private understandings lest they be thought foolish. That might happen, but since there's already a little madness in the theorizing, mere foolishness is nothing.

All you need to remember while thinking about organizing is that there's a bit of absurdity in all of us, theorists and managers alike. That absurdity can be turned to one's advantage, and I've tried to show how. But whether exploited, tolerated, or suppressed, that touch of absurdity lies just below the surface and breaks through in strange forms: "The folly of mistaking a paradox for a discovery, a metaphor for a proof, a torrent of verbiage for a spring of capital truths, and oneself for an oracle is inborn in us" (Valery 1895, quoted in Siu 1968, p. 75).

3

interdependence and organizing

In the last chapter William James urged that we talk about feelings of "and," "if," "but," and "by," and this chapter takes that injunction seriously. Words such as *connection*, *relation*, *link*, *network*, *interdependence*, and *reciprocal* are plentiful in literature on organizations. It is important to gain some experience with this way of viewing the world. The purpose of this chapter is to introduce some tools and ideas that can be used to think through some of the issues of connection as they involve organization. In the next chapter we will look at quite molecular forms of connection, interpersonal contingencies between pairs of actors. In this chapter we are talking about connections in general. The ideas to be developed here are equally relevant for connections between a therapist and client, parasite and host, nation and nation, subscribers and advertisers, an individual's failure and depression, or team expansion and fog.

To familiarize the reader with the general notion of interdependence, we will first examine two examples. Then the question of what the examples have in common will be answered by having the reader generate a personal display of interdependence using personal experience. In exploring this display, we will examine several characteristics of it that are also found in the examples and that are basic characteristics of any setting characterized by interdependence.

People and Spirit Levels

A graphic way to demonstrate interdependence is by means of a piece of laboratory apparatus suggested by Alex Bavelas (the same one) and used by Raven and Eachus (1963) (see Fig. 3.1).

In Fig. 3.1 three people are seated at the corners of an equilateral triangle; there are knobs in front of them, and in front of each knob is a carpenter's

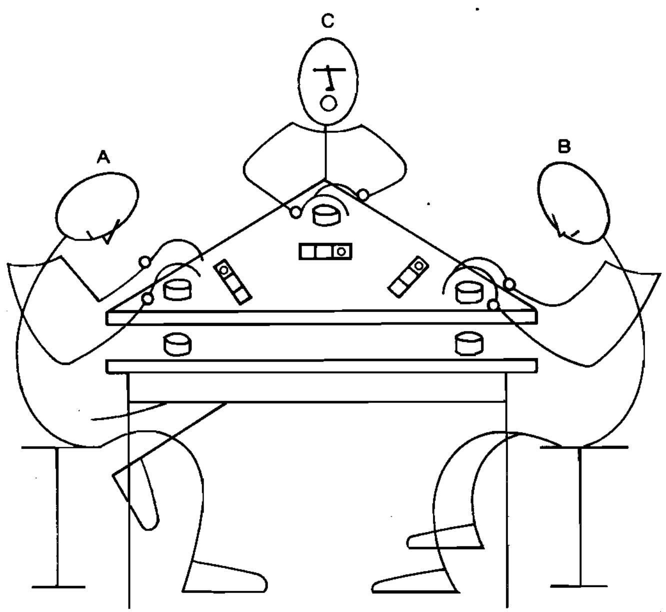


Fig. 3.1 The spirit level task. (From Raven and Eachus 1963, p. 309.)

spirit level—a piece of wood with a bubble in the center of it. If the level is put on a surface that is tilted, the bubble will not remain in the center, but when the surface is perfectly flat the bubble will be in the center. Simple as this tool is, it can portray most of the dramas of interdependence that occur in everyday life.

To see this point, look at person *A* in Fig. 3.1. If person *A* turns the knob in front of him, this raises or lowers his corner, depending on which way he turns the knob. Notice the precise direction the spirit level is facing. Suppose that the table is tilted and that the bubble is not in the center. Suppose further that *A* wants to get the bubble into the center. How can this be done? *A can't* do it alone. Persons *B* and *C* have total control over the plane of the table that person *A* must tilt to get the bubble centered. To see this property, notice where the circle is located in *A*'s spirit level. If *A* turns his knob he will lower or raise his corner, but that simply moves the level up and down. This vertical movement is irrelevant to *A*'s problem; *A* needs control over horizontal movement. And it is this kind of control that is in the hands of both *B* and *C*. As diagrammed in Fig. 3.1, the bubble is located in the left hand end. This means that the triangle is higher at person *C*'s point than it is at person *B*'s point. If *C* were to lower the point and *B* were to raise the point, then the bubble in *A*'s level would come back to the center.

Thus, given the way the spirit levels are pointed, person *A* is dependent on both person *B* and person *C* if the goal is to center the bubble. *A* is dependent in the sense that he has no direct control over this outcome. *A* does have some indirect control over this outcome, and it is this feature that makes the exact

display of spirit levels in Fig. 3.1 an example of interdependence rather than an example of dependence. We said that *A* has indirect control over whether his own level can be made horizontal. To see why this is so, simply put yourself in *B*'s chair. *B* has the same problem that *A* has. He also can't control directly the table movements that will center his bubble; his fate is in the hands of *A* and *C*. As diagrammed, if *C* lowers his corner and *A* raises his, then *B*'s bubble will be centered. Thus *A* is dependent on *B* and *C* to center his level, but *B* is also dependent on *A* and *C* to center his. And the same holds true for *C*. Any one person's fate depends upon what the other two people do, but the person who is dependent on the others can also partially control their fate.

The fascinating part of this simple exercise is that it can be used to create an incredible variety of interdependent situations simply by changing the placement of the levels. In Fig. 3.1 everyone's fate is in the hands of everyone else. If we move the levels so they are directed as shown in Fig. 3.2, then each individual gains more control over his own fate. The form of interdependence depicted here is weaker than was true in Fig. 3.1 in the sense that each individual has partial control over his own fate and is thereby less dependent on the other members; it is also weaker in the sense that each is dependent on and also can affect the fate of only one other individual. In Fig. 3.2 the only crucial person in person *A*'s universe is person *C*. If *C* remains passive and doesn't turn his knob at all, then all *A* has to do is raise his corner, and eventually the bubble will go back to the center. The drama in this setup lies in the fact that even though in *A*'s view *C* is crucial and *B* is irrelevant, if we shift around to *C*'s position, *C* could care less what happens to *A*: the crucial person is *B*. However, even though *B* is crucial to *C*, if we shift to *B*'s position we find that *B* could care less what happens to *C* because *A* is vital.

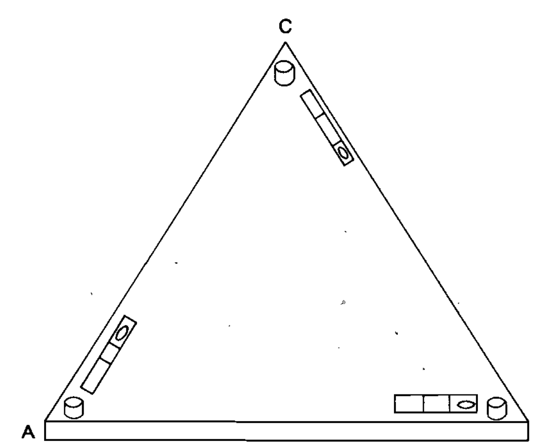


Figure 3.2

Figure 3.1 illustrated a situation of mutual interdependence, and Fig. 3.2 illustrates sequential interdependence. Sequential interdependence is the simplest type of interdependent situation that involves the use of some kind of intermediary in social interaction, and mediated interaction is the essence of organization (Guetzkow 1961). In Fig. 3.2, person *A* is interested in the outcomes that another person, person *C*, can offer. But *A* can offer *C* nothing. Instead, *A* has to rely on the actions of somebody else, *B*, who can offer something of value to *C*. Situations similar to this in everyday life include the plant manager who relies on supervisors to control the work quality of workers, the child who works through the softer parent to get desired outcomes from the other parent, and the nation that asks another nation to sound out a third regarding some possible agreement.

"Nobody Ever Dies of Overpopulation"

The phrase "nobody ever dies of overpopulation" comes from an editorial written by Garrett Hardin (1971) concerning the population explosion. His point of departure was the catastrophe that occurred in East Bengal in November 1970 when 500,000 people were killed by a cyclone. Hardin asks the question, "What killed these unfortunate people?" The obvious answer is the cyclone. Hardin argues that it's just as plausible to argue that overpopulation killed these 500,000 people. The area where they lived is barely above sea level, making anyone who lives there vulnerable to being killed by even quite ordinary storms. Hardin feels that if it were not for the fact that Pakistan is so overcrowded, "no sane man would bring his family to such a place. Ecologically speaking, a delta belongs to the river and the sea; man intrudes there at his peril."

Hardin feels that we tend to exaggerate the effect of something like a cyclone and to underplay the effect of something like overpopulation simply because if we identified overpopulation as a strong determinant, then we would have to deal with the unpleasant question, "How can we control population without recourse to repugnant measures?" (Hardin and Baden 1977). By saying that the cyclone caused the deaths, then we can comfortably say that fate, not human responsibility, was at the root of the problem. As another example, Hardin mentions the fact that every year diseases like tuberculosis, leprosy, or animal parasites "cause" the deaths of millions of people. His argument is that malnutrition is intimately connected with overpopulation.

Another population example of interdependence is found in the work of Ehrlich, Ehrlich, and Holdren (1973). They note that as the population increases cities expand and push out into farm land. This has the consequence that air pollution becomes a mixture of agricultural chemicals and the conventional urban pollutants such as power plant emissions and automobile exhaust fumes. The basic component of the urban pollution is sulfur dioxide, which drastically slows and eventually paralyzes the cleansing mechanisms of the lungs. When cities expand and encroach on agricultural lands, this has the serious consequence that a slowing of the cleansing mechanism in the lungs means that the carcinogens in agricultural chemicals reside in the lungs for a longer time before they are cleansed out. And the longer a human being is exposed to these carcinogens, the higher the probability of death from a terminal disease. Notice that if we apply Hardin's phrase, we would be tempted to say that people die from lung cancer rather than overpopulation, which was the original reason that the cities were expanding and that the urban pollutants became fatally mixed with agricultural pollutants.

Causal Structures in Group Discussions

General properties of these two examples can be uncovered with an exhibit you can generate. Please read and follow these instructions *before* you read the portion of this chapter which follows the exercise.

In Fig. 3.3 you will see 12 different boxes that each contain a brief phrase. Each of these 12 phrases describes some typical event that occurs during a classroom lecture, group discussion, seminar, or planning meeting. Think back to the most recent classroom or workgroup discussion you've been in. It's important that you have a specific session in mind and that it be vivid in your memory. Once you've chosen the particular session that you want to analyze, enter the identifying information about this session at the top of Fig. 3.3. This will help you later if you forget what this diagram represents but wish to refer back to some of the ideas in this diagram.

Fill out this diagram: draw on this figure both arrows and plus and minus signs that describe accurately your meeting experience. Basically you're asking yourself which labeled events in that meeting affected which other events. When you feel that some event affects some other event, represent this by an arrow. For example, suppose that when your feelings of boredom (10) changed—that is, they either went up or down—this change affected the number of ideas you thought of (5). If you think that was the case, then draw an arrow from box 10 to box 5, with the point of the arrow at 5 and the blunt end of the arrow at 10. This arrow simply says that when feelings of boredom change, this change causes a change in the number of ideas you think of.

Work your way systematically around the diagram. First look at box 1, "Number of people making comments," and ask yourself, as the number changes (more people make comments or fewer people make comments), does

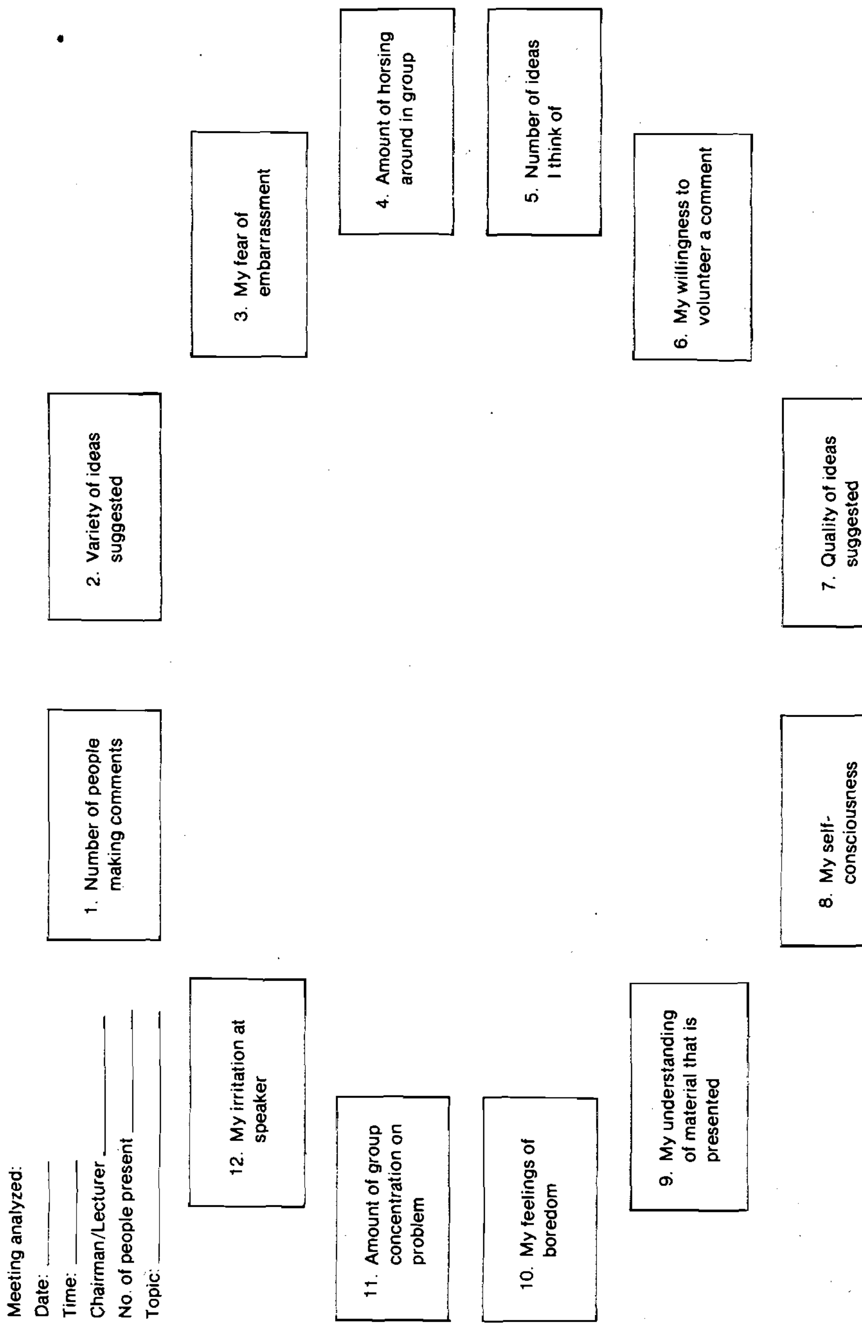


Figure 3.3 Discussion events.

this affect box 2, box 3, and so on? (These boxes represent *variables* in the discussion.) Once you have examined all 11 events other than box 1 and have asked yourself whether a change in variable 1 produces a change in these other events, then switch to variable 2 and ask, "As the 'variety of ideas suggested' changes, does this affect box 3, box 4, and so on?" Whenever something does have an effect on something else, connect those two events by an arrow.

In addition to drawing arrows among the events you should also place either a plus or a minus sign next to *each* arrow that you draw. When you draw an arrow, that simply says that the event at the blunt end of the arrow has an effect on the event at the sharp end of the arrow. The plus and minus designation permits you to identify what kind of effect occurs. A plus sign means that the two connected events change in the *same* direction. For example, suppose you had an arrow going from box 10 to box 5 showing that when your feelings of boredom change this affects the number of ideas you have. Suppose further that as your boredom increases, the number of ideas you have also increases (when you get bored your mind wanders and you dream up ideas to entertain yourself). And suppose that as your boredom decreases the number of ideas you have also decreases. In both of these cases the connected variables change in the *same* direction. When one goes up the other one goes up; when one goes down the other one goes down. In your diagram, put a plus sign next to every arrow connecting variables that move in the *same* direction.

Some events that you connect, however, will move in opposite directions. For example, it is conceivable that when your feeling of boredom increases your idea production decreases. Or similarly, as your feelings of boredom decrease, the number of ideas you have goes up. In both of these cases when one event changes in one direction, the event to which it is related by a causal arrow changes in the *opposite* direction. Wherever you have two events linked by an arrow and the two events move in *opposite* directions, then put a minus sign next to that arrow.

In summary, take some actual discussion experience that you've recently had and, using the 12 events in Fig. 3.3, portray what happened. Indicate which events affected which other events and the direction of these effects. Take your time completing this exercise. The more carefully you work on it, the more you will understand subsequent ideas presented in this book.

DO NOT READ ANY FURTHER IN THIS TEXT UNTIL YOU HAVE COMPLETED FIG. 3.3 ACCORDING TO THE INSTRUCTIONS GIVEN IMMEDIATELY ABOVE.

Analysis of Interdependence

OVERVIEW OF FIGURE 3.3

Each numbered event in your cause map is a variable: each event can assume a variety of values. Each of the 12 variables you've connected is either interdependent, dependent, independent, or irrelevant. Any variable that has arrows coming into it and arrows going out from it is interdependent: it is affected by and affects other variables. Any variable that only has arrows coming to it but has no arrows going away from it is a dependent variable. And any variable that has arrows going away from it but has no arrows coming into it is an independent variable.

Just on the basis of this crude tally, it is probably the case that more of your variables are interdependent than either independent or dependent. Whether that's true or not, the point is that the discussion configuration resembles the situations of the spirit level and overpopulation.

In Chapter 1 we talked about causal loops and causal circuits; these should be visible in your diagram. Take one of the *inter*dependent variables as a starting point. Starting with that variable, see if you can trace a pathway by following the arrows that will eventually lead you back to the variable that you started with. You are trying to start with an interdependent variable and locate some path of arrows that will lead you back to that starting point. Every complete path that you find is a causal loop. If you can find no loops, then draw in a hypothetical one—using a different-colored pencil—to aid your understanding of the following points.

CAUSAL LOOPS AND CONTROL

Pick out one of your loops and count the number of negative signs contained in that loop. If there is an even number of negative signs (e.g., 0, 2, 4, etc.), then that loop is a deviation-amplifying loop (Maruyama 1963), a vicious circle (Wender 1968), or a regenerative loop (Bateson 1972, p. 109). The potential significance of such a loop can be seen if you trace what happens when one variable in that loop increases. You will find that the variable you started with increases even further once you have completed the circuit and it continues to increase every time you complete the cycle. In a causal loop with an even number of negative signs there is no regulation or control. Once a variable begins to move in a particular direction, either up or down, the variable will continue to move in that same direction until the system is destroyed or until some dramatic change occurs (Goldsmith 1971).

To see how control operates look at portions *A* and *B* of Fig. 3.4. In portion *A* there is an even number of negative signs: zero. In that kind of situation any change in one of the variables will be amplified, and a vicious

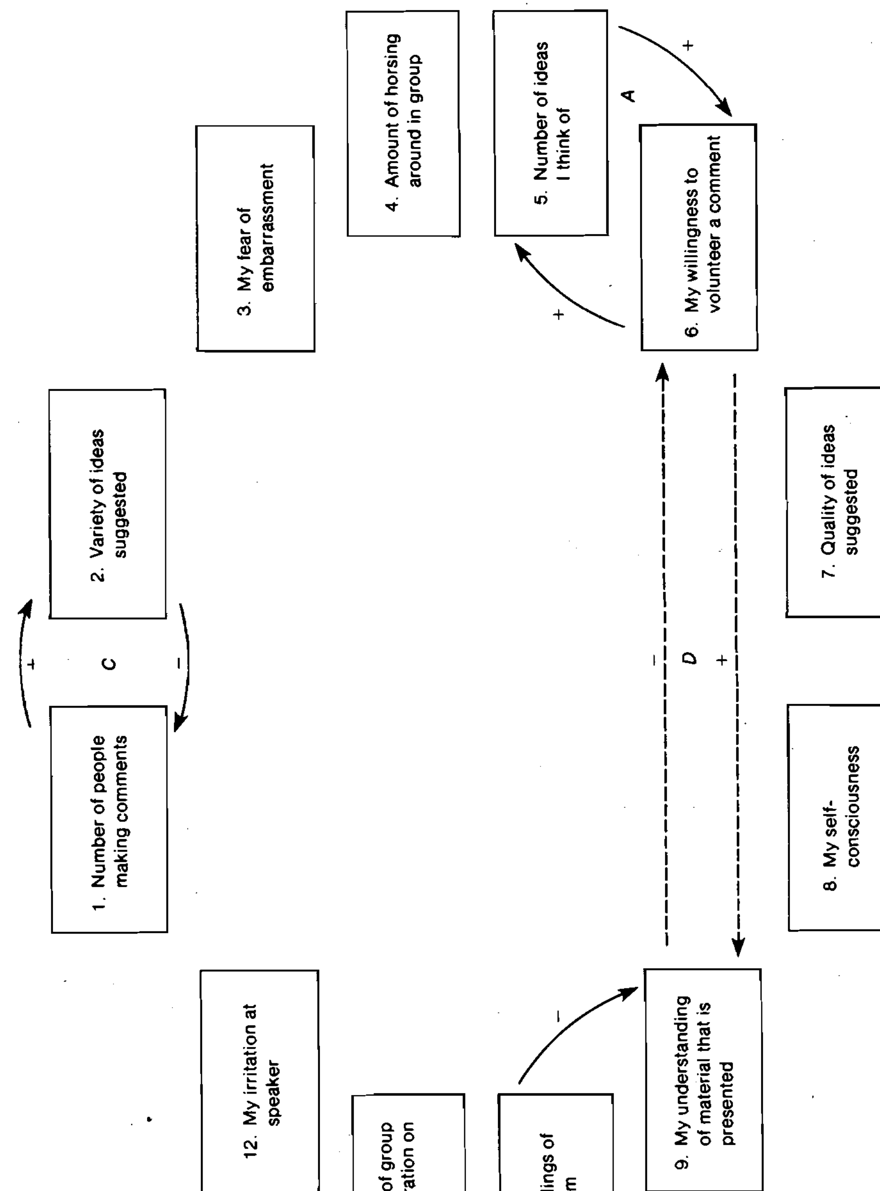


Figure 3.4

circle will result. For example, suppose that I have difficulty thinking up ideas. As the number of my ideas decreases, my willingness to comment decreases; and as my unwillingness to comment decreases, the number of ideas I think of decreases further until I either fall asleep, leave, or do something drastic to get attention—all of which change the system. In a closed loop with an even number of *negative signs, there is nothing to prevent the spiraling I just* described. The same spiraling holds true for portion *B*, which is composed of two negative signs, again an even number. If my boredom increases, this leads to a decrease in my understanding of the material that is presented, which leads to an increase in my boredom, which should lead to a further decrease in my understanding, etc. Again this vicious circle goes unchecked, a characteristic feature of any deviation-amplifying loop.

In some of your loops, however, you may have found an odd number of negative signs. These loops are particularly interesting because they impose stabilities on organizing processes. In portion *C* there is an odd number of negative signs (one). If you trace through several circuits in that pair of related events you will see how self-regulation occurs. Suppose the number of people making comments increases. This produces an increase in variety of ideas, which then produces a decrease in the number of commenters (they get overloaded), which leads to a decrease in variety, which then leads more people to make comments. Both people making comments and idea variety fluctuate, but they fluctuate around some middle value. This is so because of the relationship between these two events, a relationship that leads them to be controlled and self-regulating rather than uncontrolled and amplified. Any causal loop that has an odd number of negative signs counteracts deviations.

When people examine relations in organizations they look for interdependent variables, causal loops, and the presence or absence of control. Loops that are deviation-counteracting mean that the system is basically stable; loops that are deviation-amplifying mean that the system is basically unstable. Whether this instability leads to constructive or destructive growth is of importance, but this point will be discussed later.

MULTIPLE CAUSAL LOOPS AND THE FATE OF THE SYSTEM

When more than one causal loop exists and when some of these loops suggest the system will explode while others suggest the system will remain stable, there is the problem of knowing how to analyze such a situation. Using the set of loops depicted in Fig. 3.5 we can suggest two general strategies to use in making this analysis. First, we could assume that the loops are of *unequal* importance. If we make this assumption, we would scale the different loops on their degrees of importance, and we would predict that the fate of the system would be determined by the nature of its most important loop. If the most

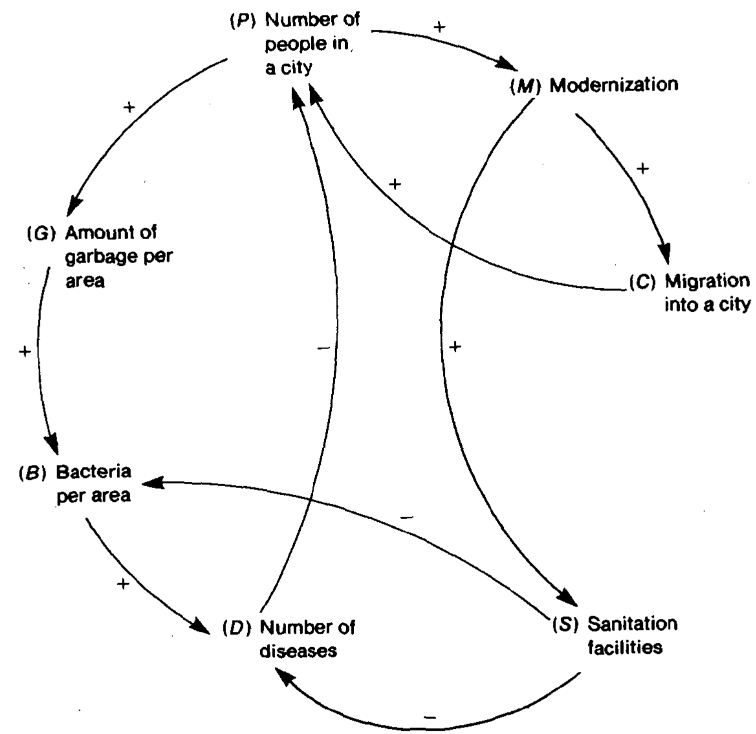


Fig. 3.5 (From Maruyama 1963.)

important loop is deviation-counteracting, then the *system* in which the loop is embedded will be deviation-counteracting. If the most important loop is deviation-amplifying, then the system will be deviation-amplifying. The difficulty with this method of predicting is that the judgment of a loop's importance may often be purely arbitrary.

However, there are some ways in which this problem of arbitrariness can be solved. It is possible, for example, to define importance in terms of the number of inputs to and outputs from the different elements in the system. The general rule would be: the greater the number of inputs to and/or outputs from an element, the more important that element is. Having assessed the individual elements, we would then search for that loop which contained the greatest number of important elements, and we would predict that the nature of that loop would determine the fate of the system. For example, if we examine the elements in Fig. 3.5, we find that some of them have more than one output (this is true of elements *P*, *M*, and *S*) and some of them have more than one input (this is true of elements *P*, *D*, and *B*). Now if we assume that the five elements with more than one output or more than one input are the most important elements in the system, then we look within this system for that closed loop that contains the greatest number of these important elements (the loop goes from *P* to *M* to *S* to *B* to *D* to *P*). Since this loop has an even number of negative signs (two), it is deviation-amplifying. Thus we say that the most important loop within this system is deviation-amplifying, and therefore the entire system is deviation-amplifying; we predict that it will eventually destroy itself unless one of the relationships changes in sign, another relationship is added, or some relationship is deleted.

All this pertains to the situation in which the investigator assumes that the loops are of unequal importance. If we make the assumption that the loops are of *equal* importance, then we can solve the problem of predicting the fate of the system in a different way. It seems plausible that we could talk about the fate of the system *as a system* by counting the number of negative loops, just as we previously counted the number of negative relationships. By a *negative loop* we mean a closed loop that contains an odd number of negative causal relationships. We would predict that any system will survive as a system only if it contains an odd number of these negative loops. If the system contains an even number of negative loops, then their effects will cancel one another, and the remaining positive cycles will amplify whatever deviations may occur. Another way of reaching the same prediction would be to count the total number of negative relationships in the whole system, counting each negative more than once if it appeared in more than one loop. If the total number was odd, the system would be deviation-counteracting; if it was even, the system would be deviation-amplifying.

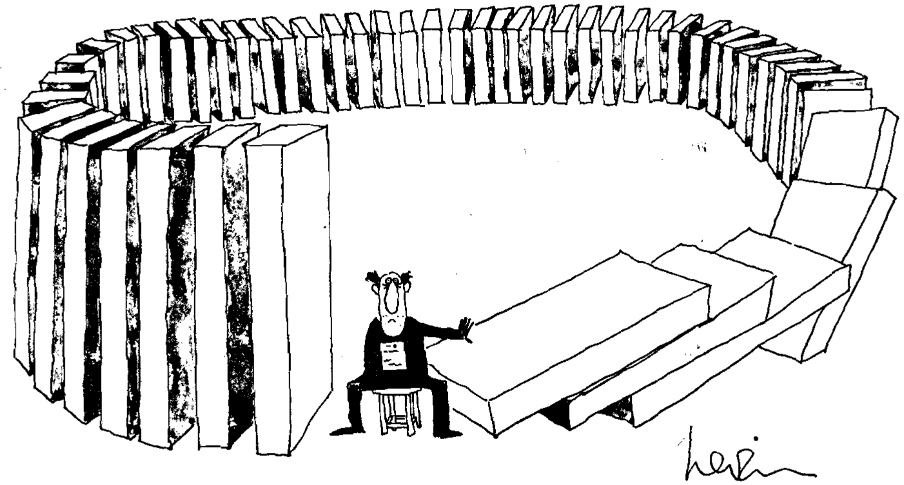
Now we can refer back to Fig. 3.5. In this figure *one* of the four loops is negative (*PGBDP*), and there is a total of five negative causal relationships (counting the one between *D* and *P* three times, since it takes part in three loops).

Since both these numbers are odd, whatever happens within this system, regardless of where it happens, will eventually be reversed. The system, according to this prediction, is a deviation-counteracting system. This prediction differs from the earlier prediction based on the assumption that the loops were of unequal strength, thereby illustrating the point that assumptions make a difference. It is conceivable that both conclusions about this system are correct. The system will continue for some period of time, but due to such things as the differential speed with which the cycles are completed, the magnitude of the changes at each variable, the tightness of the couplings among variables, the number of times each loop is activated, and the effects of exogenous variables, increasing amounts of instability could be introduced.

The tactic of using arrows and plus and minus signs is simply a means to portray situations of complex interdependence in such a way that one can then ask better questions about these situations. These cause maps do impose some order on the domain being analyzed, and it will be our argument that this ordering can be informative to both participants and observers.

ARBITRARY CAUSE AND EFFECT

When any two events are related interdependently, designating one of those two *cause* and the other *effect* is an arbitrary designation. If you examine any causal loop you will see why. In any causal loop no variable is any more or less important than any other variable. No variable in a loop controls other variables without itself being controlled by them. You can start the sequence anywhere you want by changing any variable. That change initially looks like a cause that triggers subsequent events in the loop. But the changes within the loop keep happening and eventually come back and modify the initial change which you had intentionally made. And that cycling back means that what was originally a cause is now suddenly an effect. This is a prominent feature of any structure of causal circuits. It should be kept in mind when you are tempted to argue that some changes are more important than other ones. If you have a genuine causal circuit, then any change made anywhere will eventually itself be changed by the consequences it triggers.



Drawing by Levin; © *1976 The New Yorker Magazine, Inc.*

UPTIGHT VARIABLES

Earlier we substituted the word *variable* for the word *event* to signify that an event can take on a variety of values. The number of ideas I think of, for example, can vary between 0 and 37, my fear of embarrassment can vary from slight to monumental, and so forth. Although it is sometimes hard to specify the limits within which a variable can change, the reader probably does have some feel for what it means to say that variables can take on different values. Normally when a variable moves between its upper and lower limits, these changes promote adaptation and stability.

But in any causal loop the limits between which a variable varies can produce rather dramatic consequences. One of these consequences is "uptight variables":

> When, under stress, a variable must take the value close to its upper or lower limit of tolerance, we shall say, borrowing a phrase from the youth culture, that the system is "uptight" in respect to this variable, or lacks "flexibility" in this respect. But, because the variables are interlinked, to be uptight in respect to one variable commonly means that other variables cannot be changed without pushing the uptight variable. The loss of flexibility thus spreads through the system. In extreme cases, the system will only accept those changes which *change the tolerance limits* for the uptight variable. For example, an overpopulated society looks for those changes (increased food, new roads, more houses, etc.) which will make the pathological and pathogenic conditions of overpopulation more comfortable. But these ad hoc changes are precisely those which in longer time can lead to more fundamental ecological pathology. The pathologies of our time may broadly be said to be the accumulated results of this process—the eating up of flexibility in response to stresses of one sort or another (especially the stress of population pressure) and the refusal to bear with those byproducts of stress (e.g., epidemic and famine) which are the age-old correctives for population excess (G. W. Bateson, 1972, pp. 496-97).

Suppose that one of the variables in the discussion group diagram (Fig. 3.3) is pushed to its limits: irritation (box 12) is at an all-time high or quality of ideas (box 7) is as low as it can go. If this happens, then all *other* variables related to that single uptight variable will now also become frozen, and that's true even if they are *not* near the extremes of their limits. Remember that the variables are interdependent, and this means that they are responsive to the changes made in those variables to which they are connected. If one of those variables to which they are connected is frozen and does not change, then the related variables won't fluctuate, either.

When variables freeze up danger results because they are then unavailable to absorb changes occasioned by normal fluctuations. Think back to portion *C* in Fig. 3.4. On any one day, the variety of ideas being suggested may be quite high, quite low, or right in the middle. And some of the things that happen in that discussion will have an effect on variety. People are able to adapt to these fluctuations and to stabilize them because of the deviation-counteracting loop that relates people and variety. Suppose the discussion starts off with very little variety in what is produced. That discouraging start really doesn't matter.

In a deviation-counteracting loop, the relationships are present that allow the group to adapt to lowered variety, whatever caused it. In the presence of low variety, more people speak up, which raises variety. The presence of the deviation-counteracting relationship, plus the fact that these two variables are free to vary and absorb some of these external buffetings, helps stabilize the discussions.

Bateson is worried about what happens when variables lose their variability. Suppose people get stuck on the same idea or everyone wants to talk at once or everyone is preoccupied and wants everyone else to talk. In any of those cases the variable is not free to move except in one direction. Consequently, its capacity to absorb some of the buffeting from the environment is drastically reduced.

In a discussion situation there are several variables that could become uptight. If by chance you diagramed a meeting with which you were very dissatisfied, one of the first things you should look for is the likelihood that deviation-amplifying loops are present. Secondly, you should look to see if some variables are uptight and have thereby frozen the variation in related variables. If you discover that variables are uptight or locked into deviation-amplifying circuits, what should you do?

PATTERNS ARE MORE CRUCIAL THAN SUBSTANCES

What do you do with a system that is stuck? One thing you don't do is tamper with a single variable. The basic property of interdependence is that patterns and *relations* among variables are the realities that you have to deal with; substances are trivial. If a loop is uptight it won't do any good to work on single variables. The only place that you can make a significant change is *between* variables. Those relationships are what give order to the events you have depicted.

To see this point examine portions *B* and *D* of Fig. 3.4. In portion *B* a vicious circle is operating. Bordeom cuts down on understanding, which increases boredom, which cuts down on understanding even more. Suppose I want to change that. I can't operate on my boredom and somehow develop more tolerance, nor can I somehow operate independently on my understanding so as to deepen it. The reason those changes won't make any difference is that they take no account of the causal ties between these two events. Even if I develop more tolerance, all that happens is I expand slightly the limits within which the variable varies. What remains unchanged is the fact that boredom is linked to understanding by an amplifying relationship.

I could change that vicious circle by adding a new variable into the loop, a solution depicted in portion *D*. If I could generate a world in which my understanding of the material that is presented would not affect my boredom directly but rather would affect my willingness to make comments, and if my willingness to make comments (variable 6) were tied to my understanding of material in the ways that are designated by the signs in portion *D*, then a stable relationship is created.

The sequence will be traced through to show how control has been achieved. Suppose my boredom increases. This leads to a decrease in my understanding of the material. But now, with the addition of the new linkage to variable 6, my decrease in understanding triggers an increase in my willingness to comment; this in turn increases my understanding of the material, which then finally decreases my boredom. By adding a third variable in the ways depicted in portion *D*, I have regained some control over a potentially vicious circle and now have a more stable set of events.

By relating variable 6 a situation of an even number of negative signs was transformed into a situation of an odd number of negatives. To reiterate an important point, it was *not* the fact that I became willing to volunteer comments that stabilized this system and gave it additional flexibility. Merely volunteering comments had nothing to do with this outcome. What *did* produce the outcome was the way in which this activity of commenting became related to the other events of boredom and understanding. If I had incorporated "willingness to comment" into my cause map, but had related it to understanding with a plus rather than a minus sign (when my understanding goes down I say nothing), then the causal loop would have been even less stable. It all depends on the relationships involved.

DISSOLVING RANDOMNESS

It is also a property of causal circuits that they generate a nonrandom response to a random event at that position in the circuit at which the random event occurred. This is a subtle but crucial point for organizational analyses. If there is an accidental change in value of one of the variables in a circuit, the characteristics of the *circuit* will even out that fluctuation as it moves around the circuit so that when it finally arrives back at the point of the original accident, the accident has been made orderly. By characteristics of the *circuit* we mean such things as its threshold of activity, its patterns of plus and minus relationships, how long it takes a circular sequence to complete itself, and so on. These characteristics of the circuit act as constraints on any random fluctuation and tend to even out what occurs.

For example, take the extended causal loop that combines portions *B* and *D* of Fig. 3.4. Suppose a random impulse leads me to start making comments about everything to everyone (variable 6 goes up for no particular reason). More comments leads to more understanding, less boredom, greater understanding, and finally *fewer* comments. Thus, the original random increase in comments, through the events triggered in this causal circuit, eventually makes of this random commenting a nonrandom, orderly response. This outcome occurred because of the patterns of plus and minus relationships in that causal loop, the amount of time it took for the events to cycle through (time is left unspecified in this particular example), and the amount by which a prior variable had to change before it triggered a subsequent variable (as discussed in this example I have assumed that the thresholds are very low—that is, a minor fluctuation is sufficient to trigger the next variable along the circuit).

SMALL BEGINNINGS

Deviation-amplifying loops can be either vicious or virtuous circles, and it is important that this broader implication be understood. Any chance event such as a small crack in a rock that gathers water or a farmer who builds his home on a homogeneous agricultural plain can become amplified into a tree that grows out of a rock or people congregating around the original farmer to form a city. The process, not the initial crack or location, generated the complex outcome (Maruyama 1963).

What is striking are the disproportions involved. A small initial deviation that is highly probable—such as a wagon breaking down—may develop into a deviation that is very improbable—a city. This final outcome is improbable if one believes in unidirectional causality rather than causal loops. With sufficient cycling, small deviations can be amplified into complex homogeneous events, a sequence that can be quite misleading to analysts (see Waddington 1977, pp. 145-60).

Let's return to the city in an agricultural plain. Once the farmer opens a farm at a chance spot on it, other farmers follow his example; soon one of the farmers opens a tool shop where the farmers congregate. Later a food stand opens next to the tool shop, and a village grows. The village makes it easier to market crops, which attracts still more farmers; eventually a city develops. Now, if an analyst looks for a geographical cause as to why this particular spot and not some other became a city, he won't find it. He won't find it because "it" is not there. The amplifying processes generated the complexity. And because the final outcome is so complex, there are that many more false leads concerning "things" or single variables that could have "caused" this city to form in this place. All of these clues are misleading because none of them "caused" the city to be located in just that spot. The truth will be lost to analysts, especially to the person who views reality as consisting solely of things and structures rather than relations and processes.

The analytic problem can be illustrated by a different example, one discussed by Wender (1968). Suppose we observe that an adult experiences social rejection in response to social ineptitude, and that this sequence also is associated with lowered self esteem and withdrawal. The process looks like that portrayed in Fig. 3.6. As shown in Fig. 3.6, the person now faces rejection, and that's what sustains the misery. But that isn't how it started.

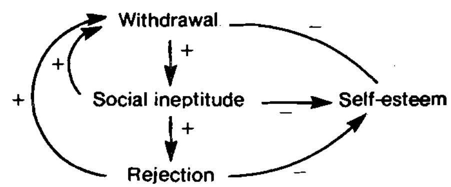


Figure 3.6

As an adolescent the person was fat and pimply, withdrew in embarrassment, and failed to acquire social skills. Thus Fig. 3.6 should be extended to reveal the factors shown in Fig. 3.7. The acne and obesity disappeared, but the withdrawal and social ineptitude persisted because of their amplifying linkage. This means that what started the problem no longer exists to sustain it. "Insight" into the *origins* probably won't help either, because they're no longer responsible for what holds the misery (rejection) in place. If the original event has disappeared and left no trace, then it may even be undiscoverable.

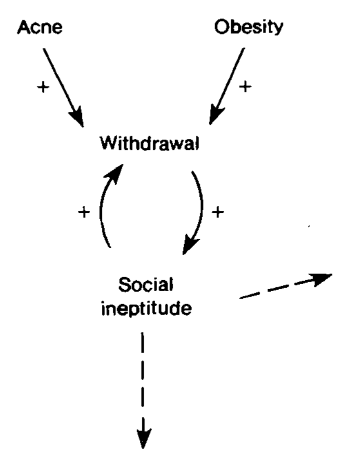


Figure 3.7

Deviation-amplifying circuits mock a search for original single causes that are proportional in size to the effect that is now observed (e.g., a tiny little stream could never have carved out that huge Grand Canyon). An outcome produced for one reason may continue for other reasons due to amplification. The same may hold true for your maps of discussions. If you diagramed an

unsatisfactory session, it is probably fruitless to look for the first minor deviation that produced the present unhappiness. Loops operating here and now are what the organizational analyst needs to study. After studying the pattern, the analyst may conclude that what needs to be done is that the direction of some variable should be reversed. That's the topic we turn to.

REVERSING A VARIABLE

Deviation-amplifying loops often cause trouble because their variables are moving in the "wrong" direction. If in portion *B* of Fig. 3.4 boredom goes up, I'm in trouble because it can only get worse, something that also happens in portion *A* when I block and can't think of any ideas. In both those cases, if the direction in which the variables are moving could be reversed, I'd be in much better shape (Ashton 1976). This is where activities such as reflection and contemplation come in and make great sense (LeShan 1976; Low 1976; TenHouten and Kaplan 1973; Pearce 1973, 1975; Siu 1974). These activities frequently result in reversing of variables and a reversal of one's fate.

A set of connected variables thought to be associated with depression (Wender 1968) illustrate this point eloquently in Fig. 3.8; these loops and connections are self-explanatory and almost painful to work through. Given the bare structure shown in Fig. 3.8 it is easy to see why depression can persist and get worse.

But the causal network of depression portrayed in Fig. 3.8 is vulnerable, and one point of vulnerability is "aid from others." As a person's self-evaluation drops, depression increases, coping ability decreases, one has to depend on others for aid, which lowers even further one's self-evaluation, and so on. This vicious circle is fueled by the interpretation that getting aid from others is a sign of weakness and dependence. Upon reflection, however, the meaning of aid can shift from one of weakness to the more positive interpretation that it's okay to ask for help and it's great to have others who care enough to come to

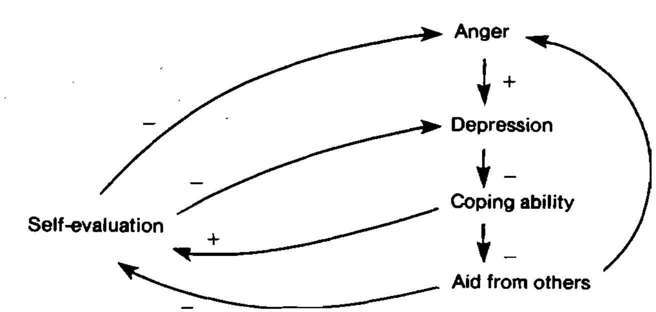


Figure 3.8

one's aid (Lyon 1977). If, after reflection, that interpretation becomes salient, then the negative sign between aid and self-evaluation in Fig. 3.8 becomes a positive sign, which turns amplification into stability.

Reversal need not take the form of a reversal of sign. It can take the form of a reversing of direction, the dynamic we mentioned in the first paragraph of this section. If coping ability can be increased by training and/or a success experience, then the downward spiral of depression can be halted and self-evaluation can increase. Because of the consensual element in organizing, reversal of direction may require social action and redefinition. And because of the density of linkage, reversing a direction may be difficult because inertia and prior understandings work against the redirection.

NONLOOPS

It is fairly common for people to draw a map of their experience and find no loops. The meaning of this outcome is not completely clear, and the reader is urged to add to our modest thoughts on this topic.

An absence of loops seems to mean most economically that an insufficient number or the wrong variables were included in the experience map. If everything is related, then a failure to find relations simply means one is looking at the wrong things. If "my fear of embarrassment" reduces "my willingness to volunteer comments," but nothing on the map affects my fear, this simply means the list of variables is incomplete. We assume that something affects my fear.

This is not, however, the sole possibility concerning loops. Events may not be interrelated richly and unidirectional causality may be a correct rather than an incorrect perception. It may be correct because that's the way things are or because that's the way they appear to fallible perceivers who invariably influence the data they are gathering (see Salancik and Pfeffer 1977, pp. 449-52, on priming).

The perception of nonloops may operate in the service of hubris, pride, or other egocentric pastimes that enhance the stature of the actor and inflate the apparent magnitude of personal power. This has the interesting twist that people who are not on a "power trip" and people who have high self-esteem should report more causal circuits and report the world to be more interdependent than do those who are high on the need for power or wavering in their self-esteem.

If one wishes to look at the same problem in situational terms, it could be argued that people who move around a lot are less likely to see the world as full of causal circuits. The reason for this is that people who are mobile may not stay in a situation long enough to discover the consequences of their actions. The consequences do not come back and affect transients, because transients

have moved to a new setting. Transients are left with the impression that what they did had an effect. What they fail to see is that if they had stayed, the effect in turn would have influenced them.

The presence of nonloops may mask the fact that variables are related by step-functions (and the threshold for triggering the next variable is seldom exceeded) or by nonmonotonic relationships (the same variable causes both a decrease and an increase in a related variable, and the effects are thought to cancel and therefore are not related). Time lags in responsiveness may mask loops.

Loops may not occur because the variable that originated the relationship (e.g., acne) may not be present in the same form when the effect finally circles back to the origin. If variables are consensual labels and if variables change, then it shouldn't be surprising that loops can't occur if the origins of the causal sequence are no longer present.

An absence of loops may simply be testimonial to human frailties such as people being unable to describe their inner cognitive processes (Nisbett and Wilson 1977; Smith and Miller 1978), people being severely limited in the capacity to process information or people being immersed in routines that *do* simply run off without feedback to their origins.

DISCREDITING A CAUSE MAP

The possibilities for changing a cause map are quite straightforward, so we will simply list them. Assume that in a cause map a simple linear relationship is stored: *the greater the number of criticisms, the higher the quality of performance.* Changing that linear sequence could take any one of the following forms:

1. The causal direction could be reversed: the quality of performance causes the number of criticisms received.
2. The sign of the linkage could be changed: as criticisms increase the quality of performance decreases.
3. Two variables could be decoupled: criticism has no effect on quality.
4. The direction of the relationship could be removed: criticisms affect quality, but there is no regularity to the direction in which this relationship moves.
5. Dissolve the variables: there is no such thing as criticism or quality of performance.
6. The coupling could be tightened: criticisms always, immediately, and in direct proportion affect the quality of performance, an assertion that is stronger than the one originally formed. This introduces change in the speed with which the cycle is completed and in the amount of influence exerted on other variables that are related to these two.

7 The coupling can be loosened: criticisms have a very modest regular effect on the quality of performance.

8 The effects of the originating variable are canceled by another pathway: even though criticisms affect quality directly, they also affect the patience of one's peers, and as this patience wears thin the quality of performance goes down. Therefore, criticisms may improve quality, but they have even more effect on peers and peer pressure decreases quality, which undercuts any direct effect from criticisms.

9 The variables are related in a curvilinear manner: criticisms affect quality of performance directly up to a point, but beyond that criticisms have just the opposite effect—they degrade quality.

The reader can add other changes to this list, but the point should be clear that anything that is done to form a cause map can be undone to change it. Obviously some of the nine changes we've mentioned are more severe forms of change, are more difficult to accomplish, and are more likely to be acceptable in certain kinds of organizations. Those potential differences may provide a wedge to categorize people within organizations in terms of the kinds of cognitive changes they are willing and able to make in their cause maps.

Conclusion

Most managers get into trouble because they forget to think in circles. I mean this literally. Managerial problems persist because managers continue to believe that there are such things as unilateral causation, independent and dependent variables, origins, and terminations. Examples are everywhere: leadership style affects productivity, parents socialize children, stimuli affect responses, ends affect means, desires affect actions. Those assertions are wrong because each of them demonstrably also operates in the opposite direction: productivity affects leadership style (Lowin and Craig 1968), children socialize parents (Osofsky 1971), responses affect stimuli (Gombrich 1960), means affect ends (Hirschman and Lindblom 1962), actions affect desires (Bem 1967). In every one of these examples causation is circular, not linear. And the same thing holds true for most organizational events.

Suppose you thumb through books to find the answer to some question you have. Your first temptation might be to say that the question caused focused searching. But that's not the way it works. Searching is circular. You start with a question, you stumble onto some apparently relevant item, which in turn affects subsequent searching, which in turn redirects your question, etc.

If you become obsessed with interdependence and causal loops, then lots of issues take on a new look.

If you take loops seriously, for example, then you realize that some very sacred ideas such as self-power and self-determination are fictions. If most of our behavior is embedded in causal circuits, then whatever we do will come back to haunt and control us. The revenge of the environment is perhaps the most obvious example. Those things we unilaterally did to the environment now are coming back to undo us.

John Steinbeck, writing in the late 1930s, described a set of deviation-amplifying causal loops that anticipated ecological concerns by several years:

> At one time an important game bird in Norway, the willow grouse, was so clearly threatened with extinction that it was thought wise to establish protective regulations and to place a bounty on its chief enemy, a hawk which was known to feed heavily on it. Quantities of the hawks were exterminated, but despite such drastic measures the grouse disappeared actually more rapidly than before. The naively applied customary remedies had obviously failed. But instead of becoming discouraged and quietistically letting this bird go the way of the great auk and the passenger pigeon, the authorities enlarged the scope of their investigations until the anomaly was explained. An ecological analysis into the *relational* [italics added] aspects of the situation disclosed that a parasitic disease, coccidiosis, was epizootic among the grouse. In its incipient stages, this disease so reduced the flying speed of the grouse that the mildly *ill* individuals became easy prey for the hawks. In living largely off the slightly ill birds, the hawks prevented them from developing the disease in its full intensity and so spreading it more widely and quickly to otherwise healthy fowl. Thus the presumed enemies of the grouse, by controlling the epizootic aspects of the disease, proved to be friends in disguise (1941, pp. 144-45).

Through the mechanism of a deviation-amplifying circuit, minor deviations (a few less hawks) created the conditions under which the survival of the grouse became precarious. Hubris was revenged by causal loops.

As a different variation of the interdependence theme, G. W. Bateson (1971) has argued that one of the major insane premises in Western thought is the belief that we have self-control. He illustrates this by discussing alcoholics. Alcoholism is inevitable as long as the drinker maintains the illusion, "I am captain of my soul and I can stay sober." That claim is an illusion, because drinking is circular. The only way you can prove that you are the captain of your soul is to test the proposition by exposing yourself to the challenge of a drinking situation. For alcoholics, these tests typically fail. Actually, when the test fails the alcoholic is demonstrating that the idea of self-control is fallacious, that he doesn't have control, that the problem is bigger than he is. He is only part of a larger circuit (Finlay 1978). But as long as he continues to believe or has foisted on him the belief that he has self-power, he'll blame his failures on external circumstances, preserve the illusion that he can control his fate, and continue to go on binges until he hits bottom.

What gives plausibility to this analysis is the fact that the most successful cure for alcoholism, the program of Alcoholics Anonymous, involves a credo that directly reverses the premises that may produce alcoholism and other problems. A major tenet of the AA credo is that "there is a power greater than you; once an alcoholic, always an alcoholic." Notice that such a premise falsifies the idea that one is captain of his soul. It says instead that the alcoholic and his drinking are part of a larger system that neither rewards nor punishes, that his relation to this greater power is both complementary and submissive, and all of these lessons are eloquently summarized in AA's insistence that members be anonymous (Bill 1957, pp. 286-94). The practice of anonymity merely restates the idea that all of us are in part-whole relationships.

Still another implication of thinking in circles is that it explains why self-fulfilling prophecies are inevitable. They are inevitable because whatever a person does comes back and does him in. William James asked the question, "Is life worth living?" He replied that you can make the answer come out either way. "Faith beforehand in an uncertified result is the only thing that makes the result come true" (1956, p. 59). If you despair and refuse to believe that life is worth living, then indeed it won't be, and your own self-destruction will prove it. However, believe that it is worth living and that belief will help to create the fact. That's more than homely advice. Like the AA credo, it confirms the reality of loops and disavows the reality of linear causation.

Most "things" in organizations are actually relationships, variables tied together in systematic fashion. Events, therefore, depend on the strength of these ties, the direction of influence, the time it takes for information in the form of differences to move around circuits. The word *organization* is a noun, and it is also a myth. If you look for an organization you won't find it. What you will find is that there are events, linked together, that transpire within concrete walls and these sequences, their pathways, and their timing are the forms we erroneously make into substances when we talk about an organization. Just as the skin is a misleading boundary for marking off where a person ends and the environment starts, so are the walls of an organization. Events inside organizations and organisms are locked into causal circuits that extend beyond these artificial boundaries.

4

interlocked behaviors and organizing

Organizing is accomplished by processes. But before we can talk about these processes, we need to describe their elements.

Processes contain individual behaviors that are interlocked among two or more people. The behaviors of one person are contingent on the behaviors of another person(s), and these contingencies are called *interacts*. The unit of analysis in organizing is contingent response patterns, patterns in which an action by actor *A* evokes a specific response in actor *B* (so far this is an interact), which is then responded to by actor *A* (this complete sequence is a *double interact*).

Hollander and Willis (1967) argue that double interacts are the basic unit for describing interpersonal influence. Since organizing involves control, influence, and authority, a description of organizing benefits from using the double interact as the unit of analysis. To see why this is so, suppose that a supervisor wants to get a worker to stop doing task *A* and start doing task *B*. The worker's action is the doing of task *A*; the supervisor tries to influence the worker to do task *B*. Obviously, we must know how the worker responds to this directive before we can make any statement about the complete influence attempt. But to determine the worker's response, we need a specific description of the original activity as a basis for comparison. The worker's typical response pattern will probably be altered in some way by the supervisor's directive, and before we can understand the meaning of this alteration, we need to know the action that was already underway. This is the point in Atkinson and Cartwright's (1964) important argument that many existing theories of motivation are inadequate because they fail to take account of ongoing activity and the forces sustaining it when a substitute activity is proposed.

The purpose of this chapter is to describe a variety of ways to conceptualize interlocked behaviors, including F. H. Allport's (1962) concept of collective structure, Wallace's (1961) concept of mutual equivalence structure, and Kelley's