

# Knowledge and Ignorance

Heinz von Foerster Lecture 2003

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## *Introduction*

One of the most peculiar features of Heinz von Foerster's thinking is its unmatched ability to combine knowledge and ignorance, knowledge with respect to theory and ignorance with respect to things and events. That ability made and still makes a lot of onlookers uneasy. Compared to first-order cybernetics which enjoyed a tremendous success both among fellow scientists and among sponsors, second-order cybernetics, which is Heinz von Foerster's invention, was a relatively unpopular endeavor. Family therapists, organization developers, and a few social thinkers never stopped considering it one of the most intriguing super theories – a theory of theories – of the second half of the twentieth century. But that does not mean that mainstream science ever got used to the epistemology or the pragmatics of that invention. First-order cybernetics holds the promise of finally discovering, fine tuning, and inventing anew the mechanisms of governance in body, mind, and society. Second-order cybernetics made one step forward by making one step back when it just looked at the observers venturing such a promise. The step forward consists in discovering the role of the observers. The step back consists in realizing that the very promise adds further complexity to things and events such that it becomes impossible to keep it.

I would like to expand a little bit on that peculiar combination of knowledge and ignorance. Everybody familiar with Heinz von Foerster's thinking at once recognizes it in all of his core ideas, be it

- the idea of “order from noise”, producing knowledge out of ignorance (von Foerster 2003b),
- the idea of “memory”, being interpretation without storage (von Foerster 2003c),
- the idea of “computation”, combining networks of self-determination with unspecified elements (von Foerster 2003d; von Foerster 1971),

- the idea of “construction”, blending the ethical imperative of acting always such that the number of choices increases and the esthetical imperative of learning to act when desiring to see, into one another (von Foerster 2003e),
- the idea of “information”, being a second-order relator of an observer (von Foerster 2003f),
- the idea of an “object”, being an eigen-value of a recursive function of behavior (von Foerster 2003g), or, last not least,
- the idea of the “non-trivial machine”, describing the synthetic mechanism of analytical indeterminacy (von Foerster 2003h; von Foerster 1984).

Heinz von Foerster developed a whole second-order cybernetics of indeterminateness and undecidability, a so-called lethology of the calculus of the unknowable (von Foerster 1993b), just to be as explicit as possible about this one point: Any knowledge we may have is a knowledge gained from an observation and description of the way we know. It is embedded in a deep and persistent ignorance of the world we rely on when venturing into a way to know.

In what follows I will not try to develop once more the basic ideas of Heinz von Foerster. Still less will I try to explain them this or that way. Instead, I would like to address them as a possible bridge between some early ideas of cybernetics and some late developments of sociological theory. I would like to speak about some ideas of cybernetics which relate back to the times when there was not yet a schism between first-order and second-order cybernetics. And I would like to give some idea of the possible reasons for sociology to try to revive a debate on these early ideas. Sure, sociology is not known for being a very faithful follower of cybernetic thinking. While there were early hopes of merging cybernetics and sociology for the purpose of the happy institution of a society including everybody, these hopes eventually died either in technocratic hubris or therapeutic guerilla warfare. Sociology then became notorious for its attempts to turn both first-order and second-order cybernetic ideas into an observation and description of feed-back and feed-forward mechanisms in society, thus turning the epistemological and in that therapeutic purpose of second-order cybernetics into a rather normal science. At least, that was what sociology looked like in the view of Heinz von Foerster who never accepted Niklas Luhmann’s change to von Foerster’s wording of the blind spot from “we don’t see *that* we don’t see,” into the wording, “we don’t see that we don’t see *what* we don’t see”. Von Foerster feared that this re-wording would lead to a risk of the loss of the therapeutic effect of an insight into our ignorance by embarking

upon the empirical project of trying to finally see what we don't see (Luhmann 1991; von Foerster 1999; Baecker 2002a).

What I would like to show in what follows is that sociology may be approaching some empirical insights into social behavior which are close to unresolved problems already addressed by early cybernetics. These empirical insights fit more easily with cybernetic epistemology than most cyberneticians tend to assume. Yet without Heinz von Foerster's insistence on the two-sided medal of knowledge and ignorance these insights perhaps would have been very difficult to gain, let alone describe. This means that I believe that there is a way to reconcile epistemology and therapy, on the one hand, and research and description, on the other. The only distinction between second-order cybernetics and sociology is, I think, the choice of the people and structures with whom to dance. Sure you can tell a story, Heinz von Foerster (1993a: 81/2) once said, but more important is with whom you dance it. The sociology I am talking about is dancing its story with powerful institutions and complex systems.

### *Three Problems from Early Cybernetics*

Warren McCulloch in an yet unpublished paper about "The Beginning of Cybernetics" (McCulloch forthcoming) gives a fascinating account of the early debates between Norbert Wiener, John von Neumann and others when arguing at the Macy Foundation meetings about the prospects of cybernetics. It is of some comfort to learn that the participants to the first of these meetings were "unable to behave in a familiar, friendly or even civil manner", stressed, as it were, by the demands of interdisciplinary talk. Yet of this account I will only pick up two remarks that may lead some way, I think, towards a better understanding of knowledge and ignorance.

The first remark I pick up is McCulloch's account of needing more than forty years just to be able to count: "My difficulty was that it took me from 1920 to 1964 to learn to count." He had to learn to count with respect to the spirals of pine cones – how they could grow while self-organizing the specific form they exhibit without anybody ever having laid out for the pine cone how it should grow. How can you, as an observer, count how the system you observe is counting the events it uses to self-produce and reproduce? McCulloch eventually learned how to count and returned to Plato, the Golden Section, and Fibonacci numbers in order to do so. I will not try to recount this here. I will just quote him saying that "only unfamiliar properties of chance and number" will prove able to "explain ontogenesis."

Onto these unfamiliar properties the second remark I pick up sheds some light. McCulloch recalls how Norbert Wiener and John von Neumann had their early debate and then did not meet again because John von Neumann became chief scientist of the Atomic Energy Commission dying young in 1957. This was most unfortunate because McCulloch considered these two men as having been the two mathematical geniuses working in science at that time. Not meeting again meant that Wiener was left alone in “struggling with three kinds of problems: The first, the statistical; the second, the coupling of nonlinear oscillators and, finally, continuous nonlinear prediction.” He did not succeed. And that again was most unfortunate because not succeeding in his attempts to tackle with these three kinds of problems did not of course mean that cybernetics came to a halt. What failure ever succeeded in stopping a theory? Instead, cybernetics evolved into the two kinds we are familiar with: first-order cybernetic technocratic model building; and the second-order cybernetic therapeutic constructivism.

Nobody is to blame, since both of these endeavors have at least kept the memory of cybernetics alive. Yet we should use, I think, any occasion we find, to go back to the unsolved tasks. They are mathematical tasks, not ethical ones. “These [three kinds of problems]”, McCulloch recalls, “and combinations of them, proved too tough and the last four years of his life, 1960-1964, were chiefly taken up with philosophical problems, often with an ethical or moral slant. This resulted in an unfortunate use of the word ‘Cybernetics’ in international meetings of a group of physicians, which Norbert christened ‘the Rheumatism of Cybernetics,’ and by other groups of would-be social reformers, all which extensions Norbert has expressly rejected in his answer to Margaret Mead and Gregory Bateson in the very introduction to *Cybernetics*. There is no doubt but that there are cybernetic problems in them, but we lack sufficiently long runs of uncorrupted data to apply the mathematical tools at our command. These things made us hesitate to set up an American Society for Cybernetics. When we did, it was to forestall the opportunists and the do-gooders. Perhaps we will succeed. The Russians have.”

It is, I think, part of the genius of Heinz von Foerster that he gave way to the “ethical or moral slant” of this “rheumatism of cybernetics” without ever losing sight of the mathematical problems still unsolved. His ideas on computation, on communication, and on ignorance go a long way towards the understanding of the three problems of statistics, of the coupling of non-linear oscillators, and of continuous nonlinear prediction. Yet it may be only by the help of sociology, that is, by social systems theory and some social network theory, that we will be able to acknowledge this contribution of Heinz von Foerster to the solution of the most serious problems of early cybernetics.

*The Statistical*

The statistical problem of early cybernetics concerns this implicit demand of long runs generating statistics under essentially constant conditions, in order to be able to describe how a system works. Statistics are necessary as soon as the system is complex instead of simple and thus consists, as in meteorology, of probability distributions of possible states and not just, as in astronomy, of a relatively small number of distinct things. Moreover, complex systems – due to the rather tight coupling of their elements – feature second-order coupling effects which more simple systems don't know. These two characteristics of states consisting of probability distributions and of elements coupled to each other in surprising second-order and higher-order effects mean that the Newton system of causal laws and reversible time does not suffice to describe them. Instead, we need, as Norbert Wiener (1961) emphasized, the James Clerk Maxwell, Ludwig Boltzmann and Josiah Willard Gibbs system of statistical and field mechanics which leads to a focus not on cause, force, and effect, but on communication and control. Among other epistemological features, to rely on communication and control means that accounting for similarities and repetition in order to be able to count at all becomes more important than looking for cause and effect (de Tarde 1895).

It proved difficult for cyberneticians as well not to try to fit communication and control back into the world of causes, forces, and effects. But to deal with communication and control in terms of statistics and fields means something completely different. It means, to cut a long story short, that you split your perspective on phenomena into the notion of an unknown probability distribution of possible states, on one hand, and the assumption of some feedback mechanism picking its way along, so to speak, on the other. It means to opt for “operational research” in the sense of W. Ross Ashby (Ashby 1958). That kind of research, which actually is any kind of enlightened behavior, foregoes the attempt to understand the phenomenon at hand and focuses instead on a constant comparison of effects observed with effects expected in order to correct on your own behavior, such a comparison being called “control”. It means to look for processes of deviation-counteraction which lead to a kind of homeostasis, as well as for processes of deviation-amplification which bring forth phenomena in a kind of “creatio almost ex nihilo” (Maruyama 1963). Please note the insertion of the small word “almost” into the old phrase of “creatio ex nihilo” which of course makes all the difference. It guarantees perceptiveness, the knowledge of some reality out there which we ignore. To deal with communication and control in terms of statistics and fields, thus, means to look at

communication as a kind of infinite recursion producing a “*nolens volens* stable eigen-behavior” (von Foerster 1980).

The problem of statistics consists in describing just how an unknown probability distribution of possible states of a system relates to the very reproduction of that distribution. There must be some operation, which at the same time is both a state of the system, and operates on one or several of these states which reproduce the system. The problem of statistics thus consists in conceiving a mechanism which is able to reproduce probability distributions simply by their selection and determination. How do you produce indeterminateness by determinate action? If you are able to answer that question you have solved the problem of statistics.

I don't know how that problem may be stated, let alone solved, in mathematical statistics. In sociology, however, Niklas Luhmann pursued a notion of communication that may serve as an indication of a possible solution. Imagine any communication, or so he said (Luhmann 1971; Luhmann 1990a, pp. 275 ss.), to produce the very surplus of meaning it is subsequently – and not necessarily happily – confronted with. Communication being, as Claude E. Shannon long ago made explicit (Shannon/Weaver 1963; MacKay 1969), a selection from a set of possible messages there is no way of producing communication, even when you want to make things as determinate as possible, without reproducing the set of possible messages. Saying “hello” to somebody else means to invite understanding as well as misunderstanding, encounter as well as evasion, an answer as well as silence, acceptance as well as rejection. Trying to channel communication on either its content-level or its relationship-level just adds further sets of possible messages (Watzlawick/Beavin/Jackson 1967).

Thus, the cybernetics problems of statistics is solved in sociology: If you want to find out how unknown probability distributions of possible states reproduce just look at communication. Communication is not the human way to make sense of a complex world but the social way to match that world and add to its complexity in the domain of social behavior relating together human beings, among others (Latour 1994).

Of course, this resolution of the first problems means to leave it to the systems themselves, the external observer struggling with attempts to find out how the system reproduces itself while internally producing a record of its own statistics (Baecker 2003).

### *The Coupling of Nonlinear Oscillators*

The second unresolved problem of early cybernetics, as addressed by Warren McCulloch, is the problem of the coupling on nonlinear oscillators. Again, I don't try of course to show how

this problem may be put, let alone solved, by mathematics. I shall try instead to show what it looks like in sociology. The problem consists of several sub-problems, which are the formulation of oscillators, the formulation of nonlinear oscillators, and the coupling of these nonlinear oscillators. Again, a sociological solution to these problems may be much more readily available if we adopt Heinz von Foerster's notions, which he did not propose in order to help sociology, but rather in order to be able to side-step it, yet which nevertheless are sociologically intriguing.

Heinz von Foerster was never very fond of sociology in particular or social sciences in general. "The existence of something called 'Social Science' is indication of the refusal to let sciences be social. This holds, of course, also for the Social Sciences" (von Foerster 1974, p. 128). But he added, "should Science be able to talk again it had better be social" (ibid.). That idea of being social by being able to talk is a core idea of Heinz von Foerster's special blend of cybernetics and ethics, called CybernEthics (von Foerster 1993a). It leads all the way to the understanding of the coupling of nonlinear oscillators (see also von Foerster 2003h). It is easy to see this as soon as one takes Heinz von Foerster's idea seriously to compare speech, and communication in general, to dance (von Foerster/Poerksen 2002). For that places the idea of the dialogue (and Martin Buber, see Buber 1962) at the center of attention and thus the possibility that the other as well as you, while and by being in dialogue with one another, oscillate between offer and comment, acception and rejection, question and answer, understanding and misunderstanding, continuing the dialogue, the dance, the communication or breaking it off. There is no communication which does not in that very basic sense oscillate. To enter into a dialogue, a dance, a talk means, at the very least, offering the possibility to the other to either accept or reject. Communication, as made explicit by Niklas Luhmann (1995, chap. 5) is not simply bothered or even infected by that possibility, but produces it, brings it forth, and relies on it for further communication.

The nonlinearity of that oscillation becomes evident as soon as one tries to take account of the dialogue, the dance, the talk being embedded in some unknown reality of mental states, body behavior, emotional stance and social behavior of other kinds of thirdness (Peirce). That reality presents the reproduction of the dialogue, the dance, the talk with different kinds of irritations and perturbations; the two (or more) dialoguing, dancing, and talking must somehow cope with. As any systems theoretical thinking since Heinz von Foerster, Humberto R. Maturana, and Niklas Luhmann has been able to show, this is done precisely by the nonlinear autopoiesis of a system obeying the basic equation of  $S = S(S, E)$ , such that at any instant  $S \neq S$  (where  $S$  stands for "system", and  $E$  for "environment") (Baecker 2002b). The

algorithm given for that equation by Heinz von Foerster is the algorithm of the nontrivial machine (von Foerster 2003h; von Foerster 1984).

Now, that much was presumably already evident to early cyberneticians. The problem, of course, emerges with the attempt to couple these nonlinear oscillators. Yet it is not clear, to begin with, that this problem is not just redundant with the nonlinear oscillation itself, since the oscillation already is produced by the communicative coupling of at least two complex entities the states of which are ignored. The oscillation is the indicator of a communication already in process, and thus of a coupling, which is in itself nothing other than a relationship assumed by the communication while it is able to reproduce.

We may, however, go one step further and assume that the problem of coupling emerges once again if one asks how entities being immersed in one kind of communication take account, first, of the uncertain future of that communication, second, of the possibility to end that communication one way or other, and, third, of the temptation or obligation to switch to some other communication. The problem of coupling thus refers to the question how different communications may proceed each having already found their precarious way of reproducing while still relating to each other. Phrased that way, the question strikes the familiar sound of Gotthard Günther's quest for polycontexturality as a way to link and network three- and more-valued distinctions (Günther 1979).

In sociology a possible solution to that problem goes by the name of "ambiguity". As above, all interaction analysis has been able to show, many, if not all, communication scripts used in dialogue, dance, and talk feature a peculiar ambivalence. That ambiguity consists in maintaining a certain ignorance about the roles being taken, about the future of the interaction being envisioned, and even about the type of the interaction being undertaken, even if it should be, and for onlookers seems to be, evident what the interaction is about. It is ambiguity both with respect to target and with respect to content that helps all the way to possibly switch issue, purpose, role, and future (Leifer 2002; Leifer 1991). It means that just about every communication is to a sometimes large, sometimes very small extent charged with the possibility of entering into other types of communication. One of the few empirical occasions that give at least some plausibility to such an assumption is the therapeutic technique of so-called "constellation work" (Weber 1998; Weber 2002). Here people are able to assume the cognitive and emotive content of issues, roles, and futures completely unknown to them so long as they are physically placed in some social space that makes it evident to them how they should relate to the situation. That may be an indication of the self-similarity of social behavior not only with respect to level (micro or macro) but also with respect to system (family, organization, society) yet is, of course, completely unproven.

The only thing that is proven is the role ambiguity is playing. And it is tempting to envision ambiguity not only as some state of uncertainty but also as a highly informed state embodying lots of possibilities to bifurcate into other states the realization of which depends on the path-determined behavior of the situation itself. It is tempting to envision ambiguity that way because it would help us picking up some very old ideas about distinctions containing distinctions, and knots containing knots, such that social behavior consists in always relating at least two possible interpretations of the situation at hand to each other, and in contextualizing these two states with a host of others (de Tarde 1897).

The prospect of that notion of necessarily ambivalent communication coupling nonlinear oscillators is fascinating because it would mean redirecting sociological attention to the management not only of that ambivalence but also to the switches enabled by it, currently kept at a distance most of the time nevertheless. Sociological network theory may be helpful here (White 1995), since it has a keen eye for the description of network-domains as structurally more or less rich in contrasting or sometimes even indifferent possibilities. Of course, novels, theater pieces, and movies already invest heavily in the observation and description of switches, looking, as it were, to people and their possible motives as well as to situations and their constraining media. Sociology might some day begin to reinvest here as well. Thus might it perhaps resume its dance with society.

### *Continuous Nonlinear Prediction*

The third and last unresolved problem of early cybernetics listed by Warren McCulloch goes by the name of continuous nonlinear prediction. Again, I do not look into the mathematics of this problem, as McCulloch would have wished, but rather look into the answer Heinz von Foerster gave, if indirectly, to the problem. What would he have answered if asked how to handle the problem of continuous nonlinear prediction? Well, checking the index of his “Essays on Cybernetics and Cognition” we see that he might have said that prediction is essential to cognition since without prediction “perception degenerates to sensation, and memory to recording” (von Foerster 2003a, p. 106). He would have said that to take nonlinearity into account is essential for all sciences interested not just in the elements of a system but above all in how they interact to bring forth the system as well (von Foerster 2003a, p. 192). And he would have said that to do continuous nonlinear prediction is tantamount to a process of cognition, which never stops to compute its descriptions and to compute its computations (von Foerster 2003f; von Foerster 2003i).

Do these answers satisfy the quest for a solution to the problem of early cybernetics? Well, perhaps. However, we need to add a further element which leads some way towards formulating the mathematical problem in showing what a calculus that can perform this kind of cognition looks like. This element adds quite naturally to those of communication and ambiguity already introduced, yet it seems to be the most difficult to realize. It is the notion of a future which is neither known nor ignored but acted upon as desired: “At any moment we are free to act toward a future we desire” (von Foerster 2003j, p. 206). That future is continuously always with us. We will never be able to exhaust its possibilities as long as we stick to the insight that presently we are free to act as we desire. That future is never to be predicted in a linear way, since acting towards it we realize that all our acts are embedded into a reality, which adds further elements and their interaction to our course of action, and to our desires as well. That future nevertheless will always be predicted in some way or other, since to forego prediction would mean to forego desire and thus to forego action.

A future, which is neither known nor ignored, poses of course some logical puzzle, which we may only be able to solve when we look at that future as a term in relation to the present (on one hand) and the past (on the other). We are talking about structure-determined or path-dependent systems that carry their past with them and would not have the slightest chance to express any desire at all were they devoid of their past (Maturana/Varela 1980). And we are talking about systems that can only act in the present, now, and have to realize that their present is of a peculiar nature since while being rich in simultaneous presents of many kinds it cannot be controlled or influenced the way the system may desire. Their present, their now is highly evasive (Hegel 1973; Whitehead 1979; Derrida 1972; Luhmann 1990b), never becoming a past that is to be taken for granted nor a future that is just one step around the corner.

Thus, the problem of continuous nonlinear prediction is solved by an understanding of the future, which is introduced into all kinds of meaning systems (mental and social) in order to let them monitor their states without becoming overwhelmed by their own complexity. It is a device to reduce complexity, which never forgets about the complexity being reduced. Again, sociology is aware of that peculiar kind of a future, which is a device to both shape and bracket the present and the past coming with it (Mead 1959; Nassehi 1993). We know from psychoanalysis and cybernetics alike that meaning systems are incapable of not imagining some kind of future, framed as purpose (Freud 1991, pp. 519/20; Rosenblueth/Bigelow/Wiener 1943; Pask 1970). Yet only recently has sociology – I mean: Niklas Luhmann – begun to take this idea seriously in beginning to describe the operative and recursive value of a future imagined as ignored yet to be designed. Again, European

philosophy ever since Aristotle, has understood about the value of contingency stemming from the future being ignored, and, in that form, shedding a specific light over the present which is the only time we can act upon in acting toward a future. Yet Luhmann in several of his last books began to look at this insight exactly in the sense, it seems to me, demanded by the problem of continuous nonlinear prediction as phrased by early cybernetics.

The two most impressive examples of this interest are Luhmann's concluding books about his sociology of organizations and about his sociology of the political system. In the book "Organisation und Entscheidung" (Luhmann 2000a), organizations are understood as those single social systems that try to determine all of their operations, that is, communication of decisions, with respect to a future defined, even fixed, as the purpose to be pursued by all of these operations. While the whole rest of the society sticks to the notion that the future is ignored, organizations select specific possible states in that future to be ignored and steer all their operations accordingly. They select people, program, and product according to these states of the future and begin to oscillate between success, defined as the future states turned into states actually achieved, on the one hand, and failure, defined as the very same states being missed, on the other. Efficient management, therefore, will be careful to select futures the states of which trigger an operationally sensible and effective oscillation.

In his book "Die Politik der Gesellschaft" (Luhmann 2000b) Luhmann looks at the reason why politics nowadays tries to shape itself in a "democratic" way and discovers that "democracy" means regular and anonymous elections and thus "confronts all political operations with a future it ignores" (Luhmann 2000b, p. 104). This single state of indeterminateness frames all attempts to gain and keep the power. It frames the selection and valuation of the issues to be pursued by politics, and the selection and stage-management of the people, their talk and their action (and non-action) imagined as possible images of a future desired by the electorate.

In economics (Keynes 1973), religion (Weber 1998), love (Luhmann 1986), and elsewhere it is similar. Introducing the ignorance of the future triggers provisions, life-conduct, and desires that are not just values added to the respective reality of these domains but their very core operations. Nothing informs as precisely as the future being ignored.

### *Constructivism*

It may be promising to introduce sociology along the lines just presented to a very strict kind of thinking, of methodology, and of epistemology as it is presented by cybernetics. Sociology may be well-advised to understand super-theoretical developments like those of cybernetics

as part of its subject domain and to inquire about the hidden social added value of these developments. It will then not be altogether too difficult to update sociological theory both with respect to theoretical means and with respect to its understanding of its subject. Cybernetics may turn out to be an endeavor that tells even more about the society seeking to frame a new kind of social contract in dealing with itself than a specific method or technology to look at and solve problems at hand.

Thus, my attempt in this paper to look at three unsolved problems from early cybernetics may turn out to give once again some reason to attempts to combine mathematical, neurophysiological, and sociological attempts to define a new kind of cognitive sciences (Varela 1999). There are “promises of constructivism” (Latour forthcoming) to be taken seriously that accept our ignorance of the world while trying to look at the presents we enjoy and suffer in terms of operations and a possible awareness going with them. It is no chance, I suggest, that the notion of “communication” figures most prominently in cybernetic, constructivist and sociological thinking. Heinz von Foerster and Niklas Luhmann, among many others, never ceased to be aware of a paradigm shift coming along with that notion. My attempt to bring communication, ambiguity, and ignorance of the future to the center of attention while trying to reframe the problem of the statistical, the problem of the coupling of nonlinear oscillators, and the problem of continuous nonlinear prediction of early cybernetics, was an attempt to be as faithful as possible to that tradition. That, however, does not spare us the need to act toward a future we desire. The future I desire is the future of serious work in cognitive sciences. It is a future I ignore.

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