Systems Approaches

After Reading This Chapter, You Should …

- Recognize the differences between a "machine metaphor" and a "systems metaphor" for describing organizational processes.
- Be able to explain systems components, systems processes, and systems properties and illustrate these ideas with organizational communication examples.
- Be familiar with cybernetics as a systems theory that can help explain goal-related communication in organizations.
- Appreciate Weick's theory of organizing as an important way to "make sense" of the workings of organizational communication.
- See the ways in which ideas from "new systems theory" can transform processes of organizational understanding.
- Know about research methods for studying systems, especially the details of network analysis.

Back in Chapter 2, we considered classical and scientific management approaches to organizational communication theory. You found that these theories are based on a mechanistic metaphor. That is, classical theorists thought that organizations could be best understood by comparing them to machines that are predictable and comprised of replaceable parts. The human relations and human resources approaches we considered in Chapter 3 objected to this model because of the way it conceptualized workers—as individuals who should be considered as laborers without feeling or thought. However, in addition to these concerns about employee treatment and involvement, many theorists also continue to find the machine metaphor to be an unsatisfying model for explanation and understanding because organizations—to a large extent, at least—do not behave in predictable and machinelike ways. A new metaphor has thus emerged to explain organizations. This systems or organismic metaphor views organizations not as self-contained and self-sufficient machines but as complex organisms that must interact with their environment to survive. As Morgan (1986) notes:

> The problems of mechanistic visions of organizations have led many organizational theorists away from mechanical science and toward biology as a source of ideas for thinking about organization. In the process, organization theory has become a

> kind of biology in which the distinctions and relations among molecules, cells, complex organisms, species, and ecology are paralleled in those between individuals, groups, organizations, populations (species) of organizations, and their social ecology. (pp. 40–41, emphasis in original)

In this chapter, we explore the systems approach by considering how an organismic metaphor can provide insight into organizational communication processes. A systems approach to the study of organizational communication is different from those we have considered so far because it shifts our attention away from how people should behave in and manage organizations to the question of how we should study them. We will first consider some basic systems concepts and apply these to the organizational arena. We will then look at three theoretical applications of systems concepts: cybernetics, Karl Weick's theory of organizing, and the study of "new science" systems. Finally, we will look at a variety of methodologies that have been used by systems theorists in organizational communication.

The Systems Metaphor and Systems Concepts

Systems theory did not originate in the study of organizations but rather in the fields of biology and engineering. One of the key founders of the systems movement was Ludwig von Bertalanffy, a theoretical biologist who was interested in the study of "living systems" within his own academic field. However, von Bertalanffy was also concerned with the extent to which intellectual disciplines were isolated from one another, and he argued that systems concepts could be applied to a large number of fields in both the natural and social sciences. In 1968, he published General Systems Theory, a book espousing a systems theory that he believed was as appropriate for the social sciences as it was for biology (von Bertalanffy, 1968).

The study of systems was eagerly adopted by organizational theorists. Perhaps the most influential application of systems theory to organizational processes appeared in 1966 with Katz and Kahn's The Social Psychology of Organizations. Katz and Kahn (1978) argue that organizations should be conceptualized as complex open systems requiring interaction among component parts and interaction with the environment in order to survive. Another early and influential application of systems theory to organizational

functioning is Thompson's (1967) Organizations in Action. In the field of communication, one of the first comprehensive applications of systems theory came with Farace, Monge, and Russell's Communicating and Organizing (1977), an application of structural-functional systems theory to communication processes within organizations. In short, the 1960s and 1970s were marked by extensive attention to the systems metaphor as a way of understanding the processes of organizational behavior and communication.

If you were to peruse some of these influential books, you would find substantial variety in the details presented about systems theory. However, almost all systems theories embrace certain aspects of the systems metaphor. In the following sections, we consider a number of concepts that are endorsed by a wide range of systems theories. We first look at what systems are made of—system components. We then consider how systems work—system processes. Finally, we discuss the unique characteristics that arise from these components and processes—system properties.

System Components

At its most basic level, a system is an assemblage of parts, or components. In a biological system, these parts include cells and organs. In an organizational system, these components are the people and departments that make up the organization. We could also think about the larger society as a system. In this case, the parts would be the organizations and institutions that make up the society. Regardless of what particular system we look at, the first task of a systems theorist is to identify the relevant components that comprise the system. After the components of the system have been identified, it is interesting to look at how these parts are arranged and how they work. Three concepts characterize system components: hierarchical ordering, interdependence, and permeability.

Hierarchical Ordering

A system is not simply an undifferentiated set of parts thrown together. To the contrary, system components are arranged in highly complex ways that involve subsystems and supersystems—a hierarchical ordering. If you think about your body as a system, you can observe this hierarchy.

Your body is composed of a number of subsystems—the cardiovascular system, the digestive system, the neurological system, and so forth. In turn, these systems are also made up of subsystems—for example, the cardiovascular system includes the heart, lungs, and blood vessels. We could take this even further with a consideration of organ components, cells, and so on.

The same hierarchical ordering can be seen when considering the organization as a system. For example, let us look at a hospital as an organizational system. A hospital consists of a number of departmental subsystems, including surgical units, recovery units, the emergency room, laboratories, and offices. These subsystems, in turn, are composed of smaller work groups and individuals. We could also move in the other direction and see that the hospital is part of a larger supersystem—the health care industry. This supersystem would include organizations such as hospitals, clinics, insurance companies, and pharmaceutical companies. Note that the concept of "hierarchy" has a different meaning here than when the same term is used by classical management theorists. A classical theorist sees hierarchy as the relatively straightforward lines of authority represented by the organizational chart. In contrast, hierarchical ordering within systems theory means that when we look at any system, we can see how that system consists of smaller subsystems and is embedded within a larger supersystem.

Interdependence

A second concept that characterizes system components is interdependence. The notion of interdependence implies that the functioning of one component of a system relies on other components of the system. Think again about the human body. The brain needs a constant supply of blood in order to function, but this supply would not be possible if it were not for the heart's pumping action. In turn, the heart relies on the lungs to bring in the oxygen that fuels the blood. Both the heart and the lungs rely on the brain for the neurological signals that facilitate functioning. In short, the body is a highly interdependent system in which the breakdown of one component would lead to breakdowns in other components and in the system as a whole.

As a system, an organization is also highly interdependent. For example, in our hospital, the surgical units could not function effectively without laboratories to provide important test results. The laboratories rely on the purchasing department for supplies, such as test tubes and chemicals. Many hospital units depend on the personnel and business offices to deal with the paperwork of compensation and insurance. Thus, no component within the hospital can function effectively without active assistance from other system parts.

At levels higher than the individual organization, interdependence can be seen by considering the complex relationships among organizations within a given business sector or in related sectors. This interdependence is particularly apparent in today's highly connected global economy. For example, Browning and Shetler (2000) conducted a case analysis of the semiconductor industry. This industry is highly competitive on a global level, and for many years, organizations within this sector wanted to maintain a clear sense of independence. However, the U.S. government formed a consortium called Sematech that worked to improve relationships and communication among a wide range of semiconductor companies. This move from suspicious independence to cooperative interdependence shows a shift in thinking toward a global-systems view of the industry.

Permeability

A third characteristic of system components is that they have permeable boundaries that allow information and materials to flow in and out. The degree of permeability varies from system to system; some are relatively closed, whereas others are extremely open. However, all biological and social systems require some degree of permeability to survive. Permeability refers both to the system as a whole—which must be open to its environment—and to the components within the system.

For example, the human body must be open to its environment in order to take in the air, food, and water necessary for survival. The components of the human body must also be permeable to allow the flow of materials among organs and organ systems. In our hospital, we can also observe both system and component permeability.

The hospital must be open to its larger environment so patients, information, and resources can move into and out of the organization. Similarly, hospital units must be open to each other to facilitate the flow of people, information, and materials.

Of course, permeability to the larger environment can cause problems for a system too. For example, if the body is taking in poisonous gas, permeability to the environment can be extremely detrimental. For organizations, permeability can also be toxic. Garner (2006) argues in a case analysis that the Columbia space shuttle disaster in 2003 can be partly explained in these terms. In the years leading up to the disaster, NASA had become increasingly dependent on other organizations in the environment, including government, contractors, and space station partners. NASA felt the power of these partners through its permeable boundaries, especially regarding the pressure to launch. A more closed system might have made different decisions than those that led to the Columbia disaster.

System Processes

Let's now look at how these hierarchical, interdependent, and permeable components function in a system. At the most basic level, systems are characterized by input–throughput–output processes (Farace, Monge & Russell, 1977). That is, a system "inputs" materials or information from the environment through its permeable boundaries. The system then works on these inputs with some kind of transformational process; this is "throughput". Finally, the system returns the transformed "output" to the environment. For example, a furniture manufacturer will input raw materials, such as wood and fabric, transform these inputs into chairs and couches, and output these products to the buying public through retail outlets. Organizations also input and transform information. For example, an insurance claims adjuster must gather information about relevant damages, make decisions based on insurance coverage, and then output that information (and, hopefully, a check!) to the policyholder.

Two kinds of processes characterize input–throughput–output operations. The first of these—the process of exchange—is apparent in both input and output activities. That is, both the input of materials and information and the output of transformed materials

and information require a process of exchange with the environment outside the system. Obviously, this process of exchange is intimately related to the permeability of system boundaries. Some organizations have highly permeable boundaries to facilitate the exchange process, whereas others are relatively closed. For example, throughout the Cold War era, many manufacturers worked primarily as defense contractors for the government and operated as relatively closed systems with regard to other markets. However, when the Cold War ended, defense contracts were in shorter supply. At this point, these organizations— if they were to be successful—needed to develop an awareness of consumer needs and exchange information regarding markets in other business sectors. By increasing system permeability and exchange, many of these businesses switched their emphasis to consumer-oriented applications, such as communication satellites and satellite dishes. In so doing, these companies enhanced their chances of survival in a rapidly changing organizational environment.

A second type of process—feedback—is critical to the throughput portion of organizational functioning. Throughput involves the interdependent components of a system acting together. Feedback is information that helps to facilitate the interdependent functioning of system components. Two types of feedback are important to system functioning. The first of these is variously referred to as negative feedback, corrective feedback, or deviation-reducing feedback. This kind of feedback helps to maintain steady system functioning. For example, suppose that a restaurant supervisor notices that one of the waiters is telling patrons about yesterday's specials instead of today's specials. The supervisor might inform the waiter about his error so he can change his message to the diners. This is corrective feedback that serves to keep organizational functioning on a steady course.

A second type of feedback is known as positive, growth, or deviation-amplifying feedback (see Maruyama, 1963). This is information that serves to change system functioning through growth and development. For example, our restaurant supervisor might notice that more and more patrons are bothered by smoke while dining. Our supervisor, then, might suggest to higher management that the restaurant be

transformed into a nonsmoking establishment. This kind of feedback serves to change the entire system rather than maintain it in a steady state.

Of course, there are times when these feedback systems get out of control or do not work effectively. For example, just as intense interaction and feedback can yield "codependent" relationships in some families, organizations can also exhibit codependence (McMillan & Northern, 1995). In these dysfunctional organizations, there can be a reliance on a limited set of feedback relationships that keep circulating and emphasizing the same information. For example, an organization that constantly provides feedback about the need to work harder and an obsession with the bottom line might create dangerous situations of workaholism. In these situations, the positive construct of "interdependence" is morphed into the dangerous construct of "codependence".

System Properties

Now we will consider system properties that emerge from the interaction of these components and processes. Four properties are particularly relevant: holism, equifinality, negative entropy, and requisite variety.

Holism

The property of holism suggests that a system is "more than the sum of its parts". Systems have this property because of the interdependent nature of their components and the information that flows through the processes of feedback and exchange. For example, imagine that five individuals are asked to solve an organizational problem. These individuals may come up with many interesting and innovative ideas while sitting alone in their respective offices. However, if these five people are placed in an interdependent system, it is likely that many more and different problem-solving ideas will emerge from their interaction.

Equifinality

The system property of equifinality states that "a system can reach the same final state from differing initial conditions and by a variety of paths" (Katz & Kahn, 1978, p. 30). This, again, is a result of the interdependent operation of system components. Because

the components of the system are integrated in highly complex ways, a variety of means exist to reach any system goal. Consider an organization that wants to increase sales by 10%. This sales increase could be accomplished through the interaction of many different system components. A change in the training of salespeople might serve to increase sales. Alternatively, supervisors might exert tighter control over procedures to reach the goal. In short, because a system is complex and interconnected, there is more than a single path to any system outcome. The notion of equifinality becomes particularly important in today's complex organizational world. For example, Rework, a book by internet entrepreneurs Jason Fried and David Heinemeier Hansson (2010), argues that there are many ways to reach success in today's business world that defy the typical rules of management textbooks. For example, Fried suggests that success can be gained by ignoring standard practices such as strategic planning, staff meetings, and typical promotion standards (Summers, 2010).

Negative Entropy

Entropy is the tendency of closed systems to run down. For example, if a body is totally closed to its environment (and receives no food, water, or oxygen), it will quickly deteriorate. Open systems, however, are characterized by negative entropy, or the ability to sustain themselves and grow. Negative entropy is possible because of the flow of information and materials between the environment and the system. As Buckley (1967) notes, "That a system is open means, not simply that it engages in interchanges with the environment, but that this interchange is an essential factor underlying the system's viability" (p. 50). For example, U.S. auto companies in the 1960s were relatively closed to their environment, ignoring information about world conditions and consumer preferences. If the auto companies had remained closed, they would have deteriorated and gone out of business. It was only through the intake of information from the environment that the automakers were able to survive. In the first decade of the twenty-first century, U.S. auto companies again seemed to be ignoring conditions outside of their own walls (building huge SUVs while other automakers concentrated on fuel-efficient hybrids), and by the end of the decade, governmental bailouts were needed to keep several U.S. companies in business.

This is the principle of negative entropy in action—a system's success and very survival depends on active exchange with the system's environment.

Requisite Variety

A final system property again deals with the relationship between a system and its environment. The property of requisite variety states that the internal workings of the system must be as diverse and complicated as the environment in which it is embedded. This "matching complexity" allows the organization—or team or group within the organization—to deal with information and problems in the environment. Morgan (1997, p. 113) argues that this "is not just an abstract concept…. If a team or unit is unable to recognize, absorb, and deal with the variations in its environment, it is unlikely to evolve and survive". For example, consider the contrast between two political campaign organizations. In one campaign, the candidate is running unopposed. In the second campaign, a bitter battle is being waged between a Republican, a Democrat, and a third-party candidate. The first campaign organization could be relatively small and simple because the political environment of an unopposed campaign is uncomplicated. However, the second campaign organization would need more complex subsystems to monitor, evaluate, and react to the quickly changing politics that surround a hotly contested three-person race.

To summarize, when we look at an organization as a system, we see it as a collection of system components that are hierarchically arranged, interdependent, and permeable to each other and the environment. The organizational system is characterized by input–throughput–output processes that require exchange with the environment and positive and negative system feedback. Because of the openness and interdependence of organizational systems, they are characterized by the properties of holism, equifinality, requisite variety, and negative entropy.

These basics of the systems approach are summarized in table on table below.

Summary of Systems Basics

System Components	Principle
Hierarchically ordered	A system consists of smaller subsystems and is embedded within larger supersystems.
Interdependent	System components depend on each other for effective functioning.
Permeable	A system is open to its environment, and system components are open to each other.

Input–Throughput–Output Processes	Principle
Exchange processes	Input and output processes require exchange between the system and the environment. Throughput processes require exchange among system components.
Feedback processes	System control is maintained through feedback. Corrective (negative) feedback serves to keep a system on a steady course. Growth (positive) feedback serves to transform or change a system.
System Properties	**Principle**
Holism	Because of component interdependence, a system is more than the sum of its parts.
Equifinality	Because of component interdependence, there are multiple paths to any system outcome.
Negative entropy	Because of system openness, a system has the ability to avoid deterioration and thrive.
Requisite variety	Because of system openness, a system should maintain the internal complexity necessary to cope with external complexity.

Source: Miller, 2012: 66

Three Systems Theories

As noted earlier in this chapter, a great many theories relevant to organizational communication have been based on systems concepts. In this section, we look at three examples that emphasize different aspects of systems theory and principles. The first of these—cybernetics—was developed many years ago in the engineering and physical sciences but has been applied to organizations. The second was developed by Karl Weick specifically to enhance our understanding of organizational systems. The third is an approach emerging in a variety of fields, including organizational science—the study of "new science" systems.

Cybernetic Systems Theory

The term cybernetics derives from the Greek word for a boat's steersman. As this name implies, cybernetic systems theory deals with the process through which physical, natural, and organizational systems are steered toward reaching system goals. Cybernetic systems theory was developed by Norbert Wiener (1948, 1954) and was initially applied to self-regulation within physical systems. However, as you will see, cybernetic concepts can also be readily applied to organizational and human systems.

A cybernetic system consists of several interrelated components. The first of these is the system goal located in the control center. The system goal is a target for a particular aspect of system operation. For example, the human body has a system goal of maintaining a temperature of approximately 98.6 degrees Fahrenheit. The system uses a variety of mechanisms that help to maintain this system goal. However, there will be times when system behavior does not match the system goal. For example, when the body is infected, its temperature will rise higher than 98.6 degrees. At this point in cybernetic processing, feedback is sent to the control center and compared to the goal. If there is a difference between the goal and the feedback (e.g., the body's temperature is either higher or lower than 98.6 degrees Fahrenheit), new mechanisms will be instituted to adjust the behavior of the system. For example, if body temperature is higher than 98.6, an individual will sweat. If body temperature is lower than 98.6, an individual will shiver. Sweating and shivering are mechanisms that serve to regulate system behavior and keep it aligned with the system goal.

Because this model seems rather complex, let's apply it to a specific aspect of organizational communication. Let's look at the process of a performance review and attempt to model it as a cybernetic system.

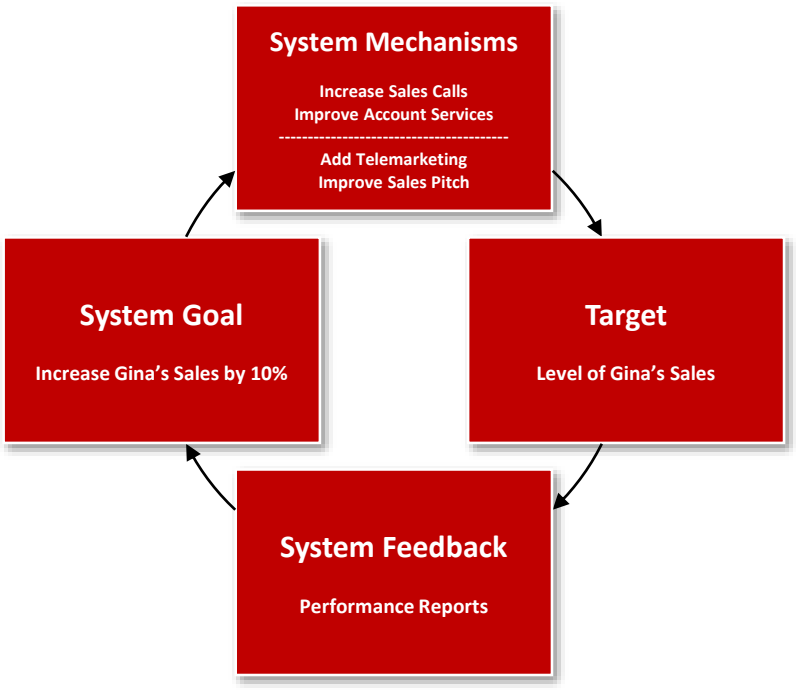
Gina is a pharmaceutical salesperson who sits down with her supervisor, Rick, to discuss her job performance. Together, Rick and Gina decide that she should aim to improve her sales by 10% over the next quarter, and they map out some strategies for attaining this goal. They decide that Gina should make more sales calls and improve the service she is providing to her accounts. Over the next three months, Rick monitors Gina's performance via the sales reports she files. At their next performance review meeting, Rick and Gina discuss the fact that her performance has improved—but only by 2%. Because they still feel that the goal of 10% improvement is reasonable, they decide that Gina may have to work on her sales pitch and begin using new telemarketing strategies to improve her performance.

All the components of the cybernetic systems model are apparent in this scenario (see Figure 4.1). The system behavior under consideration is the level of sales. The goal set for this behavior is 10% improvement. Initially, the mechanisms of increased sales calls

and account service are used to change system behavior. When feedback from the sales report indicates that these strategies have not been entirely effective, additional mechanisms of telemarketing and an improved sales pitch are instituted. We could also continue to analyze Gina's performance with the use of a cybernetic model, mapping out differences in goals, mechanisms, performance, and feedback over time.

Cybernetics emphasizes some aspects of systems theory and de-emphasizes others. In considering the system processes we discussed earlier, a cybernetic system emphasizes the role of feedback—especially corrective feedback—in maintaining system functioning. Cybernetics also emphasizes the interdependence of system parts because the mechanisms are intimately related to the goals. However, some aspects of system functioning are de-emphasized. For example, the basic cybernetic model does not account for the growth of systems nor does it incorporate the role of the environment in influencing system processes. The next theory we consider— Karl Weick's theory of organizing—is a very different type of systems theory and emphasizes different aspects of the general systems approach.

An Organizational Example of a Cybernetic System



Karl Weick's Theory of Organizing

Karl Weick's scholarship—in particular, his books The Social Psychology of Organizing (1979) and Sensemaking in Organizations (1995)—has had a profound impact on organizational theory, especially in the area of organizational communication. His highly complex model seeks to illuminate the process of organizing, and he draws on a variety of theories in developing his perspective. These include evolutionary theory, information theory, and general systems theory (see Kreps, 1990). Weick defines the process of organizing as "the resolving of equivocality in an enacted environment by means of interlocked behaviors embedded in conditionally related processes" (Weick, 1969, p. 91). This is a rather dense and complex definition. Let's try to clarify it through a look at its critical components.

Central to Weick's theory of organizing is the idea that organizations exist in an environment. Weick is clear, though, that this environment is not merely a physical environment but is an information environment. Furthermore, the information environment of an organization does not exist "out there" in an objective manner. Rather, individuals create the environment that confronts them through the process of enactment. The process of enactment suggests that different organizational members will imbue information inputs with different meanings and hence create different information environments. As Weick (1995) explains, "There is not some kind of monolithic, singular, fixed environment that exists detached from and external to people. Instead, people are very much a part of their own environments". For example, if you and a coworker were both asked to "see the boss as soon as possible," you might imbue the situation with very different meanings, depending on your past experiences, goals, personalities, and so on.

In Weick's model, the major goal of organizing is the reduction of equivocality in the information environment. Equivocality is the unpredictability that is inherent in the information environment of an organization. In an equivocal information environment, there are many interpretations that could be used for a particular event. For example, in the "go see the boss" example, an individual might be able to attach many logical (and probably many illogical!) explanations for the requested meeting. According to Weick,

reducing equivocality—or making sense— is central to the process of organizing. Some organizations are likely to be generally predictable. However, for organizations in highly competitive or quickly changing business environments or for any organization during a time of crisis (see, e.g., O'Connell & Mills, 2003), equivocality is likely to be high. Furthermore, equivocality can be read into many aspects of the information environment including the physical and spatial organization of a business (Pepper, 2008). How, then, is sense made in these equivocal information environments? Weick proposes that organizational members use assembly rules and communication cycles. Assembly rules are procedures (sometimes called "recipes") that can guide organizational members in set patterns of sensemaking. For example, a personnel director might always ask applicants for a résumé in a particular form in order to simplify the information environment. Assembly rules are particularly useful for sensemaking when the information environment is not especially equivocal. However, when equivocality in the environment is high and there are many possible explanations for an event, organizational members engage in communication cycles. Through communication cycles, organizational members introduce and react to ideas that help to make sense of the equivocal environment. The use of assembly rules and communication cycles is most prevalent during the selection stage in Weick's model, although the process of sensemaking is an ongoing one.

Case in Point: Making Sense of My Money

When we think about organizational sensemaking, we often consider the ways in which interpersonal communication with those around us reduces confusion about organizational events. However, the Internet connects us in ways that can both heighten our distress over equivocality and provide us with important new sources for understanding and support.

Andrew Herrmann made this point in his study of "Stockholders in Cyberspace" (2007). In recent years, more and more individuals have started investing in the stock market, and media outlets with information about various options for investing have flourished. If your head has ever started spinning while watching the multiple crawls and popups on CNBC or similar financial cable networks, you understand that there is a lot of information out there, and it would be fair to characterize much of the financial data as highly equivocal.

How is an individual to "make sense" of this huge influx of information? Hermann suggests that many people turn to discussion boards and chat rooms on the Web for help, and he analyzed one message board (discussing Warren Buffett's Berkshire Hathaway, Inc., on the Motley Fool website) to demonstrate this. The messages show individuals drawing on a wide array of media sources—and, especially, each other—to make sense of complicated financial data. Herrmann does not know if the bank accounts of these individuals were increased, but it appears that their equivocality was reduced.

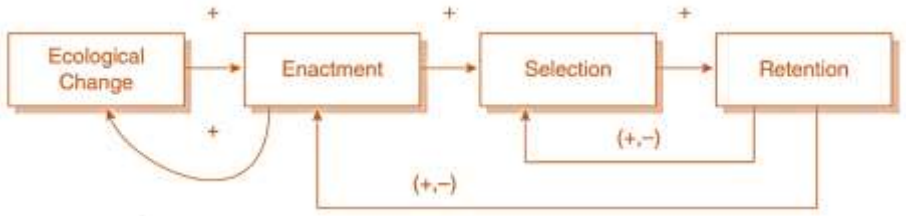
The selected assembly rules and communication cycles will sometimes be effective in reducing equivocality in the information environment and will sometimes be ineffective. When sensemaking is effective, Weick proposes a retention process in which rules and cycles are saved for future organizational use. Rules and cycles can be retained in the form of causal maps that are used to make sense of future equivocality in the information environment. Weick's model of organizing is presented in Figure 4.2.

Weick's model of organizing is obviously highly complex and abstract. At the risk of oversimplifying his ideas, let's look at an organizational communication situation that exemplifies some of them. In a study of a midwestern hospital, Miller, Joseph, and Apker (2000) looked at a group of nurses who were coping with major changes in the health care environment. The hospital where they worked was encountering increased competition within the new "managed care" payment environment and hence decided to develop a new system emphasizing interdisciplinary health care. The nurses in the study were designated as "care coordinators" but were given little guidance about what this new role would entail. The nurses in this situation were placed in a highly equivocal situation; they had to "make sense" of new roles that could be interpreted in a wide variety of ways. The Miller et al. (2000) interviews with these nurses suggest that some relied on simple assembly rules (e.g., I'll just assume that "care coordinator" is the same thing as "discharge planner"). Other nurses—perhaps the more successful ones in the long run—relied instead on intense interaction with each other and with others in the hospital environment to craft and make sense of their new organizational roles. This example illustrates both the importance of sensemaking and the selection of various communication strategies for making sense in an equivocal organizational environment.

This presentation has, of course, oversimplified Weick's model and has left out a number of his innovative ideas about the processes through which organizational members make sense of their environments. However, even from this cursory look, it should be clear that Weick's theory of organizing emphasizes a number of relevant systems theory concepts. The notions of environment and permeability are critical to his theory, as is the concept of system component interdependence. The sensemaking process proposed by Weick also highlights the concept of requisite variety. That is, simple

decision rules and structures can be used in sensemaking when equivocality is low, but more complex communication cycles and systems are needed to make sense of highly uncertain information environments.

Weick's Model of Organizing



Reprinted with permission of McGraw-Hill, Inc., from Weick, K. E. (1979), The Social Psychology of Organizing, p. 132.

Spotlight on Scholarship

As we have discovered in this chapter, Karl Weick's systems view of organizing sees organizational life as a social process in which individuals and groups are consistently confronted with opportunities for sensemaking. Of course, there are times when equivocality is low, and organizational actors can rely on established ways of doing things and thinking about events. However, there are other times when there is a "shock" or "rupture" in organizational life—when taken-forgranted ideas about how things should work are put into serious question. At these times, the need for sensemaking is particularly strong. When something surprising or shocking happens, should we just try to smooth it over as a part of organizational life? Or does the surprise require a radically different way of thinking about what we are doing?

Alexandra Murphy (2001) explored these questions with regard to a particularly important kind of "organizational rupture". Specifically, she looked at how flight attendants cope with "breaches" in the ongoing and regular routine of air travel. How do flight attendants "make sense" of the disruption of unruly passengers, mechanical failure, or dangerous weather? And how does the sensemaking of flight attendants influence their interaction with pilots, passengers, and other flight attendants?

The "dilemma" of the flight attendant is a particularly interesting one because the job of the flight attendant is—in large part—to perpetuate the story that air travel is as safe and secure as sitting in one's own living room. All the "dominant rituals of flight" are designed to decrease the perception of risk. As Murphy points out, the statement "The cabin pressure is carefully controlled for your comfort" really means that enough oxygen is pumped into the cabin so passengers can breathe (p. 38). For flight attendants, perpetuating the story of risk-free flight often involves the performance of a feminized role of giving comfort and service rather than ensuring safety, although in the years since this research, the economics of the airline industry have changed the service equation to some extent. As a participant in Murphy's research stated, "We are on board the airplane 80% for safety and 20% for service. But, the passengers don't want to know that. They want to see it as 80% for service and 20% for safety" (Murphy, 2001, p. 39).

Thus, when there is a "rupture" in this safe and comfortable world—perhaps an unruly passenger, bad weather, or mechanical failure—flight attendants must make sense of that rupture and make a choice: to uphold the dominant rituals of flight or to break the established routine and do something about the rupture. Murphy's analysis of many hours of observation, extensive interviews, and archival data points to the challenges of this sensemaking activity. Furthermore, she notes that there are barriers to sensemaking, especially rules that limit communication between flight crews and flight attendants and cost-control efforts by airlines that often lead to attendants serving with different flight crews for each leg of a flight. Without relational connections between pilots and flight attendants, it is difficult for crews to "make sense" of emergencies in the best way possible. As Murphy (2001, p. 50) concludes, "The importance of open communication in air travel cannot be stressed enough, as literally lives are on the line". Interestingly, Murphy's article was published in February 2001. In the years that have followed, beginning with the terrorist attacks perpetrated on airplanes in September of that very year, we have come to know even more clearly that there can be "ruptures" in beliefs about the safety of air travel. Making sense through communication has never been more important.

Murphy, A. G. (2001). The flight attendant dilemma: An analysis of communication and sensemaking during in-flight emergencies. Journal of Applied Communication Research, 29, 30–53.

"New Science" Systems Theory

In recent decades, a new area of systems theorizing has begun to gain prominence in organizational research. Based on work in fields such as physics and cosmology, this area of theorizing has branches that are known by such labels as chaos theory (e.g., Coveney & Highfield, 1995), complexity theory (e.g., Lewin, 1992), and selforganizing systems theory (e.g., Contractor, 1994). When applied to the study of communication and organizations, all these areas suggest new ways of thinking about organizations as "different kinds" of systems, and as a group, these ideas can be considered "new science" systems theory (Merry, 1995; Wheatley, 1992).

The heart of new science ideas is the notion that not all systems in nature and society are like those described by classical physics. That is, systems in the new sciences are not seen as necessarily linear and striving toward equilibrium. Rather, new science systems are complex and adaptive systems in which order can emerge from disorder, in which time makes a difference, in which complex systems are often preserved in fractal form, and in which large effects can come from very small changes. New science systems are not always logical, and they are not always predictable. Rather, this approach to systems emphasizes the importance of complexity, fluctuating information, and the innovativeness that can emerge when a system is at "the edge of chaos". As Horgan (1996) explains:

> The basic idea of the edge of chaos is that nothing novel can emerge from systems with high degrees of order and stability, such as crystals; on the other hand, completely chaotic … systems such as turbulent fluids or heated gases, are too formless. Truly complex things—amoebas, bond traders, and the like—happen at the border between rigid order and randomness. (pp. 196–197)

So, what do these new science systems theories have to do with communication in organizations? Some theorists and consultants (e.g., Stacey, 1996; Wheatley,

1992) argue that if ideas from chaos theory, complexity theory, and selforganizing systems theory are taken to heart in the organizational realm, it means an altogether different way of communicating in organizations. Miller (1998) lays out some of these ideas with regard to Meg Wheatley's Leadership and the New Science.

Ideas for organizational communication derived from the new sciences include:

- The importance of relationships in organizations: This factor is derived from new science ideas about the interconnectedness and interdependence of entities in quantum physics.
- The importance of participation in organizational processes: This factor is emphasized because of the participatory nature of the universe and because "participation, seriously done, is a way out from the uncertainties and ghostly qualities of this nonobjective world we live in" (Wheatley, 1992, p. 64).
- The appreciation of organizational change and instability: Wheatley argues that "organizational change, even in large systems, can be created by a small group of committed individuals or champions" (p. 96).
- The importance of being open to the information environment: In the new sciences, change occurs at the edge of chaos when we are open to the swirl of ideas around us. As Wheatley states, "we need to open the gates to more information, in more places, and to seek out information that is ambiguous, complex, and of no immediate value" (p. 109).

Thus, new science approaches to systems theory open up ideas about how the complex and chaotic nature of organizational systems might lead to the emergence of new and innovative organizational forms and processes. These theories emphasize not the "logic" of organizational systems but rather the interconnectedness of systems, their openness to the environment, and the interdependence that must be acknowledged in both physical and social systems. This kind of theorizing may be particularly important as we move to increasing complexity in our global world. For example, Houston and Jackson (2003) argue that self-organizing system theory can be especially helpful in understanding how citizens of developing nations adopt and talk about information and communication technologies.

Methods for Studying Organizational Systems

In the late 1960s and 1970s, systems theory enjoyed a great deal of popularity among organizational communication researchers. This is not surprising because systems theory emphasizes the notions of exchange, feedback, and interdependence— concepts critical to communication theory. Unfortunately, research methodologies at the time could not account for these complex processes (Monge, 1982; Monge, Farace, Eisenberg, White & Miller, 1984). However, several research techniques have emerged—or gained prominence—in the last few decades that are particularly appropriate for the investigation of systems explanations of organizational functioning. In this section, we briefly review three of these research approaches: network analysis, modeling techniques, and case analysis. Although these three research approaches are very different, each tries to capture the complexity of systems in its explanatory technique.

Network Analysis

One of the hallmarks of systems theory is the denotation of the interconnections among system components and the arrangement of those components into subsystems and supersystems. When the components of systems are people and social groups, the "mapping" of relationships among people becomes crucially important. Network analysis provides a means for creating and analyzing those maps of relationships. Monge and Eisenberg (1987) differentiate between the positional tradition of network analysis and the relational tradition. Typifying the positional tradition is the formal organizational "chart" that defines the prescribed flow of communication within an organization (see McPhee & Poole, 2001, for more on formal structure and hierarchy in organizational communication research). However, Monge and Eisenberg note that the formal chart is often a poor reflection of the actual system of communicative relationships. Thus, the relational tradition considers the actual communication relationships that emerge through the activity of the organizational system.

Properties of Networks

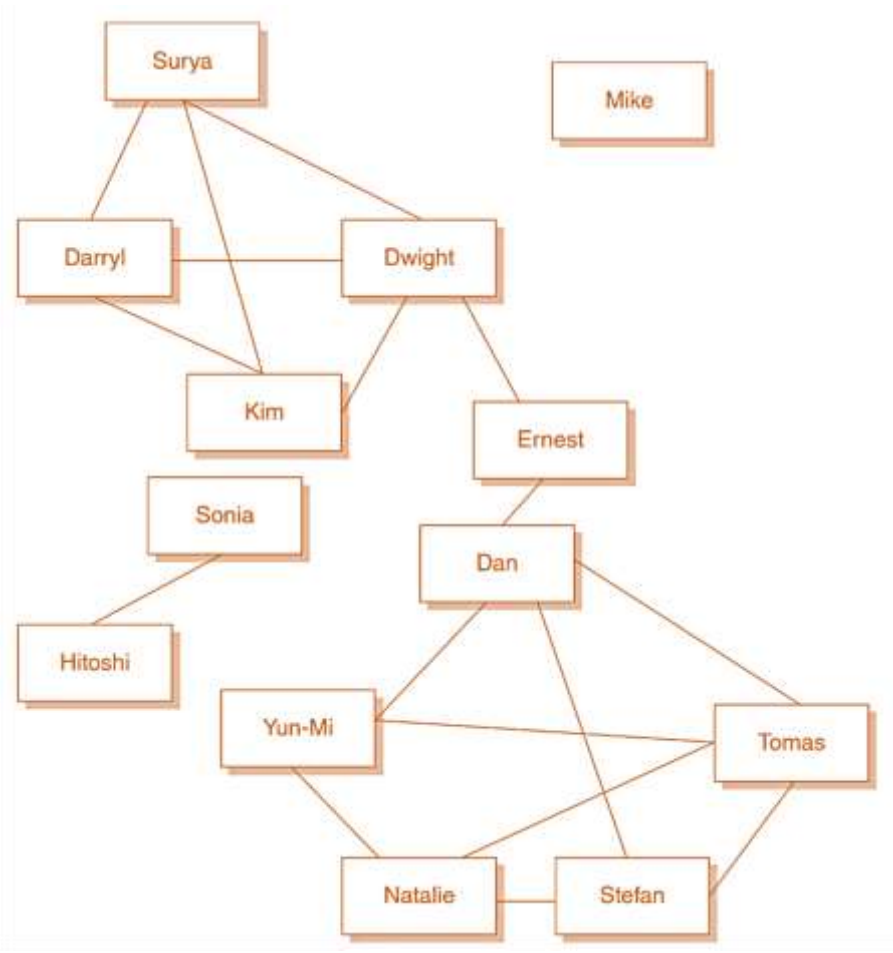
Put as simply as possible, a network consists of a system of links among components (e.g., individuals, work groups, organizations). The purpose of network analysis is to map out the flows that move among these network members. There are a number of ways we can characterize a network as a whole, including network content, network mode, and network density. Network content refers to the "stuff" that is flowing through the linkages in the network. For example, Tichy, Tushman, and Fombrun (1979) see network content as falling into four major categories: goods and services, information, expressions of affect, and attempts to influence or control. Network mode refers to the communication medium through which network linkages are maintained. Early research often differentiated between written and face-to-face modes, although the advent of communication technologies has increased the number of possible network modes dramatically. For example, consider how network connections can change and expand as wireless connections become so common that entire campuses, neighborhoods, and even cities are "wired". Third, the network as a whole can be characterized in terms of its density. A highly dense network is one in which there are many interconnections among network members, whereas a less dense network is more loosely interconnected. Finally, the network can be considered in terms of its level of analysis. Intraorganizational networks will look at connections among individuals within a given organization, whereas interorganizational networks will consider links among many organizations (see Eisenberg et al., 1985). In a global and complex society, interorganizational networks—of businesses, governments, and nongovernmental organizations—become particularly important (see, e.g., Doerfel & Taylor, 2004).

Properties of Network Links

It is also possible to characterize the connections that link members of a network together. There are many ways to consider network links (see Monge & Contractor, 2001, p. 442), but three of the most often used identifiers involve the properties of strength, symmetry, and multiplexity. Link strength has been defined in a variety of ways. For example, a strong link might be one in which there is a great deal of communication flowing between two people, one that has endured over a long period

of time, or one in which the exchange is deemed important by network participants. The symmetry of a communication link refers to whether the two people involved in the link have the same kind of relationship with each other. For example, the supervisor/subordinate relationship is asymmetrical, whereas the coworker relationship is symmetrical. Last, the multiplexity of a link refers to the number of different kinds of content (e.g., work-related, social, innovation ideas) that flow through a particular link. Network Roles Finally, it is possible to look at the individual actors within a network. Each "node" within a network can be described in a variety of ways (e.g., how central the node is in the network; see Monge & Contractor, 2001, p. 443). However, one of the most interesting ways to consider the individual actors in a network is to consider network roles. Network roles define the ways in which individuals are connected with each other. Consider the hypothetical network represented in figure below.

A Hypothetical Communication Network



By looking at this diagram, it is clear that individuals are connected in very different ways within the network. For example, compare the connections of Mike, Tomas, and Ernest. Mike doesn't talk to anyone in the network, and he would be characterized as an isolate. Tomas talks to a number of highly interconnected individuals (Dan, Yun-Mi, Natalie, and Stefan), and all these people would be characterized as group members. Within this group, Dan serves as a bridge to individuals outside of the group. Finally, Ernest talks to two people who have radically different connections within the network, and he would be characterized as a liaison.

In summary, we can look at emergent communication networks by considering the characteristics of the full network (its content, mode, and density), by considering the characteristics of network links (their strength, symmetry, and multiplexity), and by considering network roles. It is worth emphasizing that although we often think about a network as a "snapshot" of the group, organizational, or interorganizational structure, these network configurations often change over time, and these changes can make a big difference for network functioning and the effect of the network activity on individuals. For example, Shumate, Fulk, and Monge (2005) found that an interorganizational (and international) network of organizations coping with the HIV-AIDS crisis changed substantially over a period of eight years.

As for the individual, Susskind (2007) found that involvement in communication networks over time was important in helping employees cope with being "survivors" in a corporate downsizing.

Case in Point: Nowhere to Hide Connectedness

A network approach to understanding organizational systems emphasizes the interconnected communication patterns that join individuals within organizations and across organizational boundaries. This connectedness— and an ability to understand it—is enhanced through technologies, such as computers, cell phones, and global positioning systems (GPS).

For example, consider the technology of "Worktrack" developed by Aligo, a company in Mountain View, California. Levy (2004) describes the system like this:

The system is sold to employers who want to automate and verify digital time-logs of their workers in the field…. Workers have cell phones equipped with GPS that pinpoint their locations to computers in the back office. Their peregrinations can be checked against the "Geo Fence" that employers draw up, circumscribing the area where their work is situated…. "If they're not in the right area, they're really not working," says Aligo CEO Robert Smith. "A notification will come to the back office that they're not where they should be". (p. 76)

In other words, the technology creates a system where the whereabouts and connections among workers can be constantly tracked. Although Aligo president Smith claims that "workers like the technology because it insures [sic] they get credit for the time they spend on the job" (Levy, 2004, p. 76), one could also argue that the "freedom" gained from mobile technology has been turned on its head. Those systems of interconnections may tie workers more and more closely to those in control.

Modeling Techniques

Network analysis is useful in drawing and analyzing the maps that characterize organizational communication systems. However, systems theory concepts also incorporate complex processes of behavior. In order to better understand how organizational communication systems work, scholars have turned to statistical techniques that attempt to model patterns of communicative behavior and events in an organization. These models take many forms, and their complexity precludes a full discussion in this text (see Miller, 2001, for a more complete discussion). However, it is important to note that modeling techniques allow researchers to assess complex relationships among variables through the evaluation of causal models (McPhee & Babrow, 1987) or to assess changes in organizational communication systems through the use of time-series analysis and related techniques (Monge, 1990).

Perhaps one of the most exciting developments in organizational communication systems research is the use of computer simulations of organizational communication processes (Poole, 1996). Researchers using this technique program the computer with the "rules" of a particular system and starting values and then see what happens to the system when it is taken to its logical conclusion. For example, Contractor and Seibold (1993) have explored how a "self-organizing system" would work in the context of group decision-making. In a self-organizing system, order is purported to "emerge" in chaotic systems when conditions are right. Using computer simulations allows researchers to explore a variety of permutations that might emerge in such complex systems. These permutations would be impossible to explore through the isolated observation of actual organizational communication processes.

Case Analysis

Both of the research techniques discussed so far—network analysis and modeling techniques—involve relatively sophisticated statistical analyses. But mathematical techniques are not the only ones available to the systems researcher. Indeed, some scholars have argued (e.g., Sypher, 1997) that complex systems are best understood through individual cases.

A case analysis approach suggests that the richest understanding of organizational systems can be obtained by closely observing specific organizations grappling with specific issues. By collecting a variety of data through observation, interviews, questionnaires, and archives, the analyst can come to a more finely grained understanding of how and why an organizational system develops and behaves as it does. For example, a case analysis of a system using principles from complexity theory (Miller, 1998) highlighted the stress created for employees when the organization was trying to enhance innovation at "the edge of chaos".

Case analyses have been particularly useful in developing aspects of Weick's theory of organizing, presented earlier in this chapter. For example, Weick (1993) uses a historical case to enhance our understanding of times when systems of sensemaking fail. In 1949, thirteen firefighters and smoke jumpers died in the Mann Gulch fire in Montana. Weick uses writings about this disaster to develop a complex case analysis assessing the unraveling of this firefighting group. By discussing reasons for the failure of sensemaking (e.g., problems with role structure, the disintegration of the group in the face of panic), Weick is able to extend his theory of sensemaking and provide suggestions for how groups can become more resilient and less vulnerable to sensemaking collapses.

Summary

In this chapter, we have reviewed the systems approach to the study of organizational communication. The systems approach works from the metaphoric concept that an organization is like an organism. We looked at a number of basic systems concepts, including the nature of system components, the nature of system processes, and the properties that emerge from the conceptualization of organizations as interdependent and open sets of interacting components.

After our review of basic system properties, we explored three exemplary but very different systems theories. The first of these—cybernetic systems theory—highlights the importance of feedback and regulation in goal-directed systems. The second—Weick's theory of organizing— emphasizes how organizational interaction revolves around making sense of equivocal information environments. The third—systems

theory from the "new sciences"—emphasizes the chaotic and complex nature of "self-organizing" systems. Finally, we considered several methodological approaches that are useful to organizational communication scholars in the systems tradition. These methods—network analysis, modeling techniques, & case analysis—all provide avenues for understanding the complex nature of organizational communication systems.

Discussion Questions

1. How does the systems metaphor for organizing move us from a prescriptive consideration of organizational communication to a descriptive and explanatory approach? Which aspects of the systems metaphor are particularly helpful for you in explaining organizational communication processes?
1. What aspects of the systems metaphor are highlighted in a cybernetic approach to understanding? Which aspects are highlighted in Weick's theory of organizing? Which aspects are highlighted by "new science" system theories?
2. What kinds of research questions could be answered by the kinds of systems research methodologies outlined in this chapter? Are these methods mutually exclusive or can you see ways in which they could be usefully combined?

CASE STUDY

Sensemaking after the Acquisition

Helen Adams hung up the phone slowly and sat at the desk in her home office. She was surrounded by piles of documents relevant to various projects she was organizing for Sales Infomatics, the marketing firm she works for. As an independent contractor, Helen had the freedom to work at home and set her own hours. However, she had traded this flexibility at a cost of limited job security and benefits.

And now she was especially concerned about her precarious position. Sales Infomatics, a small family business, had just been acquired by Marketron Inc., a publicly held firm with more than five hundred employees in satellite offices around the country. Helen had just been informed about the sale by Les Kelsey, the longtime owner and manager of Sales Infomatics. Les assured her that her job was safe and that the Marketron people would be contacting her soon with employment information. Although Helen felt a little better with these reassurances, after the phone conversation, she had a multitude of questions swirling through her head.

Later that night at dinner, Helen enumerated her concerns to her husband, Glen. "I don't even know if I'll be an employee or an independent contractor. And what will working for Marketron be like? It's not like working for SI when I could just pick up the phone and talk to Les. And will we have to move to one of their office locations? Which office is the best for my work? Which is the best for us? Or for your career? Or should I even work for them? Maybe I could go off on my own or maybe someone else at SI would go with me?"

"Whoa, slow down!" laughed Glen. "I know you're really concerned about this change. I am too. But there's no point getting into a tizzy about it now. I'm sure someone from this Marketron place will call you tomorrow, and you can start figuring out all the details of the acquisition and how it will affect you. In the meantime, just keep doing your work. It will keep you busy and show Marketron what a valuable employee you are".

But no one from Marketron called the next day. Or the next day. Or the next. Not that Helen did not talk with anyone about the acquisition. Quite to the contrary, Helen seemed to talk about nothing but the acquisition. The other SI employees fed Helen all sorts of rumors about what was going on at Marketron. From Sara, an SI data analyst, Helen heard that all the Marketron offices worked under different project models and that getting in with the "right" office was a key to success. From Lance, an SI project manager, she heard that the incentive system was going to change radically, but the exact form of the future system was still up in the air. From Gretel, the receptionist at the SI office, she heard that the movers had come and gone and that all SI employees were being reassigned to various Marketron offices. But Helen heard nothing from Marketron. After two weeks, Helen decided to take matters into her own hands. She called Akiba Jaffe, the vice president for employee relations at Marketron. "Mr. Jaffe," Helen began, "you don't know me, but my name is Helen Adams, and I'm an independent contractor with Sales Infomatics".

"Of course. I know who you are, Helen," Akiba replied. "I've talked with Les Kelsey about you on many occasions. I hear you do incredible work, and I anticipate that you'll be a valued member of the Marketron team".

Helen was surprised. "Great, Mr. Jaffe! Perhaps, then, we could take a few minutes to talk about my employment relationship with Marketron. I have a lot of questions for you, and I'd like to start getting some things settled in my mind. We could meet in person, if you'd like, or I have a list of questions prepared that we could consider now. For example…"

"Well, you know, Helen," Akiba interrupted, "I'd love to talk right now, but I have a lot on my plate to deal with first. Our plan is to get to the arrangements with independent contractors in the next week or so, after we settle the transition plans with permanent employees. Be patient, and we'll get back to you then".

Helen was patient for the next week. And the next. And the next. She continued to do her work and complete the projects she'd been working on for Sales Infomatics. She continued to get dribs and drabs of information from former SI employees. She learned that they had all received employment contracts, although many were unsatisfied with the nature of the contracts. She learned that many of the SI "ways of doing things" were changing. But she still heard nothing about her own future at Marketron, and she began to update her résumé just in case she had to hit the streets and look for a job.

Finally, six weeks after the acquisition, Helen talked again with Les Kelsey. "Les," Helen began, "I hate to be pesky about this, but I'm still trying to figure out where I stand with Marketron".

Les quickly broke in. "But I heard from Akiba Jaffe that he talked with you and assured you that you would be an important part of the Marketron team. He's really the person you need to talk with now about all the details". Helen hung up the phone, frustrated once again. If Les didn't have the answers, who could she turn to?

CASE ANALYSIS QUESTIONS

1. How would you use Weick's model of sensemaking to describe Helen's experiences since Sales Infomatics was acquired by Marketron? What kind of information environment confronts Helen? And what options does she have to successfully cope with that information environment?
2. Do Helen's experiences reflect any of the systems factors identified by theorists using "new science" principles? Or could these principles help Helen change or adapt to the situation she has found herself in?
3. How does Helen's role in the communication networks at Sales Infomatics and Marketron influence her ability to cope with life after the acquisition? How would you describe the networks and her roles within them?
4. Think about Helen's situation as a cybernetic model in which the goal is enhanced information about life as an employee of Marketron. What kind of feedback is Helen now receiving? And what kinds of mechanisms could she use to enhance her knowledge about the new company?