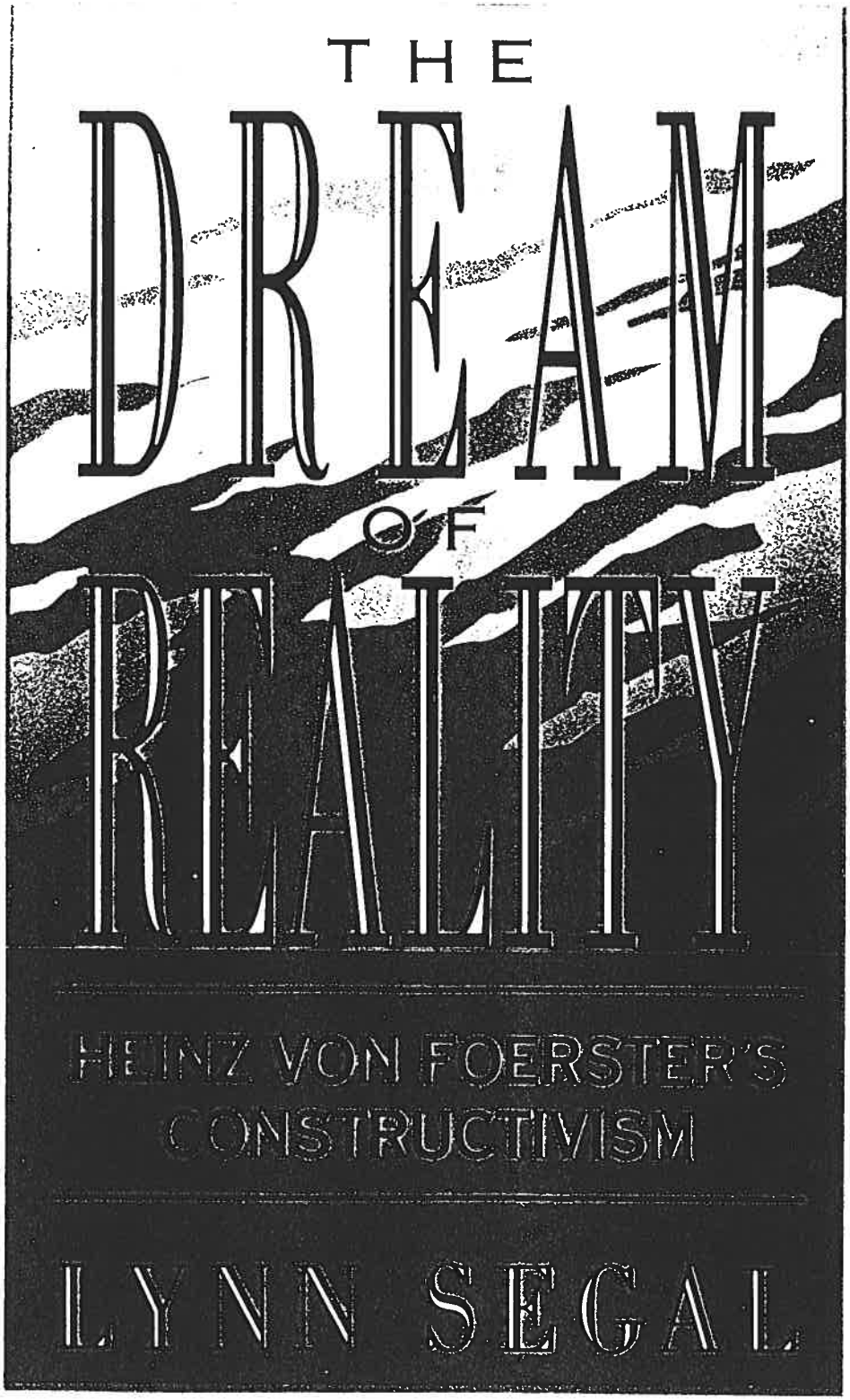
THE
DREAM
OF
REALITY
HEINZ VON FOERSTER'S
CONSTRUCTIVISM
LYNN SEGAL

# AN INTERVIEW WITH HEINZ VON FOERSTER

Carol Wilder: Heinz, it's a long way from Vienna to the Coast of the Pacific Ocean. I wondered if you could shed some light on the way that brought you here, on some incidents that were influential.

Heinz von Foerster: The first such incident was that I saw the light of day in Vienna on November 13, 1911. It was a Friday. It was a lucky day. I was born into a family which was in itself somehow reflecting the small cosmos that was Vienna before the First World War, a world of movement, ideas, theories, tensions, philosophies, political directions. Remember, Theodor Herzl was the Viennese who started Zionism, Freud was the Viennese who started psychoanalysis; in art the new direction of the Secession and Jugendstil, of the painters Klimt and Schiele, of the architects Otto Wagner and Adolf Loos, of the "Wiener Werkstätte," introduced elements into the cultural life of the time that have not stopped working even today. My own great-grandfather, an architect, did a great urban renewal job, replacing the old fortifications in Vienna by the representative Ringstrasse and, distanced from it, defining urban and suburban regions, a second ring, the

"Gürtel" or belt. This cityscape still works. At the university there were people like Ernst Mark, a precursor to Einstein, who started a revolution in the foundations of physics by his doubts about the concepts of absolute space and time, as seen through Newtonian physics, and Boltzmann, who gave the famous second law of thermodynamics a new interpretation which is still reverberating today. At the same time social concerns were seen and acted upon. The women's cause was taken up by, among others, my grandmother, one of the early suffragettes who founded the first journal in Europe, called *Die Frauenzeit* (Women's Time), completely dedicated to women's liberation. "Teachers' celibacy" was a battle cry of the time, and during my grandmother's lifetime she fought to change the law that forced a teacher in Austria to quit Academy when she became pregnant.

In 1914 the First World War broke out. My father was immediately drafted, together with all the other males of his family and his generation. The Austrian Army, under the command of an ancient emperor, had a peculiarly naive concept of how a war should be fought: you are sitting on a horse, you pull out your saber, you attack the enemy. On the other side the enemy was sitting in trenches and shooting with machine guns. Consequently, the first battles were tragically lost. The two, for me, most influential members of my family, my father and my maternal uncle, were captured in the first weeks of the war. For the next four years I grew up without a father. My mother took me along to wherever she went, mainly to the big country houses of relatives, and I was completely familiar with the world of the grownups around me. Their world was the one of theatre, of art, of journalism, philosophy and science. I did not know it at that time, but I absorbed many things. During one's active life one often handles problems in a certain way, without paying too much attention why, and only in more contemplative periods one realizes that somewhere in the past, perhaps when you were five or six, a respected elder had said, "Live right now. Not in the past, not in the future, here and now."

CW: An impressive example of this for me was when you were talking earlier about your Uncle Ludwig.

HvF: Oh, Uncle Ludwig, yes. Here is a story about a constructed reality, about family legend and the world at large. When I was five or six years old I was taken from time to time to visit an uncle who had designed and built for himself a beautiful house. There was always excellent chocolate, at that time a memorable occasion. Once he asked me what I wanted to be when I grew up. I said, "Ein Naturforscher," a researcher of nature. "Aha," said Uncle Ludwig, "then you have to know a lot." "Yes," I said, "I know a lot." He could have wiped me out, but he said instead: "You may know a lot, but you do not know how right you are." Only now, nearly 70 years later, after having observed children and grandchildren, I know how right he was. When I was 29 and studying at the university, I came upon a book that influenced me (and modern philosophy) deeply and profoundly. It was *Tractatus Logico Philosophicus*, by Ludwig Wittgenstein. Only then I realized that Uncle Ludwig and the author were one and the same. The family did not talk about his philosophy.

CW: But then you became a physicist. How did that come about?

HvF: Very logically—I flunked every other subject. You see, I was not applying myself at all, as it is called today. I just did not study, did not study for exams, did not study for languages, did not study for history. I flunked them all. But mathematics and physics I knew before I was even asked; it was all so obvious and perfectly clear. However, in the "Humanist Gymnasium," as my high school was called, the emphasis was on Greek and Latin and not on mathematics and physics. I only got through high school by the barter system. My neighbors in school were excellent students. They passed me the answers in Latin and Greek, and I gave them the solutions in mathematics and physics. After high school I thought: Let's go on with this thing because it's no problem at all.

CW: I see, it was obvious and natural.

HvF: Yes. On the other hand, there were, of course, things about which I thought: If I knew more and more deeply about them,

I would satisfy some of my basic curiosities: What is going on? What is putting the world together; what is holding it together? If I were to go into biology or any such field and not know what the basic elements of the physical world are, then the biological or psychological work I was interested in would have no foundation. I felt mathematics and logic are the fundamental disciplines for what is the structure of descriptions, and physics for what is to be described as the relation of things to be observed; they would give me some basic background on which I could build my future inquiries.

Maybe I would have turned to biology much earlier than I did if World War II had not forced me to postpone the answers to my curiosities. You could not pursue your own interests then. You had to survive. For me this meant to get out of Austria after Hitler invaded it in 1938. Parts of my family were Jewish. Everybody in Vienna knew that. I could not get a job there. I wanted to marry, I needed a job. The best place for me to go to, I decided, was Berlin. Nobody knew us there. During short stays there I had been impressed by the people, who survived bad situations with *Galgenhumor* (gallows humor). There was no situation in a bitter and soon desperate world of which they did not make fun. I found a job in a research lab. I was supposed to bring proof of my nonexistent Aryan genealogy. I succeeded in postponing it until the saturation bombing of Berlin liberated me from this concern. It also liberated me of all my earthly possessions, some of which I had rather liked and which had been in the family for a long time.

CW: You spent the war years in Berlin?

HvF: Yes, partly, and partly in a medieval monastery in Silesia. It had been secularized in 1820. Since then it had served different purposes, among others as a kind of West Point for the Prussian Army. Now, in 1943, it was transformed into a research laboratory and we had to work there, because our lab in Berlin was bombed. Göring, Hitler's field marshal, had pronounced it illegal to bomb Berlin. Unfortunately, the Allieds were not impressed and bombed Berlin nearly into extinction.

CW: But you continued to do research during all this?

HvF: Yes, I was doing plasma physics and I was working on the radar problem, the short wave German radar. It was basic and fundamental research which could not have found application for years to come. That was the whole idea: to stretch out the goal so far that Hitler could not reach for it.

CW: And how did you survive war's end, and what brought you to the USA?

HvF: I was married in Berlin in 1939. We lived there, in the very center of West Berlin and had three children, until our house, together with its neighbor the "Gedächtniskirche" (its ruin is now a war memorial) was bombed into oblivion. Fortunately, we escaped from the bombs and moved to Silesia. We knew it would be a short time before the Russians would chase us from there. The question was only: Would we escape, not only from the Russians but alsó from the Nazis, who were calling traitors the ones who did not willingly give their lives for the final victory and shooting them on the spot. There were some close shaves, and some unbelievable adventures — too many of them to talk about now.

CW: I still don't know how you found your way to Pescadero.

HvF: I am convinced that I was looking for it with my mind's eye all my life; I recognized it when I saw it, and I clung to it with all my strength.

CW: But there must have been several detours in your 35 years in the US.

HvF: Quite so. I escaped from Berlin, to which I had returned when the Russians took Silesia in April '45. The Russian artillery was bombing the city, which already was burning from saturation bombing. I made my way to Heidelberg, where my wife and children had found refuge with her family. And finally, in 1946

we found ourselves in Vienna. Friends from the US invited me to come to the US. I arrived in New York in 1949. After years of starvation diet, mentally and physically, I became immediately drunk with the energy that was driving New York and with the resulting excitement; it was as if I was on a high all the time. I had written a little book on memory, I had sent it to friends in the US; they called me and said I should come to Chicago. There was a group which was very interested in my work.

I flew to Chicago, Capital Airlines, night flight, $18.00 – all I could afford. At the University of Illinois Medical School, Department of Neuropsychiatry, there was a towering man, Warren McCulloch, who had started to think of mental processes in a new way, and he and his people were intrigued by the way in which I had quantified certain mental processes. My numbers agreed with the numbers they had measured. I had to give a lecture the same day I arrived. I could hardly speak English, to say nothing about lecturing. It did not matter. They all listened. If I groped for a word they helped me. It was intoxicating. In contrast to the culture I came from, it was the content that mattered, not the form of presentation.

CW: Did this lecture bring about your participation in the Macy Conferences?

HvF: Yes. My visit in Chicago was in February. Warren invited me to attend a conference in New York in March.

CW: I heard about these conferences and their participants through Gregory Bateson. He told me that he took part in one in 1942, on central inhibition in the nervous system. That was when the notion of feedback was introduced by Norbert Wiener and Julian Bigelow. Bateson then went off to war, in the Pacific, and found that these ideas were staying with him during that whole period. He said he ran back to the Macy Foundation after the war and said, "Can we have another one of these conferences?" And Frank Fremont Smith, the director of the conference program, said: "Warren McCulloch was just here and there is going to be another one." That began a series of meetings over

ten years of some 25 or so of the best minds from a variety of disciplines. As the conferences progressed you came in and played a central role. Can you tell me about it? What was going on at the Macy Conferences? How do you look at them now?

HvF: I told you about Warren McCulloch, who was head of the Department of Neuropsychiatry at the University of Illinois Medical School.

CW: By training, was he a neuropsychiatrist, a physicist, a philosopher or what?

HvF: The expression "by training" and Warren McCulloch are hard to combine. He was a creative receptacle for every fascinating idea, whether it was logic, mathematics, physiology, neurophysiology, philosophy, or poetry. The best account of himself he gives in his writing is the question: "What is a number that a man may know it, and what is a man that he may know a number?" That question sums up his work physiologically, neurologically, psychiatrically, mathematically, logically, theologically.

I could go on. But let me, for a moment, go back to our meeting in the basement of the Medical School in Chicago. The neighborhood there was a disaster area of poverty, neglect and dilapidation. A few months later, when my family had joined me, the McCullochs drove us around. Our boys, five, six, and eight years of age, looked out of the windows and said, "Chicago has been very heavily bombed!" They had lots of experience and knew a destroyed city when they saw one. But in that basement we were unaware of the surroundings. We were talking about my theory of memory. It was clear that, to make it work, you had to introduce the concept of learning. By recalling what you remember you are feeding it back. With feedback you have a circular causal system, a cybernetic system. So, Warren said, "Heinz von Foerster with his cybernetic idea of memory should come to the Macy Meeting where circular causal feedback mechanisms in biological and social systems will be discussed."

CW: This was in 1949; it must have been the sixth meeting.

HvF: Exactly. Let me give you a brief account of the Josiah Macy Jr. Foundation and the meetings they sponsored. A member of the Macy family had been paralyzed and had been helped by a group of scientists who met at an interdisciplinary meeting. The family consequently decided that they would fund a series of interdisciplinary scientific meetings. The director of the conference program was Frank Fremont Smith, who knew and was highly respected by the scientific community. The problems addressed were of great variety: glaucoma (about which one knew very little at the time), liver illness, aging, etc. There were 10–12 different meetings going on. "Circular Causal and Feedback Mechanisms in Biological and Social Systems" was one of them. The members of this group had met in intervals of half a year five times, so they knew each other very well.

CW: This was their sixth meeting, yet in the volumes published this is Volume No. 1? And you became the editor?

HvF: Yes. At that meeting it was decided to publish the proceedings. After I had presented my theory of memory in English, which by then I had spoken for about four or five weeks, the members of the group had a business meeting. I could not participate; I was a guest. Afterwards they called me and told me that they had decided to publish the proceedings from now on. And, they told me, they all had been appalled by my poor English and had been thinking about a device for me to learn English fast. "We have found a solution," they said. "We decided to make you the editor of these conferences."

It could not have happened in Europe. Only in America.

They were right. I learned English fast. After a month I got about five pounds of green sheets, on which all the conversations were transcribed from the steno tape. I bought the necessary dictionaries and I attacked my task. It was incredible. People like Norbert Wiener or Margaret Mead were speaking already in print. You had not to change a word. Others—including myself—did not make my life so easy.

CW: Who were the participants? Where did they come from?

HvF: Here is the list of people, remarkable, all of them, 30 all together. We will not list all of their names now; just let us look at their disciplines and it becomes clear what excitement their diversity, their different approaches, created. They come from: psychiatry, engineering, physiology, anthropology, computer science, neurophysiology, zoology, psychology, sociology, philosophy, mathematics, biophysics, electronics, and anatomy.

CW: I read through these transcripts and, as I told you at the time, they were the most remarkable intellectual documents I had ever read. The excitement and energy and involvement of these people come clearly through on these pages. I think that the Macy proceedings make a clear case for the move from the metaphors of physical science, of energy, to those of information. Bateson continually argued that the language of physical science is inappropriate to human science.

Could you explain what you think of the limits of technological metaphors applied to human systems? I know that some people take great exception to a behavioral scientist talking about feedback, input, output, analog and digital computation when you talk about human communication, and some hard-line computer scientists think it's a bastardization of their lingo. But here in the proceedings, you talk the language of cybernetics and its application to biological, social and technological systems.

HvF: I have a feeling that the meetings showed a state of affairs like plants pushing up through very hard ground. There were shoots, but not yet flowers. What you watch here, and that is the fascination, is a science in *status nascendi*, in the state of becoming. Usually at big meetings papers are presented, treating popular topics, urgent ones perhaps. Everybody has seen an abstract; they all talk about what they believe they know. But here they were all trying to find out, to get to the ground. Somebody says: "I wanted to report about the spirit of humor." "What do you mean by spirit?" "How do you define humor?" "What do you mean by report?" etc.

CW: In the good Platonic tradition of the symposium. I read them like a mystery story.

HvF: Yes, and nobody finds the solution.

CW: But there are clues . . .

HvF: Exactly, and the clues are found and tossed around. One of the clues is, for instance, the clumsy title of the conference at the beginning. It was obvious that they were looking for something under the umbrella of this complex title which allowed them to question and inform each other about the interests they had at heart.

CW: When did the title change into "cybernetics"?

HvF: When I came to the United States in 1949 Norbert Wiener's book *Cybernetics* had just been published. Warren said to me: "Why don't you read it before you come to the Macy meeting?" So I did. When they appointed me editor of the conferences, I was afraid of the long and clumsy title. I said, "May I make my first motion?" "What is your first motion?" I said, "I would like to call these conferences not 'Circular Causal and Feedback Mechanisms in Biological and Social Systems,' but 'Cybernetics.'" Great applause—they thought it was a good idea. I remember that Norbert Wiener was so touched by the unanimous embrace of his brainchild that he left the room to hide his wet eyes.

CW: Well, it's a synthesizing metaphor for what is going on in the conference, and it does redirect its way.

HvF: Absolutely. Norbert Wiener created this title for his interest in teleological mechanisms. Teleology had become a dirty word among scientists; it belonged to the dark ages. Today a scientist would not talk about teleological mechanisms, a final cause. Efficient cause, yes; final cause, no. But at the Macy meetings the scientists were looking at causal mechanisms, causes in the future instead of the past. They knew it was extremely important to comprehend certain mechanisms, where efficient cause would not bring enlightenment. But they did not know how to incorporate it, what was the language. At one of the conferences John von Neumann became really angry about the misuse and

abuse of certain terms that came out of the computer language. One day he had a tantrum. He pounded his fist on the table and shouted, in his expressive Hungarian English: "People, what are you doing?" And he gave, in his anger, an absolutely fabulous account of the distinctions and appropriate applications of the notions of digital, analog, discrete, and continuous. It was superb. The rule of the editing was that everybody got his contribution to the meeting after my editing; at that time they could change whatever they wanted; von Neumann, a perfectionist, thought he really had to elaborate on his presentation, which he had done in anger. I thought he had made all his points very clear, but he chiseled and perfected and elaborated on that presentation. The Macy people, who had to edit the final version, could not get his presentation from him. He delayed again and again; finally they had to go into print without von Neumann's beautiful story. He had pointed out that people had uncritically adopted terms from another field for their special purpose, and often the terms did not fit at all. Think of a carpenter who sees someone using pliers for driving in nails. Can you imagine his language?

CW: Apropos "digital" and "analog." These terms came from both neuroscience and computer science and were used freely at the Macy conferences. Now, they are being used very loosely, by people who study human communication; sometimes digital means language and analog means nonverbal, metaphorical. These are usages which seem intuitively attractive, but I wonder: How can we borrow an expression with a very specific meaning in one field and use it for our purpose in the study of human communication, which is soft and complex?

HvF: In the creative stage of ideas you are allowed to use anything and everything to get things going. Friedrich Schiller, the German poet, liked the smell of rotten apples and, with rotting apples in his drawer, he wrote one beautiful poem and drama after the other. The results: immortal poetry! But the rotten apples are forgotten. In the Macy Conferences you see the rotten apples as well. What comes later is a different thing. As von

Neumann pointed out at the beginning, there are four concepts: digital, analog, discrete, and continuous. These terms were later totally confused, misused here and there, one thing taken for the other. In this experimental stage one is searching for the right conceptual tool.

CW: Yes, I find that some of these terms become a power by themselves, moving along like juggernauts, used in blind devotion: "feedback," "homeostasis," "digital-analog," etc.

HvF: This has the consequence that instead of using language as a tool with which to express thoughts and experience, we accept language as a tool that determines our thoughts and experiences. Maybe when I feel that language is controlling me, then I am beginning to control language.

CW: That brings me to a question I have wanted to ask you for a long time. Feedback is one of the most important concepts at the Macy Conferences, and, as Bateson said, at the first one when the term was introduced, everyone went a bit crazy with the notion of a very powerful idea. You have been very closely identified with the notion of recursion, self-reference, eigen-values, and so on, which to me seems to be feedback coming of age. Could you tell me more about the relationship between feedback and recursion?

HvF: You may remember that in the Macy meetings some problems occurred again and again. They seemed to be attackable by the notion of self-reference, a circular causal circuit. The trouble is, self-reference gives rise to paradox. Therefore, from a scientific point of view, it has to be excluded.

CW: The statement "I am lying," for instance. Not allowed!

HvF: Exactly. Based on the premise that every proposition uttered must either be true or false, the benchmarks of scientific inquiry, you arrive at a system where propositions which are true when they are false and false when true have to be chased out.

They are "verboten." Now, in any type of theory of interaction, say, a theory of communication, or a theory of the brain, of sociology, of language, etc., the observer, the theoretician, must be included in the system he is theorizing about. Take, for instance, one who wants to write a theory of the brain. I think nobody will deny that one needs a brain to write such a theory. Now, in order that this theory can make any claim of completeness, it must be able to account for its being written. That is, a theory that describes the functioning of the brain must, so to say, describe itself or, if you wish, write itself.

At first this sounds crazy. This is because we are usually preoccupied with describing brains of others and not our own. The former task is easy, because any theory will do as long as it is either right or wrong. The type of theory I am talking about has to conform to the extraordinary constraint to describe itself—to turn, so to say, upon itself, the snake biting its own tail. There you have a similarity with feedback. However, recursive function theory goes much deeper. It is precisely the formal apparatus to handle this "turning upon oneself": The meaning of "recursion" is to run through one's own path again. One of its results is that under certain conditions there exist indeed solutions which, when reentered into the formalism, produce again the same solutions. These are called "eigen-values," "eigen-functions," "eigen-behaviors," etc., depending on which domain this formalism is applied—in the domain of numbers, in functions, in behaviors, etc. The expression "eigen-something" comes from the German word for "self." It was coined by David Hilbert in the late 19th century for solutions of problems with a logical structure very similar to the ones we are talking about.

CW: How does that help me to understand people talking? Language?

HvF: The phenomenon "language" is so rich that "understanding" it may have many different aspects. I can see two major schools of thought who look at it very differently. The one wishes to understand the rules of concatenation, by which correct sentences or, in the proper jargon, "well-formed sentences" are strung