UNIT VI INTRODUCTION

THE CYBERNETIC TRADITION

Playing off the title of the last reading in this section, one can ask, What is information? The cybernetic tradition conceptualizes communication as information processing, and yet what exactly is information? Is it the *ones* and *zeros* of machine language? Is it the messages sent by dogs to inform each other that what they are doing is playing and not fighting? Is it the messages of the man staring off into space on the bench at the bus stop? In the cybernetic tradition, scholars talk and think about concepts such as systems, processing, information, messages, senders, receivers, probability, entropy, self-organization, autopoiesis, and feedback. Often, theorizing in this tradition is discussed in terms of modeling. The language of mathematics and computation is common in this tradition, and yet some scholars in this tradition build their work around families, patients with mental disorders, or animal communication. One challenge in investigating this tradition is to nail down the idea of information, and yet the difficulty of isolating this central concept is as much in keeping with the tradition as the concept of information itself. The cybernetic tradition often leads to a holistic approach to understanding communication, and variations of a holistic approach can be seen in each of the readings in this unit.

The mathematical theory of information, developed by Claude Shannon and presented to a wider audience in collaboration with Warren Weaver (Shannon & Weaver, 1949; Weaver, 1949) was a landmark work that gave impetus to the cybernetic tradition. Although these readings are not included in this unit for reasons of space, the cybernetic tradition cannot be understood without some understanding of information theory. Shannon and Weaver can be seen as theorizing the *problem of achieving smooth information flow*. In his work to provide electrical engineers with a theory that could help them build better telecommunications systems, Shannon applied statistical principles to the transfer of information. The system needed to transmit information smoothly, so the information would not stack up and bog down the system—think of a continual busy signal because there is no room for more impulses to travel in the channel. To avoid such pileup, the designers of systems needed to know how much information would need to flow through the cables. The calculation of channel capacity also needed to take account of noise or random blips in a signal that interfere with the process of transmission. Using an idea of entropy that can be illustrated by the number of yes-no questions one would need to have answered

to determine the answer to some given question (somewhat like the game of 20 questions), Shannon worked probabilistically to calculate the amount of information that would flow through the phone lines. The theory showed that effective transmission of information requires efficient coding of messages (logically equivalent to winning at 20 questions by asking the smallest number of questions possible). Yet effective transmission also requires a certain amount of redundancy to compensate for the presence of noise in the communication channel. Without any redundancy at all, a single blip of noise would destroy the signal. Using the mathematical formulas of information theory, engineers could build systems in which the necessary amount of information could flow smoothly.

Shannon and Weaver (1949) illustrated their theory with a linear model of communication that ever since has been commonly taught with variations as *the model of communication*. The model pictures communication by a series of boxes and arrows showing how a message flows from a communication source to a destination with noise interfering. This diagram was presented as a general model that applies to any form of communication, not just signals traveling through telephone wires. Although they acknowledged that the transmission of meaning in communication involves more than just the physical transmission of a signal, Shannon and Weaver speculated that the theory could eventually be extended to provide precise mathematical explanations of meaning and communication effects (see pp. 24–28). To make a long story short, this extension of the theory was never successfully accomplished. Therefore, although Shannon's mathematical approach continues to be useful for telecommunications engineering, its application to other aspects of human communication has been very limited and imprecise. For example, there is some value in the insight that redundancy plays a necessary role in communication, even if the redundancy of meaning is impossible to measure precisely in any real situation. However, the one-way linear model is commonly criticized for failing to include a practically essential element of communication: feedback, the receiver's response to the message.

Feedback is the central concept of another landmark theory represented by the first reading in this unit. Writing at about the same time as Shannon and Weaver, Norbert Wiener (1948) coined the term *cybernetics*, although in our reading he tells of earlier uses of the term. The reading is taken from *The Human Use of Human Beings: Cybernetics and Society* (Wiener, 1954), a nonmathematical presentation of Wiener's theory of cybernetics for general readers. His work can be seen as theorizing the *problem of human-machine communication*. Stated generally, Wiener explains how human communication is parallel to machine communication. It is not that humans communicate one way to each other and in a different way with machines. Rather, the principles of machine communication can be used to explain human communication. In this case, information is that which is exchanged as communicators adapt to the outer world to have some control over the outer world. Communication is a response to an environment, and a message is a form of pattern and organization. Modern machines respond via their sensors, and their feedback mechanisms respond to actual performance. For example, an elevator opens when it actually reaches a floor, not when it formulaically should reach a floor. It is the feedback mechanisms that allow the system to have control rather than being taken over by nature's tendency toward disorganization.

Similarly, just like machines, human communicators receive feedback based on their actual performance, not their intentions, and these regulatory processes control the communicator's responses to the environment. In

other words, we communicate in response to something (similar to the elevator call button being pushed); the feedback we receive from others is feedback to our actual communication, not what we merely intended to communicate (that is, what others actually heard and did, not what was in our minds to say); and the adjustments we make (whatever next actions we take) are based on the feedback we receive (what people actually said and did, not what happened in their minds). Thus, communication consists of feedback and response patterns. Examining society from this perspective, one can see how adjustments are made to fend off nature's tendency toward disorganization and how movement's tendency toward purposive ends becomes possible.

Gregory Bateson (1972; Ruesch & Bateson, 1968) is another important figure in the cybernetic tradition not directly represented in this volume for reasons of space (although many of his ideas are referenced by Watzlawick, Beavin, and Jackson in reading 20). His work, which used concepts from semiotics and mathematical logic to extend cybernetic theory to address distinctive aspects of interaction through signs and symbols in humans and higher animals, could be seen as theorizing *the problem of metacommunication*. Bateson examined a wide variety of interactions ranging from animal communication to therapy with mental patients. In examining animal communication, Bateson saw that dogs can tell when they are fighting and when they are playing, even though their actions when fighting or playing look very similar. Play, to Bateson, was a key evolutionary step, and animals' ability to communicate to each other that "this is play" shows their metacommunicative ability. Human interaction also is infused with these unstated metamessages. Interaction has both a *report*, or informational, aspect and a *command,* or framing, aspect, which establishes the relationship between the communicators. That we engage in multiple layers of communication (simultaneously communicating about the frame and the message within the frame) produces a paradox of abstraction, and it is this paradox that keeps language changing and developing rather than becoming a rigid game with fixed rules. These layers of messages, if used skillfully by a therapist, can also lead to a schizophrenic changing her frame of interpretation.

The second piece in this unit builds on Bateson's ideas and theorizes a similar problem. The authors were associated with the Mental Research Institute in Palo Alto, California, members of which had worked with Bateson in earlier studies of the double bind in mental patients. The double bind is a repetitive pattern of interaction in which a victim is both confronted with contradictory messages at different levels of abstraction and prevented from leaving the situation or metacommunicating about the contradiction. For example, there could be a pattern of interaction between a mother and child in which the mother verbally says something such as *come here, I love you* while nonverbally signaling the child to stay away. The child is powerless to leave the relationship or to question the contradiction, which the mother will consistently deny. The child is likely to generalize this interactional pattern to other relationships and as a result becomes emotionally disturbed and uncommunicative. In this regard, the double bind resembles forms of "discursive closure" theorized by the critical theorist Stanley Deetz (reading 34).

The piece included here presents five axioms that Watzlawick, Beavin, and Jackson (1967) proposed as part of their calculus of human communication. These are notions that are commonly taught in interpersonal communication courses, and as one reads this piece, one can gain a deeper sense of the context of these axioms and how they are relevant for understanding interpersonal communication. For

instance, the well-known axiom *one cannot not communicate* involves the accompanying notion that one cannot not respond. The man sitting on the park bench staring into space is communicating, and anyone who encounters that communication responds to it in some way, even if only by trying to appear to ignore it. The communicator and the responder are connected. They are parts of a communication system. (How does this differ from Chang's [reading 18] phenomenological argument that communication is unavoidable?)

In emphasizing and examining communication as a system, these theorists also theorize the problem of the whole. The five axioms (the impossibility of not communicating, the content and relationship levels of communication, punctuation of the sequence of events, digital and analogic communication, and symmetrical and complementary interaction) provide a set of fundamentals that draw focus to the system of communication rather than the individuals involved in the communication. This idea of looking at how the system works, rather than at the parts of the system individually, itself is a hallmark of the cybernetic tradition.

The third reading in this unit is an interesting conjunction of cybernetic (information processing) and social psychological theory applied to mass communication. Lang theorizes *the problem of information processing by television viewers*. To understand how a TV message affects viewers, intentionally and unintentionally, Lang provides a theory of cognitive processing of messages. There are three components to this processing: encoding, storage, and retrieval. However, the processing system is limited in that there are only so many processing resources available to the system. If too many resources are allocated to encoding, for example, there may not be enough resources to allow thorough storage of the message. Additionally, there are characteristics of messages, such as being unexpected, that seem to automatically elicit encoding, and so if the message continually breaks expectations, the allocation of resources will be greatly skewed toward encoding so the receiver may encode a lot but not do much other processing. As Lang points out, although this theory can potentially lead to new models of how to construct and present TV messages, this idea of limited capacity is not limited to understanding mass media messages but can be applied to processing messages in other communication contexts as well.

The final piece in this unit is by the German social theorist Niklas Luhmann and examines the difference between the psychic system (individual consciousness) and the communication system (social). In theorizing *the problem of the systemic autonomy of communication*, using the ideas of autopoiesis and self-organizing systems, Luhmann makes the paradoxical-sounding claim that only communication communicates. Just as does consciousness, communication operates as a closed, autonomous system. What is communicated depends on the system, not on what the individual participants in the communication would like to be communicated. Although conscious entities are needed for communication to happen, they are not part of the communication per se. Communication either happens or it does not. Either a communication system organizes itself and communication happens or it does not. However, although communication and consciousness are distinct, they can disturb each other. When communication occurs, a consciousness is forced to accept or reject the communication. Because of the social-psychic divide, one can avoid the risk of communication when rejection is likely, and in fact institutions are constructed that facilitate this avoidance. Due to this divide, there are things that can be handled communicatively, but this is not the same as handling things in the individual consciousness.

After reading the pieces in this unit, the question asked at the outset may still be relevant: What is information? The question of how well this tradition holds together may also arise. How related are the notions of information and of system in these readings? Are there enough shared strands of thought that cybernetics is a distinct way of conceptualizing communication? What is it that sets this tradition apart from the others? How is the conception of information processing different from those of the art of discourse (rhetoric), shared meaning (semiotics), and experience of the other (phenomenology)? Do the thinkers in this unit seem to build on each other, or has this tradition been built by thinkers coming from different directions yet ending up proposing related ideas? How does the Luhmann piece relate to the others? What are the implications of his argument?

Scholars such as Lang may lead one to think and talk about everyday technical problems of message construction and technical system construction. How do communication systems need to be engineered? What message constructions will lead a TV viewer to attend, process, and be able to recall a televised message? Other readings may lead to thinking about the similarity and differences of machine, human, and animal communication. Do humans communicate with each other just as computers communicate with each other? Can studying animal communication provide a valuable and informative model for analyzing the process of human communication? One may want to extend from the machine-human-animal comparisons to ask more generalized questions, such as questions concerning the similarities and differences between systems of different types.

Additionally, the Lang and the Luhmann readings bring up the notion of mind. Is the mind an information processing machine? What is gained by taking this information systems approach to understanding mind? Is there a divide between the individual mind and communication? What is the relationship between communication and the individual? Is the Lang piece about mind? Is her model only applicable to the mental processing of mediated messages, or can it be used to model the processing of messages in face-to-face interaction? What is the difference between processing messages in face-to-face interaction and processing audience-directed messages such as television, movies, or even public speeches?

What about the idea of studying the whole rather than the parts? What is gained by taking this perspective? What practices can be viewed as systems? How large can a communication system be? Is a whole society, even the entire world, a communication system? Wiener seems to indicate that cybernetics can provide a grand theory that explains all communication, that understanding the technical level of communication can provide valuable insight into all other levels of communication. How plausible are those claims? Is the idea of information processing too general to be relevant to any specific communication practice?

Finally, some of the ideas in this tradition have had quite a bit of staying power. Why is this so? Why is the Shannon and Weaver model (1949) still so commonly referred to? Is it especially relevant for some reason? Why are the Watzlawick et al. (1967) axioms of communication so popularly taught in communication courses? Are these ideas taught in ways that seem in keeping with their presentation in these original texts? All of these questions are worthy of reflection, as well as some of the basic theorizing questions: What new vocabulary do you have? What do you see as a communication system that you did not previously? How do these readings support and call into question your own thoughts about communication? There are many questions that can be thought about as one reads the selections in this unit.

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