THE CYBERNETICS OF CONCEPTUAL SYSTEMS

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ABSTRACT

Cybernetics in the United States has evolved through three identifiable periods. In the first period of the 1950s and 1960s there was a primary concern with designing control systems and with building machines to emulate human reasoning. In the second period of the 1970s and 1980s the focus of attention was on the biology of cognition and constructivist philosophy. In recent years increasing attention has been given to social systems. Whereas the work on the biology of cognition required that attention be shifted from what was observed to the observer, the recent interest in social systems requires an emphasis on multiple observers and their beliefs. The third period of social cybernetics or the cybernetics of conceptual systems is illustrated by considering constructivist cybernetics as a conceptual system created to promote the evolution of certain social systems in a preferred direction.

THE EVOLUTION OF THEORIES WITHIN CYBERNETICS

Ideas and society interact. People describe social processes, and theories of social systems, when acted upon, change social systems. Indeed, social scientists create theories of social systems not only in an effort to describe social systems but also in the hope of changing them. Furthermore, social theories and philosophies arise in the context of particular societies. People in different societies make different assumptions about human behavior and motivation. Also, the process of social and political change does not occur in the same way in all societies. Hence, theories of social systems inevitably reflect the societies from which they emerge, and assumptions about social change reveal the processes of social change in the societies from which they originate. The history of cybernetics in the United States provides an example of these assertions.

Although a number of very early precursors to cybernetic thinking have been identified, the early period of cybernetics in the United States is usually said to have begun in the middle 1940s and continued through the late 1960s. This period was marked primarily by the study of feedback loops and control systems and by efforts to construct "intelligent" machines. This period could be called the period of engineering cybernetics or the cybernetics of observed systems.

Beginning in the early 1970s Heinz Von Foerster, following a suggestion made by Margaret Mead (1968), led a movement to turn cybernetics back upon itself and to focus attention on the observer. This movement gradually spread until by the end of the 1980s it included virtually all of the active members of the American Society for Cybernetics, and the ideas of the cybernetics of cybernetics or "second order cybernetics" were attracting increasing attention outside the U.S., particularly in Europe.

However, the roots of second order cybernetics were present at the time the field was founded in the 1940s. Von Foerster has pointed out that an interest in knowledge, cognition, observation, and the nervous system was the original intent underlying cybernetics. Warren McCulloch in the 1940s created the field of "experimental epistemology" by combining the fields of neurophysiology, mathematics, and philosophy. McCulloch (1965) asked such questions as, "what is a number that a man may know it and a man that he may know a number?" and "what is in the brain that ink may character?" Also in the 1940s Norbert Wiener (1948) designed machines that emulated human activities of acting and perceiving by first studying the nervous system and then embodying principles of its operation in electrical and mechanical machinery.

Nevertheless, the early attention to epistemology and neurophysiology was overshadowed both in the popular press and in funded research by work on automatic control and feedback mechanisms. Hence, the reorientation in the 1970s of the principal focus of attention to experimental epistemology, the biology of cognition, second order cybernetics, or the philosophy of constructivism (these are variations of a closely related set of ideas) was a significant event in the history of cybernetics, not because it was a completely new idea but rather because the reorientation was accepted by the majority of the members of the American cybernetics community. (It is perhaps only fair to acknowledge that there were only 200 to 300 active members of the American Society for Cybernetics. Those interested in control

systems and artificial intelligence were active in other academic societies.)

The "second order cyberneticians" claimed that knowledge is a biological phenomenon (Maturana, 1970), that each individual constructs his or her own "reality" (von Foerster, 1973) and that knowledge "fits" but does not "match" the world of experience (von Glasersfeld, 1987). This program of research, which focused attention on the observer, has led to important new theoretical understandings. These advances have been of interest primarily to those concerned with the nature of knowledge, cognition, and understanding itself.

However, those interested in social systems find that it is necessary to ask, "Precisely what are the various observers thinking?" Granted that different observers construct different "realities," what are their "realities" or their conceptions of the world? Given differences in perception, how do people reach agreement on shared purposes? And, what values and institutions are most successful in promoting the development of both individuals and social systems? (Umpleby, 1991a) The program of research described in this paper is concerned more with identifying the beliefs associated with the effective functioning of organizations and society and less with the biological foundations of knowledge. The point of view presented here emphasizes that knowledge is a social as well as a biological phenomenon.

One way to understand how this point of view can be regarded as an extension of second order cybernetics is to examine various interpretations of self-reference. Self-reference has been an important idea in distinguishing second order cybernetics from first order cybernetics. In second order cybernetics, unlike first order cybernetics, theories and observers refer to themselves. However, most second order cyberneticians have emphasized biological and linguistic self-reference. The argument was that a theory of biology, to be completely satisfying, should account for the existence of theories of biology, since knowledge is a biological phenomenon. Similarly, an adequate science of cognition should permit human beings to be able to "understand understanding." In the case of language the intent was to move from a view of language as a string of symbols representing external objects to a view of language as actions for coordinating actions. As an example of the new interpretation of language, particular attention was given to "performative utterances" of which the most well-known perhaps is the statement, when uttered in an appropriate setting, "I now pronounce you man and wife." The statement is an example of self-reference because it both transforms the social status of two people and describes that transformation.

However, self-reference also occurs quite commonly in social systems. For example, scientists are members of the scientific community. When they develop theories, are they attempting to advance science, their personal careers, or both? Without further evidence, the question is undecidable. Scientists are also members of social systems. When they develop theories, are they attempting to improve society, their own positions within society, or both? These instances of self-interest in the production of knowledge, though perhaps mildly puzzling, are less important than self-reference in a criminal proceeding. If a person is accused of a crime but professes innocence, is he truthfully recounting events or protecting himself from

punishment? Legal guarantees which protect a person from being forced to make self-incriminating statements are social innovations which have made torture ineffective in a criminal justice system. Those interested in biological cybernetics have not had much to say about social phenomena other than suggesting that a biological view of knowledge amounts to a justification for the acceptance of tolerance (Maturana, 1974).

If cybernetics is expanded to include multiple observers and their beliefs, we shall be able to deal with a broader range of phenomena. Assuming that we are interested in improving our social systems and that we regard social systems as collections of thinking participants (Soros, 1991), we may well ask how we might influence what people think. There is an interaction between thought and action. If people change the way they think, they will change the way they behave. And if people change the way they behave, they will eventually change the way they think, as they make their thoughts consistent with their actions. If enough people change the way they behave, the social system will operate differently. This point of view is hardly unprecedented. For example, Kenneth Boulding's 1956 book The Image can be summarized as follows: People reason through images of themselves and the world. Peoples' images determine their behavior. Images can be changed by new messages and conversation. When images change, behavior changes.

Both the earlier biological cybernetics and the more recent social cybernetics share an emphasis on subjectivity rather than objectivity. The second and third phases of cybernetics are quite compatible with recent trends in the social sciences which have emphasized subjectivity rather than objectivity in descriptions of society (Morgan, 1983).

FOUR METHODS FOR DESCRIBING SYSTEMS

Explicit attention to conceptual systems, or to beliefs and values, is not a new development within the social sciences, but in some fields, such as economics, there has been a tendency to assume that the beliefs of individuals do not matter or at least cancel out. I believe the reason for the neglect of beliefs and values in some social science disciplines is traceable to a desire to emulate the physical sciences. In the physical sciences statements may describe causal relations, but they do not alter them. However, in the social sciences, changing the way society operates is at least part of the purpose. Physical and social systems are fundamentally different in their "responsiveness" to theories. Not surprisingly, the methods developed by physical scientists (e.g., methods which do not take into account how the system responds to being observed) were shaped by the nature of the systems they were studying. As the social sciences mature, new methods, appropriate to the phenomena being studied, are being developed.

One way to make clear the focus of attention of social cybernetics or the cybernetics of conceptual systems is to consider four methods for describing systems. One definition of cybernetics is that it is the science of the regulation of systems. The way one chooses to describe systems can determine in a subtle way what questions one asks and what phenomena one pays attention to.

1. Variables: Probably the most highly regarded approach

within the scientific community is to define a system as a set of interrelated variables. Such an approach lends itself to quantification and measurement, to statistical analysis, to building deductive theories, and to computer simulation. Examples of measurable variables in physics are mass, length, and time. In economics commonly used variables are per capita income, savings, investment, and gross national product. Variables used by demographers include mortality and fertility rates and total population. When describing a system in terms of variables, the structure of a system is described by the relationships among the variables, ideally presented in the form of equations. The equations can be tested against data using various statistical methods. The behavior of the system is described by the changes in the values of the variables over time.

2. Events: Not all systems can easily be described in terms of measurable variables. Some systems are described by a sequence of events or states. Computers are programmed using a sequence of instructions, and programs are "debugged" by stepping through the sequence of states generated by the program. The history of a country is usually related as a sequence of major events. In family therapy a problematic pattern of interaction between two partners is often presented as a recurring series of events.

3. Groups: Social systems are often described as being composed of different groups of people. Each group has a history and a set of shared interests or goals. Groups, such as political parties, form coalitions to advance their interests vis-a-vis other groups. Game theory is one way of describing the strategies that individuals and groups adopt to achieve their ends. Groups can be defined by profession, income, education, organizational membership, or beliefs and values.

4. Ideas: One feature of complex social systems is that different individuals and groups are "playing different games." They not only have different goals, they live in different conceptual worlds. One way to compare the different ways that individuals or groups think is to list the key beliefs, assumptions or values which make up one or more "conceptual systems" in a table. As an example, see Table 1. Presenting beliefs and values in this way assumes that individually constructed "realities" can be described in the form of linguistic statements and that similarities and differences can be identified in these statements. Comparing ideas through the medium of language entails "objectifying" ideas, but temporarily "objectifying" ideas in language does not alter either the biological or the social nature of knowledge.

Usually authors will choose to emphasize one of these four methods for describing a system. However, it is possible to make connections among the four methods. Variables measure certain features of a system, for example the unemployment rate and the inflation rate. Events can be defined by the specific values of the variables used to describe a system. For example, a recession could be defined as a period during which the growth rate is negative and unemployment is high. A boom could be defined as a period during which the growth rate is positive and unemployment is low. A sequence of events constitutes a description of the behavior of a system. Groups can be regarded as the major actors within a social system. Their behavior determines the sequence of events. Individuals and groups act

out their beliefs and values, which are shaped by their experiences and their conversations with each other.

As we move from variables to events to groups to beliefs, we move from measuring aggregate human behavior to examining the beliefs and values which shape or justify behavior. As we move closer to the rationalizations of human behavior in ideas, we move closer to being able to influence human behavior through communication and conversation. In some sciences there has been a change over time from describing systems in terms of variables, then states, then groups, and finally conceptual systems. For example, in management science the tools of operations research, developed during the 1940s, were concerned with building mathematical models. Interest in systems analysis led to creating flow charts, which are sequences of events. The human relations movement focused attention on groups and organizational politics. A concern in recent work has been with designing a conversation and then leading a group through the conversation (Umpleby, 1992).

Leading a group through a conversation is similar to composing music and then conducting an orchestra in playing it. This method of problem solving presumes a distinction between content and process in communication. What is designed is the process -- a sequence of questions or issues the group should address. The content is determined by the group engaging in the conversation. The outcome of the conversation is not predetermined. In one method of strategic planning the members of an organization consider in turn their vision for the organization, the obstacles to achieving the vision, strategies for removing the obstacles, tactics to carry out the strategies, and actions to implement the tactics. Such methods can be used for strategic planning, team-building, and/or problem solving (Spencer, 1989). Also, they constitute a way of helping a group of people to reach consensus. These methods are based on the assumption that organizations and societies are composed of individuals who seek to work together for common purposes. The participants write down their ideas on cards and then arrange the cards in order to define the shared views of the group.

IS SOCIAL CYBERNETICS MORE PROFOUND THAN BIOLOGICAL CYBERNETICS?

For a number of years American cyberneticians have shared the conviction that second order cybernetics or the philosophy of constructivism is more profound than the conventional philosophy of realism (Umpleby, 1990, 1991b). When challenged, they point to experiments on the biology of cognition. Indeed, these experiments have been highly effective in leading many scientists from the philosophy of realism to the philosophy of constructivism. However, an argument can be made that social cybernetics is at least as profound as biological cybernetics. Consider the following propositions.

1. I (the writer) and you (the reader) exist and have mental images of each other.

2. We are both human beings who have had at least two decades of similar experiences as human beings.

3. We share a common language and an interest in philosophy and the nature of knowledge.

4. We are both familiar with many scientific theories and experiments.

5. We share a belief that knowledge emanates in the nervous system and that the nervous system can be studied by conventional scientific means.

6. Using conventional scientific means to study the nervous system leads to the conclusion that the nervous system is organizationally closed, that all knowledge is constructed to fit experience, and that an attempt to compare theories with experiments is actually a comparison of the linguistic domain within the nervous system with the experiential domain within the nervous system.

7. The nervous system never has direct access to any phenomenon other than nervous activity itself.

8. Other people, the external world, science, and language, as they are known to any individual, are all merely emanations of nervous activity.

9. Some ideas may be better for some purposes than others, but we can never be certain that our ideas are "correct." They merely fit our experiences. Other people, who have had different experiences, will reach different conclusions.

10. Hence we should be tolerant of other people and their views.

Several comments can be made on this argument. First, the constructivists start their arguments about half way down the list of propositions and do not mention the first half. However, as the sequence of propositions indicates, even arguments based on neurophysiological experiments presume a great deal of shared social experience.

Second, one could claim that the idea of tolerance is included in the early propositions, since respect for the opinions of others is one of the basic values of the scientific community.

Third, it is not necessary to go through such an argument to reach the conclusion that people should be tolerant of others. Some societies regard tolerance as a moral axiom (e.g., the golden rule: Do unto to others as you would have them do unto you). And some legal systems embody this axiom in law (e.g., The Bill of Rights in the U.S. Constitution).

Fourth, both constructivism itself and the idea that the desirability of tolerance needs to be "proven" by a scientific argument appear to emerge from the philosophy of German idealism, that is, from belief in the primacy of the inner over the outer world and from preference for the "free realm of ideas" over the "necessary realm of matter." In Kant's idealism the a priori is rational form and the a posteriori is empirical matter. In other words, a person composes a conception of the world and then acts on that idea.

CONSTRUCTIVIST CYBERNETICS AND GERMAN IDEALISM

The concern with tolerance in the writings of constructivist cyberneticians may be due to the fact that the leaders of this

movement have themselves experienced political repression either in Central Europe in the 1930s and 1940s or in Chile in the 1970s. The considerable passion that the founders of constructivist cybernetics bring to their work can be more easily understood if it is viewed as an attempt to rectify patterns of thought that led, through the power of the state, to the deaths of family members and friends. Indeed, I believe that constructivist cybernetics cannot be fully understood unless it is viewed as an effort of social, cultural, and political reform by people who come from a society that not only has a high regard for philosophical thought but that also tends to view human action as the product of a philosophical outlook.

Whereas British and American philosophers emphasize respect for the individual, empathy with other people, and the pragmatic consideration of ensuring one's own liberties by protecting those of others, a philosophy based on constructivist cybernetics emphasizes the limits on the individual's ability to know and hence the inappropriateness of one person imposing his or her views on another.

If at least part of the goal of constructivist cybernetics is to establish tolerance in society, a more direct and more certain route would seem, to an American, to be through a moral axiom and constitutional guarantees rather than through a revision of the philosophical foundations of contemporary science. However, as Dewey (1915) wrote,

> ...no moral, social or political question is adequately discussed in Germany until the matter in hand has been properly deduced from an exhaustive determination of its fundamental Begriff or Wesen. Or, if the material is too obviously empirical to allow of such deduction, it must at least be placed under its appropriate rational form. (pp. 41-42)

One implication of the notion that each person constructs his or her own reality on the basis of experience is that one should not impose one's views on another person by force or coercion. Efforts to influence others should be limited to conversation and persuasion, to comparing and interpreting experiences. That is, given what we know about the biological basis of knowledge, no one is justified in believing that he or she has a correct understanding of the world and that others are wrong. Some views or theories may be superior to others in that they fit a larger range of phenomena, but no view can be shown to match "the way the world really is." Hence, even the creators of highly regarded scientific knowledge should be suitably humble about their achievements.

Constructivist cybernetics has made important contributions to our understanding of knowledge and cognition. And the idea that a neurophysiological view of knowledge justifies tolerance is indeed interesting. But a scientific "proof" of the appropriateness of tolerance is not necessary as a foundation for tolerance in all societies.

Perhaps constructivist cybenetics is in part a way of transferring the value of tolerance to societies which have at times displayed intolerance. In the United States tolerance is accepted as a fundamental principle of democratic government. The precedents lie in the historical development of British common law and the early settlements in North America, some of

which were established by people fleeing religious persecution. Societies with a long history of class differences and which are preoccupied with controlling dissent are much less likely to regard tolerance and free speech as cornerstones of the desired social order. In historically more authoritarian societies, particularly those in which the public interest is debated in universities more than among the general populace, a scientific demonstration of the appropriateness of tolerance could be considered a necessary strategy for encouraging cultural evolution toward democratic institutions.

TWO CONCEPTUAL SYSTEMS WITH SOCIAL CONSEQUENCES

I am suggesting, then, that there is a social as well as a scientific purpose to the ideas associated with second order cybernetics. The social purpose is to change society by changing ideas about the nature of knowledge. In this sense second order cybernetics constitutes a solution to the problem of intolerance in certain societies.

One way to understand the social role of second order cybernetics and the assumptions about the process of social change associated with it is to compare second order cybernetics with another effort to change a society. Amitai Etzioni's communitarian philosophy in the United States provides a useful comparison. Etzioni contends that Americans are preoccupied with their rights but neglect their responsibilities. As an example he cites opinion polls which show that if accused of a crime most Americans would insist on their right to a jury trial. However, if asked to serve on a jury, many Americans would try to avoid the responsibility. To advance the "communitarian" philosophy he has founded a journal of opinion, The Responsive Community, and a new academic organization, the Society for the Advancement of Socio-Economics with its own academic journal, the Journal of Socio-Economics. Furthermore, he has written two books, The Moral Dimension and The Spririt of Community which set forth his view that economics needs to be expanded to include moral considerations and that Americans should be more concerned about the community and less about themselves as individuals.

Etzioni has formulated a strategy for social and political transformation. He is seeking to persuade two audiences -- opinion leaders and academic social scientists. Communitarianism is a new intellectual and political movement in the U.S. which is attempting to change the thinking of intellectuals and the general public about the appropriate role of the individual in society. Communitarianism is an American strategy for dealing with an American problem. It attempts to mobilize the intellectual community and to develop a constituency for an altered set of values.

Second order cybernetics, on the other hand, is a movement within the scientific community of the U.S. and Europe which seeks to change the thinking of the scientific community about the nature of knowledge. Second order cybernetics is based upon neurophysiology and constitutes a scientific critique of realist epistemology. Although it originated primarily in the U.S., second order cybernetics represents a "European strategy." Its roots lie in German idealism, and it is based upon an assumption that philosophy is an activity of widespread intellectual interest. Not surprisingly, European intellectuals have shown more interest in second order cybernetics than American

intellectuals.

Both communitarianism and second order cybernetics are attempts to change society by changing the way people think. But communitarianism is an overtly political effort which is addressed to opinion leaders and seeks specific policy changes. In contrast second order cybernetics seeks only to change the thinking of scientists about the philosophy of realism. The second order cyberneticians believe that all educated people should change their views as well, but they address their articles and arguments only to small, scientific groups. The general public is not addressed. The constructivist cyberneticians suggest no public policy changes. There is no effort to influence columnists, commentators, or political leaders, and there is no effort to influence a specific academic discipline such as economics, philosophy, or political science.

If there is some validity to the previous assertion that the passion of the second order cyberneticians springs from painful personal experiences with political and cultural systems, then the lack of a more explicit political component to the development of the ideas is puzzling, at least to an American. The interest of the second order cyberneticians is in the nature of knowledge and cognition, but not in particular ideas, at least not in ideas other than ideas about knowledge and cognition.

The differences in these two efforts to change society reveal the assumptions that each group is making about how to bring about social change and where efforts should be concentrated in order to bring about fundamental change. The American strategy calls for a direct, overt effort to change beliefs, values, policies, and elected officials. The European strategy calls for an effort to change the realist philosophy underlying both scientific research and public opinion. Apparently the cyberneticians assume that if one can change the thinking of the academic community, the views of the general public will eventually follow.

IMPLICATIONS OF THE CYBERNETICS OF CONCEPTUAL SYSTEMS

This paper has presented two examples of social cybernetics or the cybernetics of conceptual systems. The first example was the description of the three phases of cybernetics in the U.S. The second example was the discussion of the social aspects of second order cybernetics and the comparison with the communitarian movement in the U.S. These two examples are summarized in Tables 1 and 2.

Social cybernetics, or the cybernetics of conceptual systems, is compatible with or lends support to several existing trends. If the cybernetics of conceptual systems becomes a subject of interest among at least part of the academic community, several consequences can be expected.

1. Analysis of social systems would move away from descriptions of "forces" and "structures" and focus instead on the beliefs of people. Beliefs are no doubt the result of experiences, but different people will interpret similar experiences differently. Scientists interested in conceptual systems would study how different groups of people think, how opinions change, and how fast opinions can change.

2. The cybernetics of conceptual systems would be compatible with a "second order game theory," which would go beyond developing strategies to win a struggle with groups composed as they are and instead seek to persuade people to change their conceptualization of the game itself. The meta-game is to change conceptions of the game. The assumption would be that the purposes, motivations, and conceptions of both "allies" and "opponents" can change.

3. In policy research the intent would be to increase awareness of the role of theory, beliefs, and assumptions in policy formulation. Analysts would not simply use the prevailing metaphors but would deliberately seek to invent more suitable metaphors. A major part of the effort would be to create knowledge of how scientific knowledge is used.

4. In negotiation a conceptual systems approach would focus on constructing a metalanguage for discussing how the prior points of view of the various parties fit together. The effort would be to develop a frame of reference in which the origins of the various points of view could be examined in the context of the long term interests of the total group.

5. In science a conceptual systems approach suggests analyzing the social and philosophical assumptions underlying a program of research. The purpose of doing so would be to generate additional lines of inquiry.

6. In education emphasizing conceptual systems helps students to understand how and why new points of view were created and how ideas have evolved.

A cybernetics of conceptual systems would be a way of "controlling" not just machines or organizations but the ideas used in thinking about any subject, including how we think about theories and philosophies. Further progress, both in achieving acceptance of cybernetics and in bringing about more tolerant and humane political systems, will require, in my judgment, focusing attention not just on the observer, but on the specific ideas in the minds of observers.

Whereas the first phase of cybernetics took an empirical approach to the nervous system, the second phase of cybernetics created a philosophy based on the findings of neurophysiological investigations. The third phase, the cybernetics of conceptual systems, looks at the community that creates and sustains ideas and the motivations of the members of that community.

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REFERENCES

Boulding, Kenneth E. The Image. Ann Arbor, MI: University of Michigan Press, 1956.

Dewey, John. Germany Philosophy and Politics. New York: Henry Holt and Company, 1915.

Etzioni, Amitai. The Moral Dimension: Toward a New Economics. New York: Free Press, 1988.

Etzioni, Amitai. The Spririt of Community. New York: Crown Publishers, 1993.

Maturana, Humberto. "Neurophysiology of Cognition." in Paul Garvin (ed.) Cognition: A Multiple View. New York: Spartan Books, 1970, pp. 3-24.

Maturana, Humberto. "Cognitive Strategies." Cybernetics of Cybernetics, Salinas, CA: Intersystems, 1974.

McCulloch, Warren. Embodiments of Mind. MIT Press, 1965.

Mead, Margaret. "Cybernetics of Cybernetics." in Heinz von Foerster, et al. (ed.), Purposive Systems. New York: Spartan Books, 1968.

Morgan, Gareth. Beyond Method: Strategies for Social Research. Sage Publications, 1983.

Soros, George. Underwriting Democracy. Free Press, 1990.

Spencer, Laura. Winning Through Participation. Dubuque, IA: Kendall/Hunt Publishing, 1989.

Umpleby, Stuart A. "The Science of Cybernetics and the Cybernetics of Science," Cybernetics and Systems, Vol. 21, No. 1, 1990, pp. 109-121.

Umpleby, Stuart A. "Comparing Conceptual Systems: A Strategy for Changing Values as Well as Institutions." Cybernetics and Systems, Vol. 22, No. 4, 1991, pp. 515-529.

Umpleby, Stuart A. "Strategies for Winning Acceptance of Second Order Cybernetics," Proceedings of International Symposium on Systems Research, Informatics and Cybernetics, Baden-Baden, Germany, August, 1991.

Umpleby, Stuart A. "What is to be done? Learning Democracy while Improving Organizations," in Robert Trappl (ed.) Cybernetics and Systems '92, Volume 2, World Scientific, 1992, pp. 1225-1230.

Von Foerster, Heinz. "On Constructing a Reality," originally published in 1973, reprinted in Observing Systems. Salinas, CA: Intersystems, 1981.

Von Glasersfeld, Ernst. The Construction of Knowledge. Salinas, CA: Intersystems, 1987.

Wiener, Norbert. Cybernetics: or Control and Communication in the Animal and the Machine. Cambridge, MA: MIT Press, 1948.

Table 1

THREE VERSIONS OF CYBERNETICS

	Conceptual_Systems		
	Engineering Cybernetics	Biological Cybernetics	Social Cybernetics
The view of epistemology	a realist view of epistemology: knowledge is a "picture" of reality	a biological view of epistemology: how the brain functions	a pragmatic view of epistemology: knowledge is constructed to achieve human purposes
A key distinction	reality vs. scientific theories	realism vs. constructivism	the biology of cognition vs. the observer as a social participant
The puzzle to be solved	construct theories which explain observed phenomena	include the observer within the domain of science	explain the relationship between the natural and the social sciences
What must be explained	how the world works	how an individual constructs a "reality"	how people create, maintain, and change social systems through language and ideas
A key assumption	natural processes can be explained by scientific theories	ideas about knowledge should be rooted in neuro-psysiology	ideas are accepted if they serve the observer's purposes as a social participant
An important consequence	scientific knowledge can be used to modify natural processes to benefit people	if people accept con-structivism, they will be more tolerant	by transforming conceptual systems (through persuasion, not coercion), we can change society

Table 2

TWO CONCEPTUAL SYSTEMS REGARDING SOCIAL CHANGE

An "American" Strategy	A "European" Strategy
Knowledge is based on an assessment of the situation	Knowledge is prior to action
Influenced by British empiricism and American pragmatism	Influenced by German idealism
Question: What does American society need now?	Question: What do philosophy and science need now?
Answer: People should be concerned about their responsi-bilities as well as their rights	Answer: The observer should be included within the domain of science

Recommendation: Citizens should become more involved in public affairs	Recommendation: Scientists should use a constructivist as opposed to a realist epistemology
Theories are imperfect descriptions of the phenomena described	The inner world has primacy over the outer world
Action is based on social role	Action is based on philosophical position
Ideas are important if they enable more effective action in the world	The free realm of ideas is preferred over the necessary realm of matter
An historical experience of domination by a remote government	An historical experience of internal chaos and disorder
The key task of society is to protect individual liberties	A key task of society is to control dissent
A high regard for practical, not theoretical, knowledge	A high regard for philosophical thought
The public interest is debated by the citizenry	The public interest is debated primarily in a university
Arguments are addressed to educated citizens, and also academics	Arguments are addressed to professional intellectuals
Social change requires changing policies, laws, and institutions, not just ideas	If ideas about the nature of knowledge change, change in science and society will follow
Focus on certain academic disciplines -- economics, sociology, political science	Attempt to alter the conception of knowledge, regardless of discipline
Tolerance is justified by respect for the individual, by empathy with others, and by the desire to ensure one's own liberties by protecting those of others	Tolerance is justified by our knowledge of neuro-physiology and the consequent inability of the individual to be certain of his or her beliefs
Intolerance is restrained by morality and law	Intolerance is inappropriate given the imperfect nature of our knowledge
Tolerance and respect for others are axioms, a starting point	The appropriateness of tolerance is the conclusion of a scientific investigation.

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