *Insight Engine*. This system will be a prototype for a more generalized system, perhaps forming a very new approach to the notion of the digital archive.

A conversation about new forms of computation inspired by biology

Can we articulate new embodied models that seek to point at the creation of an electrochemical computer with linked polysensing systems, drawing from the multi-perspective approaches taken at the BCL? Can recouping ideas from the diverse ecology of BCL's research foci and enfolding them such that they become intra-relational, invent a new transdisciplinary arena for knowledge production? Can we define new computer systems that are designed to help facilitate thought and research related to such a complex undertaking? This has in part been the goal of my computational database project described above.

A conversation concerning dynamic heterarchies

McColloch in his paper entitled *A Heterarchy of Values Determined By The Topology Of Nervous Nets*, pointed to the complexity of brain/mind activity, which is best reflected as a heterarchy. Inspired by his paper, Carole L. Crumley much later presented her own paper entitled "Heterarchy and the Analysis of Complex Societies" in 2008:

> Heterarchy was first employed in a modern context by McCulloch (1945). He examined alternative cognitive structure(s), the collective organization of which he termed heterarchy. He demonstrated that the human brain, while reasonably orderly, was not organized hierarchically. This understanding revolutionized the neural study of the brain and solved major problems in the fields of artificial intelligence and computer design.[10]

It was a deeply complex society of researchers and later students that von Foerster encountered and encouraged in his pivotal role as the head of the BCL. (The Biological Computer Laboratory). This complexity nests multiple brains/minds within a complex society – a heterarchy of heterarchies so to speak. In her text related to complex societies Crumley states:

> Human organization, by measures of adaptability and interactivity, is arguably the most complex category of self-organizing system known. For human societies, the concept of self-organizing systems suggests that adaptive success may be related to the juxtaposition of cognitive and ecological liminality with flexible power relations.[11]

The BCL, a micro-society of sorts functioned at the "threshold" of a new formulation of science (the definition of liminality is in part "the condition of being on a threshold or at the beginning of a process")[12] The notion of conversation central to the BCL was often one of giving voice to each participant in a dialogical or should I say poly-logical, process of becoming – of learning through conversing (and in terms of Pask's Conversation Theory this also suggested human/machine conversation – Teaching Machines / Teaching Machines). Of course, here (in the title of my paper) I am also associating the notion by Gregory Bateson, that the mind is also a complex ecology from *Steps to An Ecology of Mind*[13]. Batson also has a lovely relevant quote, "It takes two to know one."[14] So here the BCL functioned as a dynamic ecology of intermingled thought ecologies.

A conversation about questioning questioning, and/or questioning the questioner

In conversation Heinz was asked by Müller and Müller in the lovely book entitled *The Beginning of Heaven and Earth Has No Name – Seven Days with Second-Order Cybernetics*, about questioning as a part of learning: One of the authors states "*for you – observation is a very important element that cannot be eliminated: No question, no answer. If you turn this proposition round, one must already have certain answers in order to pose questions or make observations."*

> Heinz answers: For example, there is a book called *What is the Name of this Book* and if one asks "What is the name of this book? The answer is What is the Name of this book? That belongs to a very particular class of phenomenon in which the question and the answer are the same. This book title is a wonderful indicator of how little questions can be separated from answers. Ludwig Wittgenstein is even pithier: "What is a Question?"[15]

This quote reflects the playfulness of von Foerster's thought in terms of his conversational interaction with others. The delight in this wonderful language instance by von Foerster brings up the fact that he was a contrarian. I asked my friend and cybernetic colleague Ted Krueger if there was a definition for "contrarian" that he used. He quickly replied with the following: "The contrarian takes a position on a topic that is not bound by the conventional logic inherent in it, and by so doing increases the available choices." Alternately, I associate Zen Koans with kind of playful language, employing nonsense statements that are designed to help students find enlightenment through contemplation of that statement. Von Foerster often would question the questioner with a question so that they might provide their own answer.

An ecology of coversations employing inversion as a means to generate potentially new perspectives

Von Foerster had a way of taking a sentence and inverting it linguistically as a means to expand the Wittgensteinian playing field. Von Foerster said: "These kinds of inversions come up again and again, if you wish, are actually a piece of "Heinz methodology." He went on to say "I think that it represents essential progress if our "fundamentals" are turned around as jokes, and therefore, become entertaining rather than overwealming."[16] Contemplation of the inversion often seriously opened up new perspectives. In this sense Heinz was seriously funny. I have a similar kind of dictum – displacement illuminates placement, and often enjoy punning as a playful part of teaching.

A conversation about the description and the describer

Von Foerster in his long talk with Müller and Müller would often point out that the description or definition of things told us more about the describer and their predilections than what they sought to describe.[17]

A conversation about inter- and transdisciplinarity and "no" disciplinarity

One of the exciting qualities of the BCL was its transdisciplinary nature. I often call this open methodology that allows for cross-talk across all fields, a 'multi-perspective approach to knowledge production'. When von Foerster was asked in an interview about where his expertise was, he discussed the following:

> I don't know where my expertise is; my expertise is no disciplines. I would recommend to drop disciplinarity wherever one can. Disciplines are an outgrowth of academia. In academia you appoint somebody and then in order to give him a name he must be a historian, a physicist, a chemist, a biologist, a biophysicist; he has to have a name. Here is a human being: Joe Smith -- he suddenly has a label around the neck: biophysicist. Now he has to live up to that label and push away everything that is not biophysics; otherwise people will doubt that he is a biophysicist. If he's talking to somebody about astronomy, they will say "I don't know, you are not talking about

> your area of competence, you're talking about astronomy, and there is the department of astronomy, those are the people over there," and things of that sort. Disciplines are an after effect of the institutional situation.[18]

Of course, a myriad of research topics spanning a diverse set of fields were encountered at the BCL. Karl H. Müller points to a series of integrative perspectives in the fascinating book **An Unfinished Revolution? Heinz von Foerster and the Biological Computer Laboratory | BCL 1958-1976**— He points to Systems Research, Information Theory, Cybernetics, Turing Architectures, and The Cognitive Sciences as being central to the research mission of the BCL. What I find hard to believe is how the BCL has basically been written out of history of Computer Science. I often ask my students drawn from CS – "Have you heard of the Biological Computer Laboratory" and they shake their heads "no." I of course at this moment point them to a series of books and publications.

The question is, how can we change academia such that transdisciplinary research activity is equally well supported today? In particular, can we devise educational structures where one can take on a PhD where concepts from multiple fields are bridged to open out new approaches to knowledge production. We are certainly trying to explore such an environment at Duke University in our program entitled *Computational Media, Arts and Cultures*. Here, teams of advisors embodying different areas of expertise are brought together. We also need to find new ways to promote people who are transdisciplinary researchers in terms of the tenure process.

When I was hired by Rhode Island School of Design to create a new digital media department, there was very little digital activity at RISD at that time. I proposed building a bridge to every department at RISD, as well as a number of departments at Brown University, using the Digital+Media department as a hub, defining a new approach to curriculum for each. I discuss this at length in my paper A Generative Emergent Approach to Graduate Education found in the book entitled *Educating Artists for the Future: Learning at the Intersections of Art, Science, Technology, and Culture.*[19]

A conversation about *Observing Systems*

I love this title which has a wonderful transcontextual kind of doubleing — 'Observing' Systems and Observing "Systems."

A conversation about Sounds and Music

In the book *Music by Computers* co-edited by Heinz working with James Beauchamp, Von Foerster wrote a chapter entitled *Sounds and Music,* where he biologically unpacks how hearing functions, and additionally talks about symbolic musical meaning:

> It is of crucial importance to make a clear distinction between the two levels of the interpretation of sound: the one in which sounds are interpreted as signals that hint at a source and all that may be associated with it, the other in which they are interpreted as symbols. If sounds are uninterpretable, they are called "noise." "Noninterpretability" is a concept however; hence "noises" may well be used in a symbolic way on a higher level of symbolization. The proposition 2+2=green is uninterpretable on the level of mathematical discourse. The proposition is not even false: it is pure mathematical nonsense, "mathematical noise." We cannot deny however, that by its very form of nonsensicality this proposition generates a specific frustration in the search for its meaning, which is precisely the meaning it carries with it.[20]

This thought points to the human predilection to look for meaning as an ongoing pursuit. Von Foerster also often used metaphor as an operational mechanism to talk as clearly as possible about particular subjects. In this instance Von Foerster's concept of "mathematical noise" presented above, builds a

bridge between the metaphor of noise, and the precise definition of mathematics. Given that the computer is predicated on code, there is an interesting intermingling of ideas going on here. A kind of punning on "noise" related to Shannon and Weaver and Noise related to people like John Cage and computer musicians like myself.

Von Foerster finished his text with this thought:

> It is at this point, where the complexity of the problem appears to get out of hand, that computers come to our assistance, not merely as ancillary tools but as essential components in the complex process of generating auditory signals that fulfill a variety of new principles of a generalized aesthetics and are not confined to conventional methods of sound generation.[21]

It is here that I have to present one of my favorite quotes related to the history of the computer, one that is directly related to what Von Foerster presented. Ada Lovelace, the first computer programmer, in her *Notes to the Analytical Engine* provides the following thought, in 1842.

> The Analytical Engine, [emphasis Seaman] might act upon other things beside number were objects found whose mutual fundamental relations could be expressed by those of the abstract science of operations and which should be also susceptible of adaptations to the action of the operating notation and mechanism of the engine. Supposing for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expressions and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent... It may be desirable to explain, that by the word operation, we mean any process which alters the relation of two or more things, be this relation of what kind it may. This is the most general definition and would include all subjects in the universe.[22]

So here was this lovely beginning moment where Ada Lovelace perhaps inspired by both poetics and mathematics (her father was Byron) saw the open ended operational potentials of the computer, and the idea that it could be used for aesthetic purposes. Here computations could lead to subjective experience— aesthetic configurations as brought about through the operative machinic nature of the computer.

A conversation with Gyorgy Kepes concerning the concepts linking stimulus to symbol via the economy of biological computation.

I undertook my Master of Science in Visual Studies Degree at the Center for Advanced Visual Studies at MIT. Kepes was the founding director there and he was still alive and on the scene when I was a student and later a fellow there. He was very much interested in art and science, and how they could talk to each other. My wife made a gift to me of perfectly new copies of Kepes' entire set of published books which included titles like—*Language of Vision*, *The New Landscape in Art and Science*, and in particular his Vision + Value series including such titles as *Structure in Art and Science*. I was excited to see that Kepes and von Foerster were known to each other. In the wonderful book ***Sign, Image, Symbol*** edited by Kepes, von Foerster presented ***From Stimulus To Symbol: The Economy of Biological Communication***. It is clear that Von Foerster saw the BCL as an open intellectual environment that could tackle difficult transdisciplinary questions. He states:

> An approach which considers symbolization in this framework suggested by the formulation of this problem does have the advantage that it can tie together evidences accumulated in a variety of fields. Moreover, within the framework suggested here it becomes impossible to talk about symbols in a static, ontological way and not consider the dynamic evolution of symbolic presentation. Likewise, it becomes impossible to separate a symbol from its symbolizer, his

> sensory motor and mental capabilities and constraints. And further it becomes impossible to separate symbol and symbolizer from his environment which we have to populate with other symbolizers in order that symbolization makes any sense at all.

I find Heinz's embodied approach at the center of a deeply holistic practice, one that flies in the face of scientific reductionism. This is where von Foerster was pivotal in bridging communities through conversation, and conversational vehicles like papers. He thus brought people from diverse and generally unrelated fields together to tackle the most difficult of problems.

A conversation about self-organizing systems and noise

In a wonderful contrarian moment von Foerster made a thought provoking introduction to his paper entitled *On Self-Organizing Systems and Their Environments*. "What makes a self-organizing system?" Heinz began his talk with the following remark: "Thus, I hope you will forgive me if I open my paper by presenting the following thesis: "There are no such things as self-organizing systems!" Of course, this was a way to get people to listen and think through his argument. In fact, at the end of the lecture he was given a question: How can noise contribute to human learning? Isn't noise equivalent to nonsense? Von Foerster answered- "Oh, absolutely, yes. (Laughter) This distinction between noise and nonsense is an interesting one. It is referring usually to a reference frame." He went on to describe how he might use this kind of playful strategy in learning. "For instance, when I am teaching a class and want to have something remembered by the students particularly well, I usually come up with an error, and they point out – "you made an error sir." Oh yes "I made an error," but they remember this much better than if I had not made an error. And that is why I am convinced that an environment with a reasonable amount of noise would not be too bad if you would really like to achieve learning."[23]

I early on wrote a paper about what I called *Nonsense Logic*. When artists make interfaces that include poetic, punning and/or nonsense related content on the symbolic surface of a work of computer art, underneath there is still a computational logic that enables one to interact with the system in a self-organizing manner.

A conversation about learning by doing – The Cybernetics of Cybernetics book

The Course "Cybernetics of Cybernetics"[24] 1973-74 was conducted with a participatory model. Albert Müller states: "The publication resulting from this course still provides a useful compendium of the field, because it contains definitions that remain valid as well as reprints of important articles. The stronger involvement in teaching, in combination with innovative pedagogical approaches, also had the effect of providing a kind of summary and articulation of the work of the BCL."

I am of course deeply fond of this book, and in particular this kind of participatory pedagogical approach.

A conversation about what life is

Heinz had read with interest Schroedinger's little book, **What is Life**? Albert Müller told me that it was a book that meant much to Heinz for his entire life. As a journalist he actually wrote a review of it just after the war. Von Foerster had a way of making a difficult question into a new question by displacing it, inverting it (as mentioned above), re-seeing it, and/or providing a new perspective for it to be viewed from. In terms of the above question he stated:

> I think that the question "what is life?" can offer no forms that will satisfy us, or at least none that will satisfy everyone. Because the question is already once again a question about the question. Now is this satisfying for the questioner or not? Or, with regard to this question, is the unsatisfactoriness such that we become more interested in the question of life. In this case we have won the game— because then life stays open and will constantly be led back to life.

So it is keeping the game in play that is central to von Foerester. To perpetuate the dance. When we examine the self, we must include the self. This was central to the creation of Second Order Cybernetics, a space of ideas that to many scientists was "way out of bounds" in terms of the historical scientific method.

A conversation about place-value logic with Gotthard Günther

Günther was interested in defining a logic that could be useful for cybernetic research.

> Heinz remarks: In this context I would like to remind you of a significant work by Gotthard Günther that is rarely understood correctly. Common logic knows the truth values "true" and "false," which can be interpreted as 0 or 1 and can be extended to a value arithmetic in which the particular symbols are input values for functions. Gotthard Günther spoke, however of an additional value, and readers and listeners acquainted with many –valued logic said, "Okay, he has just introduced a third value!" No, he hadn't introduced any ordinary third value! His third value was in fact not the result of an operation but one that referred to the operator itself. He called that a "rejection value," a rejection–operator…

The BCL defined a very new kind of space for Understanding Understanding…Gunther in his text: *Cybernetic Ontology and Transjunctional Operations* provides this reflection:

> When computer theorists pose such questions as: can machines have memory? do they think? are they able to learn? can they make decisions? do they possess creativity? we can see that subjectivity enters into cybernetics from the very beginning in a much stronger fashion than into physics.[25]

These very questions are still at the center of Computer Science today. I find it important to go back and examine the beginnings of things – the inception points for certain ideas. In particular how people articulated their perspectives in relation to such topics. I have written many papers on computational creativity, and also have been considering the present and future of this field where we as humans collaborate with computers on the highest of levels. My audio album in collaboration with John Supko, S_traits was also a collaboration with an AI. We are currently developing an experimental generative opera exploring this very subject called The Oper&. As an artist/cyberneticist, this brings together subjective concerns and aesthetics, with pragmatic CS related questions of how to embody and make operative such foci in developing very large self-organizing systems. Günter points out a relationality where traditional science was in no way interested in Subjectivity, and that by its very nature cybernetics was![26]

Günther's multi-value logic is central in articulating biological/logical processes in the body, seeking to articulate the logical complexity of a subject<->object unity. Von Foerster points at the importance of Günther's thought:

> If you want to talk about something, then I also need to have a place, a logical space, in which I can set this proposition. Therefore, I find a logic, a place-value logic according to Günther, then I can ask myself what the logic of the places in which I set my propositions looks like. Thus, from the beginning I am moving in a second order problematic.[27]

Here again, Second Order Cybernetics opens out a new kind of science that of course seek to be clear and logical, yet it seeks to do so based on its own needs. Here the observer who is at the center of meaning production, necessitates a new form of physical place logic – or place-value logic as von Foerster puts it. Günter states:

> The demand for a suitable new logic should be recognized in cybernetics more than anywhere else. And this investigation has imposed upon itself the task of furnishing the basic concepts for a formal theory of self-reflection that might satisfy the comprehensive demands of cybernetics.

Such logic begins to enable us to approach the creation of Neosentient robotic entities, of self-aware learning systems. It is interesting to note that we are at a moment where computers are beginning to write their own code. Günter succinctly describes the computational melieu we are approaching:

> … the possibility of developing automata which display all characteristics of self-reflection depends entirely on finding a formal logical criterion for self-consciousness or subjectivity which would be amenable to treatment in a calculus, and consequently in mathematics…the distribution which von Foerster's principle, order-from-noise, is supposed to produce is actually a spreading of exchange relations. This extension, of course, can only be made by the introduction of additional values. In other words, Von Foerster's principle is logically definable only if we introduce a many-valued calculus.

The subjectivity that so interests von Foerster is clearly pointed to in relation to the concept of noise… (interesting that this is also punningly referred to in our musical conversation above.) Günther discusses this “noise.”

> If we use a term borrowed from information theory we might say that a formal logic is required to be a "noiseless" system. The introduction of subjectivity into it would make it very noisy. Since this cannot be tolerated in classic logic, but is demanded in cybernetics, we are required to develop a more comprehensive theory which is not hampered by the morphogrammatic restrictions of two-valued logic.

The human body is an extremely complex entity. Approaching subjectivity and considering the authoring of code to enable it’s arising in a self-organizing system is extremely complex and yet to my mind, can only be tackled in an environment of transdisciplinary cross-talk like the one the BCL brought into being.

A conversation with N. Lindgren and others concerning Bionics

In his paper **Bionic Principles** (A Summary)[28], von Foerster layed out the underpinnings of a transdisciplinary field of research as a sub-field of Cybernetics. He was exploring a deep interest in “information” and how it functions in relation to human behavior. This kind of framing of “Information” was aligned with people like Donald MacKay, in his book **Mechanism and Meaning**, perhaps adding a set of new perspectives to the work of Shannon and Weaver, because here not only the physics of information propagation was engaged but also meaning production and its consequences, as engendered by physical and biological human processes. Here he was interested in both information flow and the self-reflection of informational effects as “fed back to the effectors for initiating appropriate action.” Von Foerster was interested in the infinitely difficult questions — “How do these organisms work?” and “What are the principles that underly these processes.”

Perhaps one of the most interesting ideas defined in Von Foerster’s paper is the creation of an “Inductive Inference Engine.” New forms of inference engine are a very fruitful way to bring forward some of the ideas articulated by von Foerster and the BCL in general. Imagine that you begin to articulate what certain things (particular data) means to a researcher – If I see “this” then “this” will probably be the case. Let’s say I make hundreds of these kinds of articulations and I define an inference engine that can “look” at huge data sets and suggest a series of potential ideas based on these inferences… In particular I am working with a researcher that is interested in how new inferences can shift the historical understanding of long held cannons in her field of Archaeology. I believe this kind of thinking might be applied to many differing fields. Can we begin to define new forms of inference engine that both codify existing knowledge yet also suggest new “goal oriented” knowledge or perhaps even use the system to help define new

goals, inferred by defining a human relationality to the data. Here the definition of Bionics might be recouped…

> for Bionics characterizes an activity — or point of view—which insists, that attempts to synthesize biomorphic functions such as habituation, adaptation, perception, recognition, cognition, recall, learning, abstraction, conceptualization, association, induction, ideation, awareness, consciousness, self-repair, self-reproduction, growth, self-organization, etc. etc. will not only aid the analytic studies of these functions in living organisms, but also will eventually provide us with operational definitions of these terms.[29]

Given this paper is from 1965, von Foerster layed out a set of transdisciplinary research agendas that are formidable, yet incredibly clear. It seems ironic that in working on developing AI and other new learning systems, that we learn more about human understanding in the process. Or what von Foerster might call Understanding Understanding. It is also clear that these can also be seen as contemporary research questions that are still in the process of being researched.

A conversation about Transcontextual Gifts with Gregory Bateson

The ecology of the BCL was a complex one. In *Steps to an Ecology of Mind*, Bateson discusses "transcontextual" as a general term for a particular genus of syndromes. It has both positive and negative connotations and is quite punny in nature. Bateson remarks: "It seems that both those whose life is enriched by transcontextual gifts and those who are impoverished by transcontextual confusions are alike in one respect: for them there is always or often a "double take.""[30] For me this "double take" takes many forms in terms of von Foerster's thought and action. Of course, puns are a lovely way to play out transcontextuality --- but one might say this is also a form of punishment and intentional digression in the name of humor! Yet, transcontextuality gives rise to insights that can take multiple contexts into account and either juxtapose them with intention or seek to bridge them through new operational means. Greg Ulmer's concept of the puncept is relevant here, which is basically a specifically pointed forking concept delivered in an appropriate pun.[31] (Didn't that just sound like I said inappropriate pun?)

A conversation with Francisco Varela concerning precursors to the concept of *autopoiesis*

Varela paints a beautiful, clear picture of the supportive role conversation and feedback from Heinz played in his intellectual process. I believe this kind of support was valuable for many of the researchers and students at the BLC. For me the ideas surrounding autopoiesis are exciting and essential. Autopoeisis can be defined as "The property of a living system (such as a bacterial cell or a multicellular organism) that allows it to maintain and renew itself by regulating its composition and conserving its boundaries."[32] It is clear that conversations surrounding the initial ideas and the 1st paper to talk about it, very much included feedback from Von Foerster. Varela States:

> Heinz was the right man at the right time in the role he played during those now mythical meetings known as the Macy cybernetics gatherings…Heinz's style is one of posing questions and main principles in a concise form, which made his writings intellectual *zettels*... Heinz kindly invited me to come to Illinois a few times during the time I was in Cambridge, and each time I was touched by the humor and openness of this Viennese… the notion of *autopoiesis*, and the first paper published on it owes a tremendous amount to Heinz's comments and corrections…Heinz was perhaps the first who recognized immediately the interest of this idea at a time when almost everyone else wanted us to drop such idle speculations…Since then and until today Heinz has been an untiring ear and friendly advisor. His ethical and human qualities are impeccable, and they have been a source of much needed inspiration. Thus, this is the right place for me to restate all my enormous debt towards him. Without his influence and his presence for the last 30 years, my life would have lacked a deep, joyous, and nourishing dimension. I call him Heinz the Great. [33]

Von Foerster was the quintessential polymath of polymaths. That he was giving as a person, helpful in giving feedback, and ethical, seems to be a strong matter of record. It is interesting again to note that where Maturana and Varela are well known for their framing of Autopoeisis, that Heinz and the BCL are rarely mentioned in the light of Von Foerster's input in the process. Nor was their research activity at the BCL.

A conversation about emergence with Müller and Müller

Heinz in conversation with Müller and Müller stated the following related to emergence:

> The moment I see something differently, something new is there. You can call this "emergence" and thereby remain generally understood. However, one could also bring the perspective of self-organization into play: This self-organizing system has swung into new eigenvalues that it did not previously possess. And with this there are new insights to observe, something has "emerged." But not there— no here, inside of me something is newly configured, and I see it as a new understanding. Emergence is my ability to see newly.[34]

As co-head of the Emergence Lab in the Media Arts + Sciences consortium of labs at Duke, team teaching with Musician, Composer, and Media Computer Scientist John Supko, we seek to explore emergence in image, music and text, employing both analogue and digital methods. We are interested in emergence as it becomes relevant to the arts, the sciences, and the humanities. For me the study of consciousness and how it arises as part of a physical system is the deepest question we can chip away at… can this study be translated to new forms of bio-code that may inform the emergence of a form of consciousness and self-awareness in the Neosentient?

A conversation with the self

Heinz quote of the day:
"At every moment, I can decide who I am."[35] In terms of the conversations Heinz participated in at the BCL, he allowed himself to be many many selves, deeply reflecting on each of the potential areas of research that played out through dynamic interaction with his colleagues.

A conversation about cognition

Heinz's pithy definition:
Cognition → computing a reality[36]

Or Computations of Computations (with this recursive line)

My own take on this was in a paper entitled *The Engine of Engines – Towards a Computational Ecology*[37]. My thought was that it might be interesting to bring every different kind of computers together into a network – DNA, Nano, Quantum, Von Neumann Machine etc., and let each do, what they are best at. In particular I was interested in how different computational systems are interfaced in the body and how they actually form a functioning self-organizing system.

A conversation about the future

I would like to leave this gathering with a positive thought (Albert Müller called this a Utopian thought in giving me feedback on the paper). Heinz was the polymath and a pivotal personality standing at the apex of the BCL. It would obviously take a large group of people to fill his shoes. Yet it is interesting to think about re-opening the lab. Where might it be? Who might fund it? Could it be a consortium of labs that are distributed internationally? Many of the questions that were initially posed at the BCL are still essential, and their contemporary extension is highly relevant. Could we start with a conference concerning this

idea? This conference could take the form of A Dynamic Heterarchical Ecology Of Conversations! OK, My conversational ouroboros is now complete.

I cannot tell you what an honor it has been to be asked to give this talk. I want to specifically thank Albert Müller for his ongoing support of my research through the archive he heads, his feedback and his wonderful books and deep promotion of new knowledge production and historical understanding!

Thank you for your attention

Bill Seaman
November 13, 2017

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Heinz von Foerster Society in Cooperation with the Institute for Contemporary History,
Given in Vienna Austria on November 13, 2017

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