

# Reintroducing Communication into Cybernetics

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**ABSTRACT:** The paper recalls some sceptical comments Norbert Wiener made regarding the potential use of cybernetics in social sciences. A few social scientists were seduced by cybernetics from the beginning, but cybernetics never really caught on in sociology. The paper argues that one reason for this may lie in the mathematical theory of communication entertained by early cybernetics. This theory which maintains that there are probability distributions of possible communication is at odds with the sociological theory's idea of a communication driven by improbable understanding. Yet the move from first-order cybernetics to second-order cybernetics, by re-entering the observer into the very systems she observes, provides for a bridge between cybernetics and sociology.

key words: communication, culture, cybernetics, double closure, observer, sociology, technology, understanding

## *A Refusal*

Norbert Wiener, in his book on *Cybernetics*, left few doubts about the usefulness of cybernetics for the social sciences. He acknowledged that "the importance of the notions of information and communication as mechanisms of organization proceeds beyond the individual into the community" (Wiener 1961, p. 18). And he did not hesitate to distinguish the social system from the individual, describing the social system as "an organization like [i. e., different from, D. B.] the individual, that is bound together by a system of communication, and that (...) has a dynamics in which circular processes of a feedback nature play an important part" (p. 24). But that is where his venturing into the realm of social sciences stops short, as far as his methodology is concerned. Urged by Gregory Bateson and Margaret Mead, among others, to pay more of his attention to social and economic problems in the "present age of confusion," he bluntly refused: "I can share neither their feeling that this field has the first claim on my attention, nor their

hopefulness that sufficient progress can be registered in this direction to have an appreciable therapeutic effect in the present diseases of society" (p. 24).

Methodology excepted, he did not hesitate to comment on current problems of the society. In the last chapter of the original edition of *Cybernetics* we find a sharp critique of "an official article of faith in the United States, that free competition is itself a homeostatic process: that in a free market the individual selfishness of the bargainers, each seeking to sell as high and buy as low as possible, will result in the end in a stable dynamics of prices, and with redound to the greatest common good" (p. 158). Wiener refers to Oskar Morgenstern and John von Neumann's general theory of games which is able to show that when there are more than three players, "the result is one of extreme indeterminacy and instability" (p. 159). The picture, however, becomes more determinate and stable when one abandons the assumption of perfectly intelligent and perfectly ruthless players—since it "is rare to find a large number of thoroughly clever and unprincipled persons playing a game together"—and refers instead to a situation structured by the presence of knaves and fools: "Where the knaves assemble, there will always be fools; and where the fools are present in sufficient numbers, they offer a more profitable object of exploitation for the knaves. The psychology of the fool has become a subject well worth the serious attention of the knaves. Instead of looking out for his own ultimate interest, after the fashion of von Neumann's gamblers, the fool operates in a manner which, by and large, is as predictable as the struggles of a rat in a maze" (p. 159).

The situation now is structured by the distinction of fools from knaves. But unfortunately this structure leads to a homeostasis of anti-homeostasis, to a process of dynamic stabilization bound to disrupt ever further the bonds of society, and maintained by a group of people who are neither fools nor knaves but profiteers of a time out of joint: "It is only in the large community, where the Lords of Things as They Are protect themselves from hunger by wealth, from public opinion by privacy and anonymity, from private criticism by the laws of libel and the possession of the means of communication, that ruthlessness can reach its most sublime levels. Of all of these anti-homeostatic factors in society, the control of the means of communication is the most effective and most important" (p. 160).

Wiener thus paints a poignant picture of the social situation of modern society. He is plain enough about the decisive factor determining the organization of the society when referring to the "control of the means of communication". But he refuses to go a step further. He would not know which step. There is no other mode of organization of society he could conceive of. On the contrary, there is still a need to promote, even, and above all, among his friends in the social sciences, the idea of benign anarchy in society. Social scientists tend to believe the whole more intelligent than its parts. This is an

error. "Like the wolf pack, although let us assume to a lesser extent, the State is stupider than most of its components" (p. 162). The parts exhibit a higher reflective power than the whole (see Günther 1976, p. 319). That is why social scientists know something about society they would not know how to implement, since it already *is* implemented—in the form of them knowing it.

The reasons for Wiener's refusal to approach sociological problems, however, lie even deeper than in his belief in benign anarchy—a belief which he, no doubt, could have substantiated by anarchy's control of the control of the means of communication. Cybernetics, for Wiener, is a branch of statistical mechanics. And there simply do not exist the long runs of statistics under essentially constant conditions which statistical mechanics demands when applied to any field whatsoever. The runs of statistics of society are "excessively short" and exhibit "widely varying conditions". "Thus the human sciences are very poor testing-grounds for a new mathematical technique" (Wiener 1961, p. 25).

As far as I can see, there is no reason to think this situation has changed in the almost fifty years since *Cybernetics* appeared. For it is not just a lack of statistical data which precludes statistical mechanics being applied to sociological problems. It is the impossibility of getting this data which precludes it. The social sciences lack a necessary precondition for the application of statistical mechanics, which is a sufficiently loose coupling between observer and phenomenon. Statistical mechanics has been successfully applied to areas of natural sciences where man is either too small (astronomy) or too big (atomic physics) to play a role which is of more than epistemological interest. In the social sciences, however, this role is a systematic one, one not to be neglected (Wiener 1961, p. 163). There is no loose coupling between the observer and the phenomenon, and thus there are no statistical runs ever to be expected on sociological problems which could exhibit constant conditions.

### *An Enticing Idea*

The love affair between cybernetics and social sciences did not stop right there. Certainly, the sociological mainstream never yielded to cybernetics, let alone to statistical mechanics. But there are some heretical endeavors in the social sciences which did not take Wiener's refusal to apply cybernetics to sociological problems as the final word on this matter. Anthropological epistemology (Gregory Bateson), management studies of viable systems (Stafford Beer), and sociological systems theory (Talcott Parsons, Niklas Luhmann) are among those which proved stubborn enough to stick to cybernetics. And the reason they had for this stubbornness is exactly the reason Wiener gave in or-

der to justify his refusal. They wanted to be able to talk about the couplings between the observer and the phenomenon. And they were understood, even by cyberneticians themselves. They could take comfort in second-order cybernetics' attempt to reintroduce the observer into the systems cybernetics talked about.

But long before the advent of second-order cybernetics social scientists were seduced into cybernetics. Why? A posteriori descriptions of the situation refer to cybernetics' discovery of self-reference and self-organization by means of feedback. That clearly must have attracted scientists interested in biological and sociological phenomena. But it seemed to be more the idea behind the notion than the notion of feedback itself which convinced people. There is ample evidence of cyberneticians eager to warn of a too-faithful application of the notion. In his 1961 Preface to *Cybernetics* Wiener even withdrew the notion of "simple linear feedbacks, the study of which was so important in awakening scientists to the role of cybernetic study" (p. viii), because it did not fit in with the study of non-linear circuits of all kinds, and went beyond statistical mechanics' trigonometric functions to Brownian motion functions. W. Ross Ashby (1956) thought feedback a notion inappropriate for the study of dynamic systems with more than three interdependent components. (How many components are there to be considered in a social system?)

So what was the idea behind the notion of feedback?

Norbert Wiener understood cybernetics to be a special branch of statistical mechanics with respect to a special problem of communication engineering. Social scientists were, and are, suspiciously quick in discarding the mathematical theory of communication proposed by Wiener and Claude E. Shannon as an element of a possible sociological theory of communication. It is true that mathematical communication theory applies to problems of information transmission by means of telephone, telegraph, and other types of tele-communication. But Wiener and Shannon did not hesitate to claim a broader application for the mathematical theory, to for instance written and oral speech, arts, and other human behavior; in fact, as Warren Weaver (1963, p. 3) emphasized, to "all of the procedures by which one mind may affect another."

Neither the idea of one mind affecting another nor the aspect of information transmission itself, but the notion of information advanced by the mathematical theory of communication proved to be able to fascinate social scientists. At least there was a theory of communication able to abstract from its semantic and pragmatic aspects in a way which did not preclude in any way a reintroduction of these aspects after a proper development of a theoretical understanding of communication. The mathematical theory of communication, and cybernetics a well, for that matter, offered an algebra of communication distinct from specific social situations but capable of being applied to any of

them. Wiener and Shannon offered the prospect of an algorithm of communication able to describe, as we will see, precisely the structure of a social situation in terms of itself—and something else.

For Wiener, communication theory already *is* the answer to the problems of the understanding of phenomena which exhibit too much coupling between interdependent components for a Newtonian or otherwise causalistic science to be of any use. When trying to understand phenomena, like in meteorology or in biological evolution, where couplings between the components lead to second and higher order effects, we cannot describe any actual situation but only the probability distribution of possible situations (Wiener 1961, pp. 31-32). And we can only describe probability distributions if we have the necessary statistical data—hence Wiener's refusal to venture into the social sciences where these data do not exist.

Yet there is a second exit to the problem of understanding complex—i.e. interdependent—phenomena featuring second and higher order effects. We can try to understand couplings better than we have done hitherto. And that means not only taking the probability distribution of possible situations as a concept for the description of otherwise intractable phenomena, but over and above that as the appropriate point of departure for further investigation. Couplings are taken to be nothing other than changes of probability. A coupling changes the probability of further couplings. Any coupling, as soon as it comes about, restricts, limits, or constrains further couplings to be expected. That is the insight of mathematical communication theory which moves cybernetics beyond its mere notion of feedback into a deeper understanding of self-organizing phenomena.

The fundamental notion, then, for the mathematical theory of communication and cybernetics alike, is the definition of information as a choice between (at least) two messages which are each a selection from a set of possible messages (Shannon 1963, p. 31). Certainly there are "noises" to be taken into account, but that suggests not only a set of messages but "a set of messages and noises with a known combined distribution" (Wiener 1961, p. 66). Everything hinges on the ability to designate a probability distribution. Having given the starting point of the theory by saying: "The *information source* selects a desired *message* out of a set of possible messages", Weaver (1963, p. 7) adds in parentheses: "this is a particularly important remark, which requires considerable explanation later." Indeed, I would not think it an exaggeration if one were to try to grasp the whole of cybernetics, in regard to its appeal now and in the past, as an explanation of this remark. Cybernetics is a set theory of probable messages and noises. It is a probability theory of communication.

However, we must remember that the fundamental notion of information is derived from the notion of coupling. And it is designed to be independent of distinctions between first, or second, or higher order effects of couplings. As soon as, and as long as there are couplings at all, there is information. As soon as, and as long as there is the reproduction at one point, either exactly or approximately, of the message selected at another point, there is communication (Shannon 1963, p. 31).

Thus the idea behind the notion of feedback is the idea of information changing the probability distribution of further information to come. "To be sure, this word information in communication theory relates not so much to what you *do* say, as to what you *could* say" (Weaver 1963, p. 8). Describing what happens in information transmission as a process of communication means speaking of a process whose components or events reduce in the course of the process, the probability of further components.

### *Second Thoughts*

Cybernetics is the abstract study of constraints. "In fact, the 'restraints' upon which cybernetic explanation depends can in all cases be regarded as factors which determine inequality of probability" (Bateson 1972, pp. 399-400). The 'form' it studies is the form a communication system acquires by continuing to exploit its own constraints. This form customarily goes by the name of 'control', but it is important to underline that control is nothing but communication (see Glanville 1979).

But still, the social sciences do not feel at ease with a notion of communication that consists of a series of distinctions between information source, transmitter, signal, noise, received signal, receiver and destination, and nevertheless calls the message selected by the information source the same as the message selected by the destination (see Weaver 1963, p. 7):

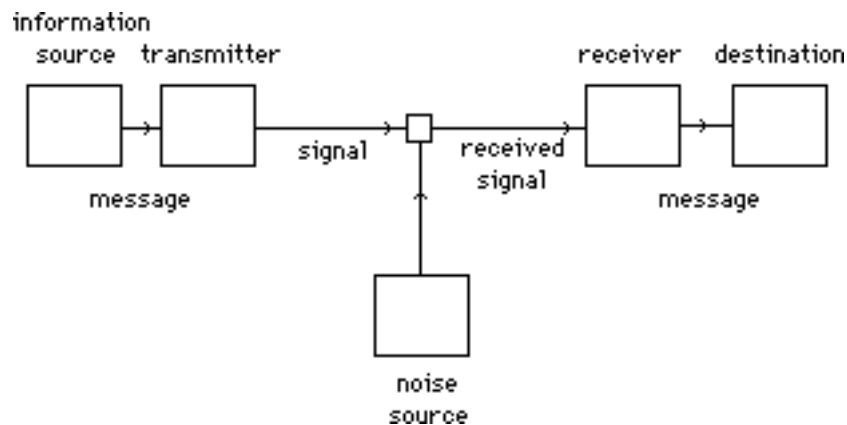


Fig. 1: The communication system of the mathematical theory of communication

It is obviously only an external observer who is able to call what happens at the information source the same as what happens at the destination. It is an external observer interested in engineering communication devices like the telephone, the telegraph, or a radar tracking an airplane, and working in the presence of noise. Eventually a communication device may be compared to "a very proper and discreet girl accepting your telegram. She pays no attention to the meaning, whether it be sad, or joyous, or embarrassing. But she must be prepared to deal with all that come to her desk" (Weaver 1963, p. 27).

It is a communication theory which does not pay attention to the selection process of different messages, save in that it is a selection process which creates at the start—that is, as it selects its first constraints (say, speaking English, or talking love, or chasing an airplane)—the probability distribution of further messages, and noises, to be expected. Due to its background in thermodynamics, the statistical mechanics version of cybernetics does not have to answer the question as to why there are choices at all in a process which consists of the exploitation of its own constraints. These choices are guaranteed by the presence of noise. And noise is a rather paradoxical notion in this case, since it hints as to possible entropy as well as to at least one distinction to be maintained even in situations becoming more and more entropic, that is, the distinction of message from noise. Lest you forget, there is Maxwell's demon to remind you. At least some choice is unavoidable, thus messages will be selected, constraints will be established, and probabilities will become computable. It is all a question of hardware, Friedrich Kittler (1992) would suggest. And nobody will deny that there is a good deal of redundancy not only in technical communication, but in social communication as well.

However, there remains one problem whose processing has led to an altogether different notion of communication. How are we to produce a model of a situation like our own, where the external observer is herself a participant in the situation, that is where the identity computed between the messages transmitted and the message received is itself part of the message received, or, for that matter, of the message transmitted? Just think of any conversation going on. How are we to conceive of a situation where the computation of probabilities is itself part of the structuring of the situation? Think of a business calculating its next marketing strategy in an environment consisting of turbulent fields. How are we to maintain the distinction between message and noise, when this distinction is part of the constraints to be selected at the start, when it later proves to be an arbitrary one? Think of modern art's attempts to shuffle around our much too rigid expectations concerning what messages are and what noise is in our social envi-

ronment. In short, how are we to take into account the observer being herself a part of the communication going on?

Attempts to answer these questions constitute what is widely known as second-order cybernetics, a cybernetics no longer of observed but of observing systems (von Foerster 1981; see Pask 1970, and Pask 1982). Second-order cybernetics maintains the possibility of talking about the unity of a system by breaking it into two necessary constituents, the one being its continuing operations, the other being its capacity to observe what is, and how it is, continuing. "Inside every white box there are two black boxes trying to get out," as Ranulph Glanville (1982) explains when bringing home this point that a distinction constitutes a unity. When we think of it this way, it is possible to reintroduce the whole notional apparatus of cybernetics into the systems it described and to look for the mechanisms these systems use in order to produce, and reproduce, themselves. It took only a switch—and development—from statistical mechanics to the theory of automata (see Wiener 1961, pp. 40 sq.) in order to change the focus of cybernetics' attention—albeit, "the theory of automata has proved more provocative than the automata theory divorced from the automata" (McCulloch 1989, p. 394).

How is it possible to deal with the paradox of a distinction constituting a unity, or of two constituting one? The breakthrough in answering this question came with second-order cybernetics' notion of operational closure, supported by notions like self-reference, recursivity, and autopoiesis (von Foerster 1981; Maturana/Varela 1980; see von Foerster 1987). The observer re-enters the system that she was formerly restricted to observe only externally by now simultaneously being part of the system and observing the system from within. That of course means that it is only the observation itself which becomes comprehensible. The system turns as black as the observer, the white box is the relation between them. Thus, the constraints cybernetics refer to when explaining systems turn into relations between observer and thing (see Ashby 1981, pp. 51-74).

The paradox of two constituting one was translated into the paradox of an observer participating in a system only partially comprehensible for her, yet nevertheless observable as being a necessary contribution to constituting herself as well, thus making her partially incomprehensible to herself. The paradox of a distinction constituting a unity was thus shifted to the paradox of a situation intelligible to itself due to the acceptance of necessary ignorance. This translation of the paradox has all the advantages of being a faithful description of our post-romantic epistemological situation, which is the situation of us living, thinking, and talking. Second-order cybernetics becomes a "lethology", a positive theory of ignorance able to deal with indeterminacy and undecidability (von Foerster 1993a, pp. 126-160).

The only language first, second, and further order cybernetics is able to speak is the language of constraints. Thus, reintroducing the observer into the system means adding another constraint. Since all constraints in cybernetics are constraints of producing, and reproducing, a system, adding a constraint means adding another factor of closure. Closure is a translation for 'constraints': "While at first one would think that the introduction of closure adds richness to the arguments, it does in fact do the opposite. It removes one degree of freedom. This is so, for whatever we may consider the 'end' in any domain, it must coincide with the 'beginning', otherwise the system is not closed." (von Foerster 1984, p. 6)

Re-entering the observer into the system, then, leads to a notion of not only simple, but double closure: the system "now recursively operates not only on what it 'sees' but on its operators as well" (von Foerster 1981, pp. 305). The system consists of observations, which are empirical operations, materializing themselves in the very reproduction of the system, and of observations of observations, or regulations of observations, which are similarly empirical operations, materializing themselves in the very reproduction of the system. One always needs two, an operation of observation and an operation of the observation of observation, in order to make one system.

Double closure adds indeterminacy by removing one further degree of freedom. The first degree of freedom removed by simple closure relates to the system's operations, which must exhibit some connectivity value in order for further operations to be able to continue the system. The second degree of freedom removed by double closure relates to the observer necessarily participating in the system, thus 'being', so to speak, the system's observations. The observer is sitting inside the system, and there is no way out. But she is not alone. There are always operations (of observation) going on already, otherwise there would be no system, and all she actually does, and can do, is to relate to these operations. That is what her organism is doing when living, what her mind is doing when thinking, and what her language is doing when communicating. In fact, it is three times that 'her' is to be in quotation marks, since the operations already going on are, and are not, hers. She can only relate *to* them, thus distinguishing herself *from* them, thus distancing herself in a double way from what she is.

The indeterminacy stems from being able to relate to operations (reproduction) as well as to observations (regulation), without being able to decide whether the relation to operation or the relation to observation is either an operation or an observation. It is both, and what it 'actually', or rather 'eventually' was depends on further operations (and observations). Re-entering the observer into the system means that you never know, you yourself being an observer inside a system, whether what she is doing is the drawing of a distinction or the marking of a distinction. We know from G. Spencer Brown's

(1972) calculus of indications that there is a difference between drawing and marking a distinction, the first one just doing what it is doing—that is, indicating some thing—the second one observing the form of the distinction—that is, the undistinguishable no thing behind the distinction, or the decision to distinguish, and indicate some thing, arbitrarily made by the observer.

Re-entering the observer, adding a further constraint and removing a further degree of freedom thus leads us to discover arbitrariness in the very technical sense of linguistics (Saussure 1972; see Glanville 1984). There is nothing mysterious in this arbitrariness. It is just the discovery of the observer making the distinctions, of an observer, however, who is referred to further distinctions when trying to know that is, to distinguish 'who she is' (see Baecker 1992, 1993, and 1994).

### *A Door Opening When Closing*

Cybernetics thus begins to oscillate between distinctions being drawn and redrawn, producing and reproducing a system on the one hand, and observations relating to the indeterminacy, undecidability and arbitrariness coupled to these distinctions producing and reproducing the system as well on the other hand. Cybernetics begins to oscillate between its explanatory principle of constraints, on the one hand, and its epistemological self-reference on the other, without being able to conceive of its epistemology as independent of the systems it describes. That is why there are so many references in the literature to the ocean being the only possible model of an ocean, to the mind participating in the study of the mind, to language being already the answer to all questions (being asked that is, voiced that is, 'understood') relating to language, to social sciences being precisely the answer to the question of communication they pose, and so on. There is no way to leave epistemological questions out of the domain under consideration. Everything you describe is a description of yourself as well, you being—at this moment—the one who is speaking.

Thus cybernetics should find a way to accept, and make use of, its own oscillation between the distinctions it draws and the undistinguishable it discovers when doing its work of description and explanation.

Interestingly enough, cybernetics has been even more shy of sociology than sociology has of cybernetics. In regard to one point, however, that is a pity. There is a notion of communication in sociology which might have been helpful for cybernetics. At any rate, it is a notion which would not have been possible to establish without the help of cybernetics' understanding of the double aspect of operation and observation, operand

and operator, being distinguishably different and indistinguishably the same, depending on the system's own handling of the distinction.

Communication in sociological systems theory (Luhmann 1984 and 1990) is far removed from the mathematical theory of communication's notion of transmission. There are no senders transmitting messages to any receivers whatsoever. There is nobody acting in order to communicate something to somebody. It is instead the communication, and only the communication which communicates. It is exploiting its own constraint, which consists in being able to find further communications only in the case where it distinguishes itself, by relating to other communication (compare the concept of 'writing' in Derrida 1967), from everything else—for instance from life, or from consciousness. Communication is producing, and reproducing, itself, and it is doing this autopoietically, that is, by having recourse to itself *and* to the prevailing circumstances happening to be around. Note that autopoiesis does not mean *creatio ex nihilo*, but production (*poiesis*) of itself (*auto*) out of itself and something else. Thus it presupposes an environment. The reality, to be sure, is a construction of the system. But it is something already out there as well. *Both* sentences given by Heinz von Foerster as no. 11 of his formalism of an epistemology of observing systems are to be kept in mind: "The environment contains no information"; but also "the environment is as it is" (von Foerster 1981, p. 263).

Sociological communication theory shares an important insight with cybernetics, and that is the insight into the multiple constitution of communication (Luhmann 1984, chap. 1). There is not one communication, but always a network of communications already going on, some communications fading out, others pushing themselves to the forefront, some being discarded, others being emphasized, and all of them present in their specific mode of absence. Nor is there one communicator, but always a distribution of at least two complex entities exhibiting divergent perspectives whose interaction constitutes the unity of the system. Note that it is not possible to dissolve the unity into the divergence of the complex entities constituting it. It is the communication itself that constitutes the communication; everything else, like intentions, motives, actions, even individuals, as far as we know how to speak about them, is a construction inside the system itself, thereby adding structure to its operations. And the structure of a "complementarity of expectations" (see Parsons and Shils 1951, p. 15) is all the structure there is, expectations expecting expectations. Of course, these expectations are not expectations maintained by individuals, but expectations produced, and reproduced, by the evolution of the social system and as such more or less gently 'offered' to individuals.

Expectations are structures solving and reproducing the problem of 'double contingency' of two or more 'actors' both, or all, waiting for the other, or others, to do something they can relate to. If ego's selections of actions are contingent on alter's selections of actions, and vice versa (see the Sherlock Holmes/Moriarty paradox which is famous in economic theory), then nothing happens, if not somebody risks doing something, or at least something else happens, a birth flying by, that both can risk referring to. Parsons and Shils (1951, p. 16) still considered some normative orientation to be necessary to solve the problem of double contingency and to let emerge some structure of complementary expectations. Niklas Luhmann (1984, chap. 4) maintains that a temporal feature like ego advancing a selection and waiting for alter to respond this way or that way, may suffice.

Sure enough, this picture of communication closely resembles the notions of communication entertained by different conceptions of 'dialogue', 'conversation', or 'language' (see von Foerster 1993a, Pask 1981, and Maturana 1994). It would be very interesting to compare these pictures at some length. I imagine it would turn out that they have at least two characteristics in common. The first one is the emphasis on multiple or mutual constitution, or on the emergence of a unity capable, in linguistic terms, of de-motivating, and then re-motivating, any one-to-one relationship between the communication and the external world. The second characteristic is the emphasis on a component constituting the unity of the communication which can be attributed neither to anyone speaking nor to anyone listening. Instead, it is the recursive connection between any one communicational event, a previous one, and the next one which constitutes the communication. Both Niklas Luhmann and Gordon Pask call this event 'understanding', an event neither objective nor subjective, but nevertheless, or rather therefore, "sharp-valued" (Pask 1981, p. 270).

Understanding is the third factor constituting communication that Peirce as well as McCulloch sought. Peirce (1960) called it an 'interpretant'. Referring back to Stoic logic, McCulloch called it a *Lekton*. Indeed, Stoic logic, as recalled by McCulloch (1989, p. 390) identified all three elements important to this day in sociological systems communication theory: "There are always three real related bodies: One is the utterance, the *flatus vocis* of Abelard; one is that which it proposes; one is something in the head like a fist in the hand called the *Lekton* ." Luhmann (1984, chap. 4) just renames them: as utterance, information, and understanding. But he goes an important step further by showing how the third one, understanding, relates to information and utterance, and how information and utterance, by being referred to by understanding, relate to each other. It is the understanding that distinguishes between the information and the utter-

ance, that is between some thing referred to and some body speaking, gesticulating, or otherwise being addressed by the understanding as 'acting out' a communication.

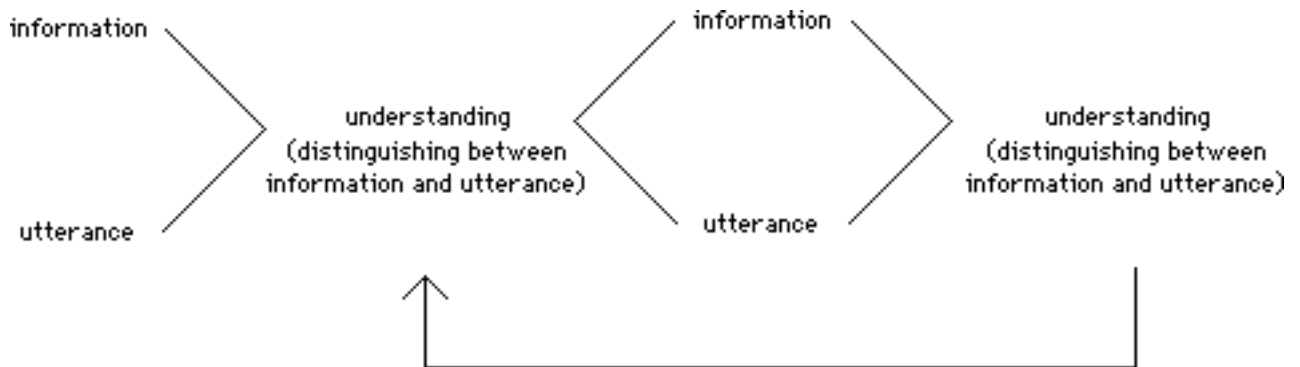


Fig. 2: The communication system of the sociological theory of communication

In other words, referring back to the mathematical theory of communication's notion of a selection of a message out of a set of possible messages (and noises): the information is a message *about* some thing (other-reference), the utterance is the message to the effect that there *is* a message (self-reference), and the understanding is the distinction *between* these two types of messages (see Fig. 1). There is no communication without an understanding to draw this distinction between information and utterance. But what is more, there is no information and no utterance without an understanding to distinguish them. It is the distinction drawn by the recursive communication network itself which produces and reproduces information and utterance. As soon as you take the obligation, that is the option, of choosing between utterance and information out of the communication system (if that were possible at all), you would kill it off. Because that obligation and option are shorthand for communication. To be able to choose between relating to the self-reference of a communication ("Why did you tell me right now?") or to its other-reference ("Could you explain what you mean?") is the necessary precondition of all communication.

Of course, there is no need for communication to understand 'really' what any body means. Nor is the communicational understanding necessarily related to whatever a consciousness happening to be around understands from what is going on. To draw the distinction between information and utterance is sufficient—and already demanding enough. The communication constructs its own continuation of understanding out of the recursive history of the communication, drawing on the states it passed through, as on the states it is in, as on the states it is able to expect.

The operation called understanding takes place before there are questions raised as to the acceptance or rejection of a communication. The acceptance or rejection is a sec-

ond option entering the process as soon as understanding comes about, forcing the communication to branch off further into different possible paths at hand. Either acceptance or rejection, a Yes or a No, continue the communication, whatever may happen then. Even dissent, protest, and opposition are to be communicated if they are to be at all. It is like a door opening when a door is closed (Lacan 1978).

A final remark on this model is that one does not need a special place for noise to explain how disturbances, perturbations, irritations, deviations of all kinds can come about. The communication system is capable all on its own of producing the noise it needs to feed on, by being highly sensitive to random events, especially those produced by psychic systems operating in its environment. One can read the history of the evolution of the communication system of modern society, especially after the Romanticist intervention into the expectations of the French Enlightenment and German Idealism of an ever continuing progress of communicational rationality, as the history of the discovery of consciousness as an operationally closed system as the communication system is an operationally closed one (see Luhmann 1995a). That is one reason, it appears, why it is so difficult for us today to reverse the perspective and indicate the operational closure of the social system.

There are two types of systems present (present, that is, in their respective modes of absence) which both operate on meaning and which are both able to not only select one meaning among others but to observe the selection as a choice discriminating others which, perhaps just because they were discriminated, have a good chance of being selected the next time. There is no way to avoid summoning an inexhaustible horizon of further possible meaning referrals as soon as just one is selected. Maybe there are probability structures of the selections to be expected and those not to be expected. But as soon as there is communication about these probability structures, they will be no structures any more one were to bank on. That is why Wiener (1961, p. 163) can be so sure when saying that there "is much in the social habits of a people which is dispersed and distorted by the mere act of making inquiries about it."

Add second-order observation, that is, observers observing what others are observing including what they are not observing and including that remarkably, they do not see that they do not see what they do not see (of course: von Foerster 1981, pp. 289-90)—and you get a highly fluid system of communication capable of switching its focus in a way no sequential information processing device—including the book, preliterally hypertextual as it ever was—could dream of.

Communication turns out to be as operationally closed as a system can possibly be (von Foerster 1993b). Without necessarily claiming that all autopoietic systems are so-

cial systems (as do Zeleny and Hufford 1992), there is certainly ample evidence of social systems being autopoietic ones, even if Maturana would not like to hear that.

Yet the nice thing about communication is that one can use it either to make it easier, faster, and more reliable in the sense of mathematical theory of communication or to make it more difficult, delay it, and make it more uncertain. Both ways work through communication being applied to itself. Both re-enter communication into communication by means of communication and have to rely for that on the possibility of internal delays (MacKay 1964, p. 177) built almost naturally into communication. The one making it easier to communicate may be called a 'technology'. The other one, making it more difficult, may be called a 'culture'.

A technology is a "functioning simplification in the medium of technology" (Luhmann 1993, p. 87), operating by means of the establishment of selected couplings which can be isolated from their environment and its undesired effects. Any technology, even the most technical one, presupposes such an isolation from undesired effects, among them those emanating from communication. Proof of this is the problem of modern high technologies which cannot be isolated from communication, as they demand for their isolation, further and further 'containment technologies'. Accidents, then, are to be expected (Perrow 1984).

There are communicational technologies as well, for instance those developed in education, in therapy, in the penal system, or in marriage-brokerage. Their functioning is not guaranteed, it is true, but they are simplifications which work as long as there is an interest in communication, to relieve the strain on the communication produced by the very impossibility of these technologies functioning at all. Let communication take charge of the handling of this paradox. Once again, it will work miracles. Modern society is differentiated into subsystems which all have their special function, like law, economy, politics, science, religion and others, and which all are technologized to the degree of featuring a binary coding that enables them to identify with all necessary ease those sharp-values of understandings they need to reproduce themselves: legal versus illegal, payment versus non-payment, government versus opposition, truth versus untruth, transcendence versus immanence, and others (see Luhmann 1989).

At first sight, there is nothing to hinder an analysis of these social systems in terms of statistical mechanics, provided we know how to identify their basic components and how to enumerate them. We might even start to investigate into the communicational procedures necessary to maintain the splendid isolation of these systems. Communication itself has already started this process of investigation, as is demonstrated by the organizational revolutions concerning authority, hierarchy, and competence taking place in the economic system as well as in politics and universities.

Such an investigation, be it instigated by the social systems themselves—interestingly enough, you need social systems capable of (individual or collective) 'action', like organizations, to venture to do this—or by external observers like cyberneticians, social scientists, consultants and the like, must in any case have recourse to the other way mentioned to handle communication by means of communication. It brackets out technologies, it requires further communication, it strains cherished conventions, it tries to show every body what is being done and how, in short, it is a real nuisance, but you are right to call it 'culture'. We are, I suppose, wrong in thinking that culture is what is left when cultural critique has done its work. Culture, rather, is what cultural critique does. Maybe the first master of it was Jean-Jacques Rousseau in his 1750 Academy Discourse on Arts and Sciences. Since then we have known how to cultivate our unhappily cultural consciousness.

Culture effects the double closure of society (Luhmann 1995b). It is everything called upon to show its other face of not just being what it is meant to be (a chair, for instance) but of being a selection of one meaning out of a set of possible other meanings (a lifetime job, or a piece of art, or grandmother's comfort at the eve of her life). These possible other meanings, selections as arbitrary as the first ones relating to the pragmatic use of some thing, are to be communicated as well. That makes it more difficult, more burdening, more work to communicate. It is as if you were meant to indicate something and indicate the distinction you are using to indicate it at the same time. It is as if you were to draw a distinction and to observe its form (in terms of Spencer Brown 1972) simultaneously. It is as if it were demanded that you make your epistemological justification at the same time as you describe or explain some thing. It is, in short, as if you were to do second-order cybernetics while still being interested in feedback.

Of course, the girl can still accept your telegram. But a good deal of the epistemological endeavor initiated by second-order cybernetics, sociological systems theory, deconstruction and the like expects everybody to be able to switch from taking dictation over to discussing either the message or your sending it, or the writing demanded to take it, or the gender asymmetry established almost without saying by expecting that it will be a girl who takes dictation from you. Let us cancel the phrase "without saying", and we know where we are, even when "the excursion to infinity undertaken to produce it has denied us our former access to a complete knowledge of where we are in the form" (Spencer Brown 1972, p. 57). We seem to have entered almost without knowing, Karl Marx, Søren Kierkegaard, and others notwithstanding, the era of statistical mechanics and its enticing belief in probability distributions and hardware. We will not be able to leave it without reconsidering, for instance, our notion of communication.

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