GENERALIZING

Contents

Chapter 1

DOING WHAT COMES NATURALLY

Humans anticipate, get ready, prepare. I'll give a few examples of ways we do that. The examples will give you a fair picture of what this book is about. The "Chief Points" at the end of this chapter will enlarge the picture. The first examples here may not sound much like social science, but be patient; I'll get there.

Getting Ready: Some Examples

1. **Walking downstairs.** When you walk downstairs, your foot doesn't grope about randomly. It swings forward the right amount to fit nicely onto the next step. When you lower your body to that step, you don't just relax all your muscles and let yourself fall. You lower yourself rather quickly about the right amount; then, as your toe signals contact, your muscles slow the fall and begin to take some

of the weight of your body. Then the heel of your foot touches, and you shift your weight to that leg. The other leg relinquishes your weight and begins to swing forward for the next step.

The leg swings forward in accurate anticipation of the place the toe will encounter the step. Some muscles contract and others lengthen in accurate prediction of the momentum with which the body will come down upon the heel. And so on. We use memories of many descents of stairs in the past, and we diagnose the present situation in fractions of a second with sensory feedback from toe and heel and the kinesthetics of momentum. Most of that accurate prediction and action occurs without conscious thought. We become suddenly aware that we are acting from prediction, however, when we go downstairs in the dark and encounter one more step than we thought was there.

2. **Getting to the grocery store.** When we go to a grocery store for the first time, we put into memory a map of its location. We predict that it will be there tomorrow--barring signs to the contrary (such as "Going Out of Business") or acts of God. Reading our mental map, we predict that turning left as we leave the house will get us to the grocery, turning right will not. It works every time.

3. **Getting enough light.** Some people study the behavior of electricity. Some people manufacture copper

wires, and other people manufacture cotton string. We hear about (and remember) some of what those other people have learned and done. If we are building a house, we can use that knowledge to anticipate having light after sundown. We wire the house with copper wires, not with cotton string, even though string is cheaper. We predict, anticipate, that the sun will go down every day, that we will often want light after sunset, that copper wires will carry electricity from the generator to the lights and back again, that cotton string will not, and that the electricity will make the lights glow. It works almost every time.

Not all people, of course, satisfy their desire for light after dark with electric lights. Some use fires, some candles, some oil lamps, some kerosene lamps. Some go to bed at sundown. To get what we want, we make use of what is handy in the environment while at the same time not making it hard for ourselves to get other things we want. We don't use electric lights if we don't have enough money left for them after buying food. Those choices, too, require predicting, anticipating, getting ready, preparing.

4. **Risky decisions.** If you want a group to come to a risky decision, you will almost always get greater risk-taking if you both (1) choose individuals to be members of the group who are willing to take a risk and (2) let them talk about what might be the best decision before they make it. McGrath (1984, pp. 80-83) has given a brief but

elegant summary of the research on the matter. In the United States, the "risky shift" is a reliable phenomenon even when the group is composed without first ascertaining whether the members are willing to take a risk.

The kinds of risk taken in a "risky decision" can be various: the materials needed to carry out a plan might not be easily available or it might not be clear whether the available materials are the right kind, it might be hard to judge whether the skills of the persons available are adequate, the plan might be hard to defend to the boss, it might be hard to estimate undesirable side effects, and so on.

The theory goes like this. American culture imbues most of its members with a high value for taking risks in many kinds of activities, though of course not in all. If the activity about which you want a group decision is one for which the culture urges taking a risk, most members of almost every American group will feel the urge.

Nevertheless, taking a risk is indeed risky, and at first some members will be cautious; for them, other criteria about the decision will outweigh the attractiveness of the cultural norm for risk-taking. But those members will discover during the discussion that they will have the support of most other members of the group if they adopt a position of risk closer to the cultural norm, and they will hear information and argument that they can use to bolster

their shifts toward the risky decision. They will hear more information and argument in favor of risk than against it. The apparent readiness of others to take a risk and their reasoning about it will make the risk seem less risky. The willingness of members to join in carrying out the decision increases as they get clues to the commitment of others during the discussion.

Even members initially very eager to take a risk may find more support for their position than they had anticipated and will be able to maintain their position or even move it still farther toward the risky decision. The "risky shift" of the members is not caused by the bare fact of the group's discussion. It comes about as the discussion helps members to find a decision that is a best match to the degree of risk they want to take and also to other features of the activity that they want to optimize. You can predict, in sum, a riskier decision than you would get from a secret vote without discussion if you follow the two rules: (1) Choose members who are willing to take a risk and (2) let them talk about their decision before they make it. Your prediction works, by the way, only because the members of the group also make predictions.

5. **Reducing turnover.** Maybe you run a company with a hundred (or a thousand) employees, and you find it expensive or difficult to predict operations because of the rate of turnover among your employees. Cotton and Tuttle

(1986), in their meta-analysis of many studies, have given us a long list of variables that showed some connection with rate of turnover. Some variables, such as education and the employee's perception of the availability of other employment, showed positive relations to turnover. Employees with more education, for example, were more likely to leave after shorter tenure. Other variables, such as the presence of a union, unemployment rate in the region, satisfactions of various sorts, age, and the degree to which an employee's expectations had been met, showed negative relations. Cotton and Tuttle listed many more relevant variables.

Maybe you would like to reduce the rate of turnover in your company. You might undertake to alter jobs and procedures to increase the satisfactions of the workers and the degree to which their expectations are met. You might invite a union to establish a local chapter. When the opportunity arises, you might hire older workers with less education. You might hope for an economic depression that would increase unemployment and decrease your workers' perceptions of other available work.

What the Examples Illustrate

Whether or not you are a social scientist, you may say, "We know all that. Why say it again?" Well, some social scientists know that, and some don't. Some will wonder what walking downstairs has to do with generalizing. Some believe that generalizing is a matter of sampling and tests of statistical inference. They believe that generalizing is a matter of reasoning from the particular to the general--from some observed cases to a larger number of not-yet-observed cases. Statisticians, indeed, limit the word to that meaning. But that is not the heart of the matter. The heart of it is the simple idea of getting ready for a future event in such a way as to minimize the average discrepancy between what we want to see and what we do see.

Continuity from Unconscious to Conscious

We anticipate or generalize in our unconscious functioning as well as in our conscious functioning. In getting ready for what might happen next, there is no discontinuity between the unconscious and conscious.

Our neural nets set up routines for us--sequences and programs of actions that we can use over and over again. (By "neural net," I mean all the innervation of the body, both central and peripheral--brain, eyes, touch sensors in your finger-tips, and all.) Some of the routines are managed very low in the neural net--for example, the sequences of muscular actions that swing a leg forward. The

very lowest sequences are never conscious. We can be conscious of swinging a leg forward, but not of the complex sequences of tensions ~~in the~~ many muscles that must act, all of them working ~~in~~ opposing pairs so that the tensions position the leg ~~precisely~~ in the right place.

Often we are not conscious of swinging the legs, either. When our purpose is to get someplace by walking, the sequence of muscular action in swinging a leg is governed by the higher-order sequence of alternating the swinging of the two legs, and the direction our swinging legs take us is governed by the still higher-order image of the to get where we are going. We pay attention to the signs that we are approaching our destination, not to this swing and that swing of a leg. And arriving at a particular destination, in turn, can become part of a still higher-order program of going to the grocery store, finding the potato bin, putting some in a sack, taking them to the check-out counter, paying for them, and carrying them home. Our neural nets call up lower-order sequences to serve higher-order programs that, in their turn, answer our purposes. Still higher in the neural net, we set up conceptions of the physical world and general strategies for action that enable us to decide whether potatoes are good things to eat when we are hungry and how we might go about finding some. I'll say more in a later chapter about sequences and programs and about what I mean by "low" and

"high" in the neural net.

Finally, just as we can set up conceptions and strategies about potatoes, grocery stores, and money as useful parts of our environments, so we can also form conceptions and strategies about other people. When we note carefully the successes and failures of our conceptions and strategies about dealing with other people and compare our experience with that of others, we become social scientists.

From the tentative toe to the reasoning researcher, we must anticipate our interactions with the environment. We do so in hierarchies from the small and soon to the large and later, from the always unconscious to the partly or sometimes conscious and thence perhaps to the mostly conscious. But all anticipations have the same character--that of bringing us to act as if we will encounter an environment with certain features and not others. There is no discontinuity.

Continuity from Ordinary Life to Research

We generalize in our ordinary lives as well as when we act as researchers. There is no discontinuity between the two realms.

For me, no clear boundaries exist among pure research, applied research, and ordinary vulgar information-getting. (I use the word "vulgar" in the sense

expressed by the Random House Dictionary [Jess Stein, 1971] as "pertaining to the ordinary people" or "popular, common.") I am tempted to say that pure or formal research is more systematic than the vulgar, but that is frequently not true. The TV repairer is very systematic in finding the trouble in your set. Some might say that the pure researcher wants to generalize, whereas the vulgar researcher is satisfied to learn something new about one case. The TV repairer, some might say, wants to find out only what is wrong with <u>your</u> set, while the formal researcher wants to find out how <u>all</u> TV sets work. But that is not true, either. Surely the TV repairer often thinks, "I had a set two weeks ago with these symptoms. What did I learn from that one?"

Some people might say that pure research is more likely to end with thinking or writing, and applied research is more likely to end with doing things in the physical world: building aircraft controls with new shapes of knobs and levers, building a teaching machine, writing a personality inventory for use by personnel managers, and so on. But basic research can end in building a cyclotron to use in further basic research, and vulgar research can end in thinking about what life is about and writing one's conclusions into one's memoirs.

Furthermore, I do not think that "reality" is a useful way to distinguish one kind of research from

another. All settings in which research is done are real, because the people in them are real. An experiment in a psychological laboratory is certainly not less real than some meetings of university faculty I have attended. Job interviews, kaffee klatsches, church services, football games, training simulations for corporation executives, and laboratory experiments all have their own realities. It is true that what you do as a subject in a psychological experiment may have little to do with what you do in your kitchen. The same comparison can be made between playing "Monopoly" and running a bank. But a psychological experiment, baking a cake, playing Monopoly, and running a bank are all real activities in real human lives. A good argument for the way one setting shades into another is McGrath's (1984, p. 49) diagrammatic display of varieties of human groups. He did not distinguish them by degree of reality. He said, more or less, that groups in various settings and of various origins differ in their constraints and opportunities, and in that respect one kind of group shades gradually into another.

Scientific work and ordinary work are intimately entwined. All humans, scientists or not, generalize. If that were not so, no one but scientists would be able to use the fruits of scientific work. Supposing the rest of us could somehow stay alive without generalizing, science would become only a game--a fascinating game, but nevertheless a

game with as little use in ordinary life as Monopoly has in running a bank. But all of us do generalize.

Even though it need not be, science can be played as a game. Many scientists justify science as a game simply because of the glory of it. "Man does not live by bread alone," and all that. I understand. The same kind of thing can be said of chess and hockey, and I understand the thrill of the well played game. I am writing in this book, however, about generalizing not just to more scientific experiments, but to life beyond formal experimentation also. I will write as if generalizing is a universal human activity, not a disembodied algorithm in a textbook. I will write as if the basic things I say about generalizing should describe what we do in ordinary life as well as what we do as scientists. I will write as if I have a right to demand that social science, like physics, be a guide to action in ordinary life as well as in the laboratory.

Particular to General and Vice Versa

Sometimes in research, formal or vulgar, we observe a few instances and extrapolate from them. We get ready for a lot of later instances by supposing they will be similar to the lesser number of instances we have already experienced, as in observing a sample from a population. We go, that is, from the particular to the general. At other times, we observe a lot of instances and generalize from

them to the very next particular instance about to happen. So it is when we put out our foot as we descend the staircase, when we study trends in the stock market and then purchase particular stock, and when we study the scientific literature on managing organizations and then start up a series of Quality Circles in our own company. We go, that is, from the general to the particular.

General to Particular. When we act, we always act as if some particular condition exists. (Actually, we almost always act as if several, maybe a multitude of particular conditions exist.) When we breath, we act as if we will discover that we are surrounded by air containing about 21 percent oxygen. When we walk, we act as if we will discover the foot meeting the ground or the step at about a certain place. When we set out for the grocery store, we act as if certain turns and traverses will get us there. When we want to encourage a risky decision, we act as if the participants will expect others to admire them for taking risks. When we want to increase mutual trust in a new group, we act as if most members of the group prefer trust to distrust and as if some members will be more ready than others to make the first offers of trust. When we want to reduce the expenses of operating a company, we act as if a low rate of turnover will cost less than a high rate and as if hiring older workers (for example) will reduce the rate of turnover.

Many years ago, George Kelly pointed out this matter

of acting as if in social science. He called it the invitational mood. A hypothesis, he said (1964, p. 138) is "a human device for anticipating the events that are about to happen to us." Its chief usefulness, Kelly said, is not to "prove" that an idea is "true," but to be ready for new possibilities and contingencies. We can expand the uses we make of the environment, Kelly said, if we act as if certain features of the environment can yield certain perceptions to us--especially perceptions we do not ordinarily expect--and then test whether indeed they do. If we act as if workers can do their jobs well with less supervision, for example, we find out whether they can. From acting as if we will perceive certain results from our actions and then noting whether we do so, we build and revise our programs of action, our principles of effectiveness and morality, and our understanding of the world about us.

In social science, a hypothesis is a guide to being systematic about the future experience of which we wish to take note. In daily life, a hypothesis does the same thing, though we may put it into words only vaguely or even leave it entirely unconscious, and though we may not always be very thorough in noting the relevant later experience. Generalizing, whether or not we are social scientists, becomes useful at the point where we act as if we will encounter a certain condition in the environment--as if we will receive a certain perception of what is going on out

who? what? generalizes?

there.

Some generalizing anticipates very few possible conditions, maybe only one, and the neural net sets in motion a limited, comparatively inflexible repeated action to maintain a desired perception of an interaction with the environment. So it is with the fish that pulls water through its gills. It anticipates only immersion in water. If a wave tosses the fish onto the beach, it can only go on trying to pull water through its gills. Neither its bodily organs nor its neural net gives it a choice of another way to get oxygen.

Other generalizing can specify actions appropriate to different conditions. When we reach the bottom step, we switch out the routine for descending stairs and switch in the routine for walking on the level. Under condition A, we tell ourselves, "Here routine A will work." Under condition B, we tell ourselves, "Here routine B will work." When we pursue our purposes by altering the environment beyond our bodies in more manipulative ways than simply moving from one place to another, the procedure is similar. When we want to get light, we use copper wire to get electricity to the light-bulbs in our houses. When we want to catch fish, we use fishing line. So clever are we at altering the environment to suit our purposes, indeed, that we have even figured out how to venture into airless space by enclosing our bodies in suits and ships and carrying along with us the

air that we need.

In those examples, the predictions are highly reliable. Most of us rarely find ourselves in an environment without air; we breath most of the time without any consciousness of doing so. When we dive into water, most of us do not make a conscious decision to suspend breathing; we usually make the switch at a low level of neural organization. Even babies do that. The predictions in walking are as easy. Again, we usually predict the places our feet will touch the ground and the dynamics of the ways we will shift our weight without conscious attention.

The examples of the electricity and the fishing line are a little more complicated, but not much more. The prediction that copper wires will enable us to light our houses works with great regularity. So does the prediction that fishing line will work well in throwing out the hook and pulling in the fish. Beyond furnishing two more illustrations of highly reliable predictions, however, the examples are useful to illustrate the kind of thing we do when predictions go wrong.

When a prediction fails, we don't always go on doing the same thing in the hope that eventually the right thing will happen, as the rat in the food box does when the first press of the lever fails to bring the food pellet. Sometimes we do that if, like the rat, we are somehow caged

and there is simply nothing else to try. More often, when an act fails to bring us what we want, we try making use of some other feature of the environment. If the lights go out, we don't stand there flipping the switch very long. We find a candle and light it. We put down our book and go to bed. We call up the power company to find out whether the trouble is in the transmission lines. And so on. If the fishing line breaks, we don't go on making casting motions with the rod. We stop and tie on a new hook. Maybe we buy a different brand of line when we get back to town. Maybe we give up fishing as a recreation and take up sky-diving.

The point is that the prediction itself is not the end of the story. Neither is the confirmation nor the disconfirmation of the prediction. The story doesn't have an end. We go on until we die acting so as to bring ourselves what we care about--enough light to see what we want to see, the pleasure of a recreation without too much frustration in it, and a thousand other things. We don't do just one "thing" in "response" to a "stimulus." We acquire a repertoire of a great many acts that we can use, as the resources in the environment permit, to get what we care about--more exactly, to maintain the receipt of evidence through our perceptions that we are getting what we want.

Suppose you are driving along a freeway. You possess a repertoire of acts you can draw upon to further your purpose of getting to your destination. You can watch

ahead, behind, and to the side. You can turn the steering wheel this way and that. You can press down on the accelerator or the brake or let up on it. You can look at your watch. Those actions can serve the larger acts (and purposes) of starting, stopping, speeding up, slowing, turning into another lane, and so on. And those acts, in turn, can serve the larger act (and purpose) of getting to your destination, which can serve the still larger purpose of doing whatever it is you want to do once you get there.

As you drive along, you see a car approaching on an entry lane at a rate that could bring it alongside your own car at the merging point. You look to the side and behind. The left lane is open. You move into that lane, maintaining your speed, and the entering car as room to draw into the right lane where you would have been. A half hour later, a car again approaches in the entry lane. This time, there is a car just ahead of you and a car pulling up beside you in the left lane. You slow down to allow the entering car to enter in front of you. You care about getting to your destination in good time, but you care more about maintaining a safe position in the traffic. Slowing to let the car in ahead of you delays you by only a tiny bit, but crowding the car would reduce your safety by a great deal.

Some person might, however, have a firm view of herself as one not ready to let other people push her around, as acting always as <u>she</u> chooses to act, by God, not

as others might want her to act. She might very frequently act to maintain that view of herself. When the car approaches in the entry lane, she continues at the same speed in the right lane and lets the other car speed up or slow down as necessary. In fact, if the car speeds up to get ahead of her, she might take that as a threat to her freedom of action, and she might race ahead to cut the car off. Her desire to maintain her view of herself, in this case, displaces schedule or safety.

Your internal standard for not being pushed around might be much less demanding than that of the person I have just described, but after making room for four or five entering cars in a row, your average tally for not getting pushed around might get too low, and you might then, at the next approach of an entering car, act with more belligerence.

The point is that the entering car is not a "stimulus" that brings a particular act from you. It does not set off any particular response. What you do depends on the opportunities for action the environment offers you. If you are already travelling near the top speed of your car, it will do you no good to wish you could pull ahead of the entering car. What you do also depends on the hierarchy of internal standards you are maintaining. If you believe you are getting behind schedule, you may speed up to pass entering cars more often than you slow down, at least when

you can do so while still maintaining a safe position in the traffic. In the case of some higher-order internal standards, what you do depends on some history, as in the case of getting pushed around too often.

What you might do is usually affected by many more internal standards than those I have put into my example so far. You may be getting hungry. You may come upon a wonderful spot to take a picture. You may see a state police car in your mirror.

What you do as you drive along is not a sequence of discrete sub-sequences of the stimulus-response sort. When you move into the other lane, you do not then do nothing, go comatose, inert, until another stimulus shows up. Your actions and non-actions are continuous parts of feedback loops through which you maintain perceptions that you are getting what you care about. If you are going along smoothly according to your schedule and doing nothing other than keeping your car in its lane, you are not "doing nothing." You are maintaining your rate of change at zero. And zero is just as good a number to maintain as any other.

The vital point to remember about generalizing from the general to the particular, about "using" a generalization, is that a generalization cannot prescribe a particular act--not unless the environmental opportunities are severely restricted to fit exactly the prescription, as in the case of the fish and its gills. There are times when

the environment and individual need permit only one choice. If the hungry rat in a cage can get food only by pressing a lever, it will press it. There are times when well understood social agreements make a particular choice of action overwhelmingly likely. If your skillful secretary has become accustomed to your preferences and has adopted them as his or her own standard, you can ask for a letter to be typed and one copy made by tomorrow morning or even within the hour and have very high confidence that you will get them, properly done, by then. Such highly restricted environments, however, physical or social, are unusual, and the necessary specification of severe environmental restriction makes the point. Almost always, a generalization is a guide only to the first tentative direction in which to move. Particular action must then be adapted to the environmental conditions one encounters, and changes must be made to match one's purposes.

Particular to General. Going from the particular to the general is something we do at the higher levels of the neural net. There we form plans and programs, principles and strategies, average expectations, and conceptions of systems. Though forming conceptions of the general or the average is not always conscious, it is a large part of what we do with our consciousness.

Generalizing "to a population," as the statisticians say, doesn't mean getting ready for something that is going

to happen time after time, like finding the next step when walking downstairs. It does not mean expecting that something will happen or be true "in general" if by that you mean every time. The statisticians don't mean that you can get ready for the same experience, over and over, with every member of the population. Rather, they mean that some particular statistic (such as a mean) will characterize the population even though the members of the population will differ from one another. I'll say more about that feature of statistical inference in another chapter.

The point is that you must, you can do no other than, get ready for some particular kind of event, not something "in general." When you act, you prepare for some narrowed range of a kind of event and then, through diagnosis, get ready for the still narrower experience with which your body and mind can deal immediately. That is not to say that you always expect the right event and successfully deal with it. Sometimes you expect another step at the bottom of the flight when none is there, and you stumble or even fall. Even then, however, you shift in a trice and deal with the expectations of what is about to happen during the stumbling or falling.

The example illustrates how we deal with expected events "on the average." Having stumbled or fallen a couple of times, we can adopt a new policy for dealing with stairs. Hereafter, when we encounter a flight of stairs in

the dark, we can go more slowly and tentatively than we used to. We can enlarge the realm of diagnosis, keeping our weight fully on one foot until the other toe has told us there is or is not another step below. We do not now trot confidently down the stairs as if the flight will of course be the average one. Rather, the experiences from which we take an average enable us to start with a wider range of expectation and to give ourselves time to narrow that range at the point of action. We do use averages to get ready for experience, but we use them at a higher level than at the level of carrying action beyond our bodies. We use them at the level of thinking or mental imagery to guide the lower levels at which we get ready through active diagnosis. Going from particular experiences to the general or the average is what we do at the higher levels of the neural net to tell the lower levels the kind of perceptual input they should seek.

When you have the furnace checked in June or July (if you live in the northern hemisphere), you are using generalizations about furnaces, motors, blowers, electrical switches, and so on to anticipate possible particular events next winter. There is no way to check over a furnace "in general." You must examine this particular bearing, that fan, this filter. Action is always particular. You can and do, however, use your generalizations about such devices to lay out a "general" <u>plan</u> for a sequence of actions. You can

set forth on the general plan by noting the date, calling the furnace-servicing company, and so on.

You cannot act on an average event; it is never there for you to act upon. Even events reasonably close to the average happen to you only very rarely. Indeed, in the case of events having many features you care about, such as the behavior of other humans, an overall average event is so unlikely as to be practically impossible. How likely is it that you will meet a person average in all of age, height, weight, income, number of days absent from work per year, number of books read per year, and taste in music? How, indeed, can you find a person who is average in nationality, family lineage, or sex?

Sometimes, it is true, a conscious averaging is indeed the particular thing that we do want to get ready for. We do so when we look for a number on a piece of paper. Perhaps the insurance company is the quintessential example. But here, too, the person deals with a particular perception of a particular event--the number on a piece of paper. The manager in the insurance company does not deal "generally" with all the claims that go to make up the average. The clerks, agents, and adjusters do that; they deal, as we say, with the "general run" of claims. But to do that, they work one at a time with the particular events leading to claims, each event differing from the last. The manager works with events one at a time, too--this month's

average claim, next month's average claim, and so on.

In sum, we can go from the from the particular to the general or from the general to the particular. But we can go from the particular to the general only in thinking, in imagination, not in action. It is easy to get mixed up about what we can mean by the "general" and "generalizing."

Diagnosing

For uncertain events (and all events are to some degree uncertain) you can get ready only for a likely range and be ready to adjust your action quickly when the particular event happens. You must, so to speak, be light on your feet. You must diagnose--test what is happening to you--repeatedly, sometimes continuously, to keep on getting what you want from the environment. But the predictability of events that might happen hours or days in the future, to say nothing of years, is often very poor. As predicted events come nearer, you reassess their likelihood; you get ready for a new range of likely events. You keep diagnosing and testing. That is the reason, for example, that many people who depend on the stock market for their income (or their diversion) read the market reports every day--and fuss around in their heads, too, with various sorts of averages.

Reading the writings of social scientists, one often gets the impression that the author thinks we can be ready for immediate action once we have a good enough theory.

That is never true. No theory can ever be "good" enough for that. The best a theory can do is get us ready for more efficient diagnosis. A good theory can tell us to find out whether we have copper wire in our hands or cotton string. I will say more about the uses of theory in later chapters.

Predictability

Some human actions are much more predictable than others. Once a person starts walking, we can predict very well the subsequent motions of the legs. Within a particular culture, we can predict very well even some of the actions managed from higher levels in the neural net. With very rare exceptions, we can confidently predict that motorists in the United States will stay on the right-hand side of the road except when passing, mile after mile, hour after hour, trip after trip, year after year. Once we see a person sitting at table and starting to eat, we can predict very well actions the person will and will not take to get food to the mouth. In most parts of the United States, we can predict with a high degree of confidence that the drug store will open at a certain time every working day, rain or shine, whether the manager or someone else actually turns the key. Those and a thousand other predictions are very highly reliable. Predictions of some other kinds of behavior, however, do much less well, and still others do no better than chance.

It is easiest to find highly predictable phenomena by looking either at (a) an individual's control of bodily purposes or (b) statistics of masses of people. We can predict that every person not suffering some sort of internal damage or disorder will maintain an internal temperature between very precise limits. We can predict very well the maintenance of the required temperature range. We cannot usually, however, predict very well the particular actions the person will take to maintain that temperature--whether the person will take in more fuel by eating and if so what or when, whether or when the person will put on a coat or a blanket or snuggle against another warm body or build a shelter or make a fire, whether the person will exercise to increase the flow of warm blood to the bodily extremities, or whether the person will choose among many other possible actions. We cannot predict particular actions very well, but we can predict with certainty that <u>every</u> person will act to maintain a particular bodily temperature. We can predict confidently that under the threat of cold weather, <u>everyone</u> will take <u>some</u> sort of easily visible action to aid the body's own procedures for maintaining the desired internal temperature.

Mass phenomena, too, are often very reliable. The increases and decreases in traffic flow over the arterial streets of a city as rush hours come and go are highly

predictable. So are seasonal changes in retail purchasing and in visits to the Grand Canyon. Note, however, that the reliability of a mass phenomenon does not enable us to predict well the behavior of any element of it. We are not helped to predict the time Clarence Berquistson will drive to work, what arterial he will choose, or whether he will visit the Grand Canyon this year. We are helped somewhat to predict the behavior of the "average person"--with whom none of us ever has any dealings--but not that of Clarence Berquistson.

And so it goes both in everyday life and in social science. The proprietor of a drug store cares little who comes in to buy vitamins, but does care how many do so. On the other hand, the proprietor does not need to know much about the average pharmacist, but does need very much to know how to deal reliably with his or her own pharmacist, Clarence Berquistson.

Social scientists exhibit two needs similar to those of the pharmacist. First, if social scientists want to know how an individual behaves, any and every individual, they must study the ways a neural net, every neural net, deals with sensory input, since that is the only path through which a human or other living creature can know the environment and therefore initiate selective acts upon it. Physiologists, neurologists, physiological psychologists, and other varieties of biological scientists do indeed study

those neural functions that are the same in every undamaged individual through long periods of time. I will explain in a later chapter what I mean by "the same."

Second, if social scientists want to know the proportions of individuals who will, with some specifiable probability, exhibit one sort of action in one sort of situation, they can then simply count anonymous cases, as do the druggist and the National Park Service. Culture and geography make it easier for people to carry out their purposes through certain uses of the environment instead of others. Since all humans have the same bodily purposes, and since social life encourages many of them to develop similar higher-order purposes (art, ritual, and so on), the uniformities of environmental opportunity offered by culture and geography make it possible to predict many mass phenomena with success better than chance. It becomes possible to predict proportions of anonymous behavior, though with larger margins of error, even in rather small "masses" of humans--say 20 or 30.

In later chapters, I will call the first method the "method of specimens" and the second the "method of relative frequencies." Both methods deliver useful information; both enable us to get ready for future events. They do so, however, differently. The method of specimens enables us to anticipate actions that will maintain the perceptual inputs a particular individual wants to maintain. The method of

assumes our inability to understand.

relative frequencies enables us to anticipate statistics about groups of people. The two methods deliver different kinds of information. The method of specimens enables us to discover how a species "works"--how its internal workings enable it to do what it does. The method of frequencies enables us to estimate behavioral trends in the mass--such as how many anonymous lemmings will run into the ocean this year. Social scientists, I believe, have wasted years of research because they have been confusing purposes with actions and actions with statistics. That is the burden of this book. I will do my best to clarify that confusion in later chapters. As an introduction, however, I will use the study by Cotton and Tuttle (1986) here to show some of the things the method of relative frequencies will not do. Studies using the method of frequencies come in many varieties, but the one by Cotton and Tuttle is sufficiently typical to serve here.

Using the meta-analysis of Cotton and Tuttle, you can get ready to find certain ranges of statistics in another similar study. Academic researchers find that kind of getting ready to be useful. The meta-analysis of Cotton and Tuttle cannot, however, get you ready for what might happen in a particular company if you were to alter one or more of the variables they studied. The statistician's generalization is a guide to ranges of features you are likely to find in other studies of samples and populations.

It is not a guide to practical local action.

You can't use the article by Cotton and Tuttle as a handbook of ways to save money on turnover. Altering the variables they studied is not a royal road to low turnover. Only in exceptional circumstances are you likely to reduce your turnover rate by much or to save much money if you do. I will give here some reasons I say that; my reasons will be a foretaste of some things I will say later about the method of relative frequencies.

First, the findings of Cotton and Tuttle were averages (of a sort) over many studies. Since averages contain members that lean both ways, your company might have the characteristics of Cotton and Tuttle's companies that went contrary to the general trend. Not a single one of the variables showed a relation to turnover in a hundred percent of the studies that examined it. Even among the variables that Cotton and Tuttle said had "strong" relations with turnover, I calculated that the percentages of studies showing a significant relation (even allowing $p < .10$) with turnover ranged from 32 to 94, with a median of 72.

Second, if a study did show a relation between a variable and turnover, that does not mean that every company in the study followed the relation; it means merely that a statistically significant number of them did, or that a number of them did so to a significant degree. That is, not only did some studies fail to show a relation that a

majority did, but even within the studies that did show the relation, some companies still remained outside the pattern. In brief, the chances would be very good that your turnover rate would not decline, because your company might be more like those that did not follow the patterns that Cotton and Tuttle discerned than like those that did. That is always a difficulty in trying to make use of a study of this sort.

Third, you cannot optimize all the variables that might have some effect on turnover. You might try to hire people who are at the same time the oldest and the least educated. But you might find yourself having to choose between an 18-year-old without a high-school diploma and a 50-year old with a master's degree; years of education are correlated to some degree with age. Tenure is also related to turnover; people who have worked for a company longer are less likely to leave. But if you lay off younger people so that you can hire older and less-educated people, you reduce the average tenure because you will now have more recently-hired people. And so on. To put it another way, the variables will be "confounded" in different ways in different studies.

Fourth, Cotton and Tuttle tell us nothing about shapes of relations. Does some variable affect turnover at the same rate when current turnover is five percent as it does when turnover is 30 percent? Do changes in the lower

ranges of a variable affect turnover at the same rate as changes in its higher ranges? This kind of question gets still more complicated when you combine it with the confounding of variables.

Fifth, some independent variables may be beyond your power to alter, at least single-handedly or in the near term--for example, the regional rate of unemployment.

Sixth, some variables predict turnover but do not cause it. Changes in a predictive variable and in turnover may both be caused by employees' reactions to still other conditions. Cotton and Tuttle found, for example, that the best predictor of turnover was "behavioral intentions." I take that to mean that if you want to know whether people will leave soon, ask them. But obviously, both intent to leave and actual leaving stem mostly from previous events and from many kinds of employees' preferences. Many variables may be partly predictive and partly causal, and in those cases, changes in them will produce little change in turnover.

Those are six features of Cotton and Tuttle's study--and of thousands of other studies--that make it very chancy that altering even a "significant" variable (such as some aspect of satisfaction) will bring a change of some other variable (such as turnover) <u>in your particular setting</u> (such as a business).

I should also mention cost, as I will do again from

time to time. The cost of raising satisfactions or increasing pay levels, for example, can sometimes be higher than the resulting saving from reduced turnover. If you hire older workers, to take another example, they will more quickly reach retirement age, and you will that much more quickly incur the expense of replacing them. I don't suppose the studies analyzed by Cotton and Tuttle counted retirement as "turnover."

I turn now to a few more remarks about research.

Research

Research is one of the ways we get ready for future experience. Knowledge got from research enables us to choose programs of action later on with which we can anticipate conditions in the environment better than we could without that knowledge. That, anyway, is our hope. Research differs in two ways from the anticipations within our bodies such as those of our legs when we go downstairs. The differences come from the fact that the immediate outcome of research is not a muscular action, but a conscious mental image of some sort that can be held in memory or recorded in language.

First, because the image is conscious, we can make a conscious choice whether to use the "map" of the environment

the research has given us. We can try out the suitability of the map to a situation in imagination before committing ourselves to action. Second, because the image can be translated into language, we can make the map available to other people. People who give maps to others get the benefit of hearing from them how well the maps work out in the imaginations and actions of the others. People who receive maps from others get the benefit of not having to carry through the research themselves. Thus does language and social life benefit individuals.

In the informal manner of research, for example, experience with climbing mountains enables us to anticipate lacks of food, oxygen, and warmth, and get ready with food packs, oxygen tanks, and heavy clothing. In the formal manner of research, for example, experimentation with electricity and cooper wires enables us to find out, before we invest millions of dollars in equipment, how big the generators must be and how big the wires must be to transmit the electricity all over town. In both cases, we can use the experience or not or choose parts of it as we wish in any situation in the future. We can select parts of our experience with mountains, for example, to get ready for certain experiences we might have in airplanes. And in both cases, our experience can be used by anyone who can read the language in which we set it down.

We act to achieve our purposes with as little delay

and effort as possible. Through research, formal or informal, we try to find ways to reduce, given some present knowledge or store of experience, the varieties of events for which we must be ready. Suppose, on a sunny day, you break your sunglasses and want to replace then as reasonable cost. From previous experience, you know that sunglasses are much more likely to be found in optical shops, sporting-goods stores, and drug stores than in grocery, stationery, dry-goods, or furniture stores. Suppose you know, too, that optical shops usually ask more for sunglasses than do drug stores. Suppose, furthermore, that it is Saturday afternoon, and you have learned that the optical shop is closed, but the drug store is open.

You go to the drug store and buy a new pair of sunglasses at a reasonable price. Your previous knowledge saves you from traipsing about to a great variety of commercial establishments, and it also saves your waiting until Monday for the optical shop to open. Actually, your action makes use of still further previous knowledge. You also know (predict with high confidence) that neither optical shops nor drug stores change their ranges of prices very much. And you know that when stores tell you on the telephone or by means of a sign in the window that they will be open at certain hours, you will indeed almost always find them open at those hours.

As another example, suppose you know, as

organizational consultants and group counselors do, that most people in a newly formed group of strangers will at first be less free in telling others about their thoughts and feelings than they will be later on after favorable experience in the group accumulates. That knowledge saves a chairperson from wasting energy and time in pressing for certain kinds of communication too soon. And suppose you know, too, that most people in a newly formed group think that others are less ready to tell their thoughts and feelings than they themselves are. That knowledge, if the subsequent work in the group goes along cooperatively, saves the chairperson the trouble of setting up elaborate procedures to encourage trust and free interchange. The chairperson need only let the bolder members serve as examples, making a remark when necessary to help the others see that the bolder ones are suffering no harm and in fact are helping the group to do its work.

In both those examples, knowledge (experience giving confidence in predictions) gained previously reduces the range of future events with which one need prepare to deal. Of course, if the drug store turns out to be closed or if all the members of the group turn out to be exceptionally timid, then one revises one's action. Nevertheless, both are examples of research. In both examples, previously acquired knowledge enables us to prepare for future events more quickly and easily.

Knowledge does that because it reduces the possibilities for which we must prepare. Since information is knowledge once it is inside you, using knowledge to reduce possibilities fits with the definition of information given by information theory--namely, whatever reduces the possible choices. Generalization is useful not because the information is so very "general," but because we need get ready for fewer eventualities than we would without the information.

The organized experience that research brings us, in memory or on paper, enables us to do things we could not do before--climb high mountains, electrify a city, build a teaching machine, write a personality inventory for personnel managers, make bolder decisions in groups, even perhaps keep more of our employees longer. For me, all research answers the question, "What can I do now that I couldn't do before?" And any activity answering that question is research.

You might want to interrupt me to say that I have included as research every occasion when we reflect on our experience, no matter how small a piece of it, wondering what we might do next. You would be right; I do include those small wonderings. The propensity that urges any untutored person to ponder how future action can profit from past experience is the same propensity that urges some of us to follow the discipline of formal research.

It is true that we often stumble. We make mistakes, in our generalizing, about what kinds of experience to expect next. We do that in both vulgar and formal research. Because of the unpredictability of the world around us, many mistakes are unavoidable. Others, however, come from inept generalizing. Many people, from cracker-barrel philosophers to professional methodologists, have given us advice about how to avoid mistakes. This book is still another addition to that literature. One way to pare down to one sentence what I have written here is this: The cracker-barrel philosophers and the professional methodologists ought to exchange seats now and then.

Chief Points

Generalizing was not invented by scientists or statisticians. When we do it--and we do it all the time--we are doing what comes naturally. It is a necessary capability, an ever-present function of all the neurally more complex living creatures. You do it, I do it, the birds and bees do it. Though we ordinarily think of generalizing as an operation in a neural net, it also occurs in the very bodily structure of a species. Fish are streamlined and equipped with gills because they "expect" to be living in water all their lives. Generalizing occurs in

bodily shape, in reflexes, in neural routines and programs for "automatic" sequences of action (such as walking downstairs), and in the conscious scanning and planning of everyday life as well as when, as scientists, we try to be conscious of generalizing and self-critical about it.

Here is a recapitulation of the chief points I wanted to bring out in this chapter.

1. **Purpose.** Throughout this book, I assume that humans act according to their purposes. If you do not think people have purposes, you may as well stop here.

2. **Anticipating.** By generalizing, I mean predicting, anticipating, getting ready for further action. I mean choosing an action that will (we think or hope) bring us what we want if we find ourselves in certain conditions rather than others.

3. **Continuity.** Generalizing occurs both unconsciously and consciously. The lower levels of the neural net respond more quickly and more narrowly to deviations from what has been anticipated. At the higher levels, generalizing is more often conscious, it encompasses wider ranges of possible events, and it can wait for farther futures. But there is no discontinuity. We are no smarter, so to speak, when we are writing a research report than when we are walking.

Generalizing occurs both in everyday life and in formal research. Generalizing in science may be typically

more systematic, self-critical, and publicly inspected than in other realms of life (though I am not nearly as sure of that claim as I once was), but there is no discontinuity.

I think a test of whether a proposition in social science can be a guide to diagnosis cannot be made under the "controlled conditions" (controlled by the experimenter) we think of in connection with "laboratories." I do believe that fruitful exploratory studies can be made under "controlled conditions" <u>if</u> the proposition tested includes the specification of those controlled conditions. An example would be ". . . among rats of strain W and of sex X that have been handled gently for a total of at least Y hours previous to the experiment, have been deprived of food for Z hours, and are prevented from discovering any way of getting food other than pressing the lever." Another example would be ". . . among male Midwestern college sophomores in the U.S. in 1988 who are given academic credit for participating in the experiment, who are strangers to one another, who are put together for one hour with no expectation that they will ever meet again, and who are allowed to converse only about topics X and Y." But a test under such restricted conditions does not ready the proposition to be used as a guide to diagnosis outside those restricted conditions.

I think a "final" test of a proposition in social science must be a test of whether the proposition provides

people in uncontrolled conditions (uncontrolled by some experimenter) with a guide to diagnosis with which they succeed in carrying out their own purposes more quickly, more surely, or with less conflict with their other purposes. If the guide to diagnosis specifies that the user of the guide will do well to set up a restricted environment, that's all right. But the choice of whether to do so, if the proposition is to be a guide outside the surveillance of the experimenter, must be left to the user.

Humans act to carry out their purposes, and their purposes consist of maintaining an array of perceptual inputs. If that is so, when we cannot see clearly the evidence for a proposition unless it is being used by persons free to carry out their own purposes, not by persons whose behavior is being bent or restricted to the purposes of an experimenter. By persons being "free," I mean that they are in an environment rich enough in opportunities to approximate the degrees of freedom of choice that they typically have in everyday life. The easiest way to provide that richness of environment is to let the user (the "subject") use the guide to diagnosis in everyday life.

Because that is my view of human behavior, because I think we generalize both unconsciously and consciously and in everyday life as well as in the laboratory, and because I believe that humans do guide themselves by principles having the same if-then form as scientific propositions (as well as

by other sorts of internal standards), I will offer illustrations from everyday life in this book as freely as I offer accounts of formal research.

4. **Particular and general.** We can generalize from the particular to the general in our "minds"--at the upper levels of the neural net. When we act, however, we can act only because we have generalized from the general to the particular. No generalization, whether it comes from "pure" or from "applied" research, can be a guide to immediate, particular action. It can be a guide only to diagnosis. Conversely, any kind of research can serve a practical purpose if it does indeed give us a guide to diagnosis.

5. **Diagnosis.** Generalizing serves us well only if we constantly keep diagnosing to be sure of the condition we are in. If, having in mind the research on the "risky shift," we want to use group decision-making in some other country than the United States to help the participants commit themselves to making changes in their organization, we can save ourselves from possible catastrophe if we first make sure that the culture encourages taking risks in the kind of activity that will be required, if we make sure that the particular organization is not somehow an exception to the cultural norm, and if we then check repeatedly as the discussions continue to make sure that some further norm is not reducing the attractiveness of risk. This kind of repeated diagnosing is an essential feature of "action

research," a strategy for making changes in social life far more effective than mere advice-giving by experts, no matter how expert. After the sections that describe separately the methods of relative frequencies and of specimens, I will describe "action research" in chapter ### as a way of melding those two methods.

6. **Frequencies and specimens.** I think we use two chief methods to get ready to perceive future events and deal with them. I will call one the "method relative of frequencies." Using it, we count cases and estimate statistics. We look for ways that conditions and actions cluster. In Part ### of the book, I will show what I think the method of relative frequencies can do and what it cannot do.

The other method I will call the "method of specimens." Using it, we treat persons or groups as members of a species. We look for behavior (not, however, for a particular action) that is invariant within an individual over time and for the ways of managing behavior that are the same from one individual to another. In Part ### of the book, I will show what I think the method of specimens can do and what it cannot do.

Both methods yield useful information. They yield, however, different kinds of information useful for different purposes. In the rest of this book, I will do my best to show the differences.

References

Cotton, John L. and Jeffrey M. Tuttle (1986). Employee turnover: A meta-analysis and review with implications for research. Academy of Management Review, 11(1), 55-70.

Kelly, George A. (1964). The language of hypothesis: Man's psychological instrument. Journal of Individual Psychology, 20, 137-152. Reprinted in B. Maher (Ed.). (1969). Clinical psychology and personality: The selected papers of George Kelly (pp. 147-162). New York: Wiley.

McGrath, Joseph E. (1984). Groups: Interaction and performance. Englewood Cliffs, NJ: Prentice-Hall.

Stein, Jess (Ed.) (1971). Random House dictionary of the English language. New York: Random House.