James G. March, Charles A. Lave *Introduction to Models in the Social Sciences,* New York: HarperCollins, 1975.

2.1 INTRODUCTION

The best way to learn about model building is to do it. In this chapter we invite you to speculate about human behavior. The procedure we have adopted is a familiar one. It is used by novelists in developing characters or events, by historians in interpreting history, by children in training their parents, and by astronomers in creating theories of the universe.

Despite such testimonials, our procedure is not the only procedure for examining human behavior. Intelligent people differ on how to give meaning to observable phenomena. They differ even more on a variety of special issues that we will happily ignore. If we had some unique vision of the only way to approach social science, we would be delighted to present it. If we knew of some major new solutions to the ancient complications of the search for interesting meanings, we would hurry to announce them. Our intentions are incomparably more modest. We have found one common approach to interpreting human behavior both fruitful and enjoyable. We hope you may find it similarly rewarding.

In this chapter we ask you to practice your skill at imagining speculations. In each section we start with an observation and then speculate about processes that might have produced the observed fact. The examples are all taken from the world of ordinary experience: government, college life, friendship, and population control. They even include one example drawn from the physical world simply to demonstrate that the process of speculation is fun there too.

2.2 CONTACT AND FRIENDSHIP

Suppose we were interested in the patterns of friendship among college students. Why are some people friends and not others? We might begin by asking all of the residents of single rooms along a particular dormitory corridor to give us a list of their friends. These lists of friends are our initial data, the result we wish to understand.

If we stare at the lists for a while to see what they mean, we eventually notice a pattern in them: Friends tend to live close to each other; they tend to have adjacent dormitory rooms. What does this mean? What process could have produced this pattern of friendship?

One feature of this book is that we will often ask you to stop and do some thinking. We are serious.

> ***STOP AND THINK.*** **Devote a moment's time to thinking of a possible process that might produce this observed result.**

One *possible* process that might have led to this result is the following:

> Each spring the director of campus housing allows students to indicate their dormitory room preference for the following year; groups of friends take advantage of this and ask to have each other as roommates or to be put in adjacent rooms.

This process is a speculation about a prior world. If the real world had once been like our model world, then the observed facts would have been a logical consequence. That is, this speculative prior world would have produced our observed result, namely, that friends tend to have adjacent rooms. Thus we have found a model, a process, that accounts for the facts. We do not stop here, however. We next ask: What other consequences does this model have? What else does it imply? It also implies that the students in each dormitory friendship group must have known each other previously; hence they must have attended the university during the previous year; hence there will be fewer friendship clusters among freshmen.

Is this further implication of our speculative prior world correct? To test it we first examine the friendship patterns in a dormitory of juniors and seniors, and, as expected, we discover groups of friends living next to each other.

We also examine a dormitory that has only freshmen and discover that there are as many groups of friends clustered there too, which is not an expected result (according to the model). This result would not have been predicted by our model unless the freshmen knew each other prior to college. Perhaps the freshman friendship clusters consist of students who knew each other in high school and who asked for adjacent rooms. We look at information on the backgrounds of freshmen to see whether this is true; but we

discover that almost all of the students come from different high schools.

So our speculative model world does not do a very good job of explaining what we have observed. Some process other than mutual selection by prior friends must be involved. We think about it some more and try to imagine another process that could have led to these results. Our new speculation (which is probably the one you yourself thought of when the question was first posed) is as follows:

> College students come from similar backgrounds. As a result, they have enough experiences, problems, and values in common that they are capable of becoming friends with each other. Pairs of college students who live near each other will have frequent opportunities for interaction and hence are likely to discover these common characteristics.

Thus students who live close to one another will become friends. This new speculation explains the presence of friendship clusters in freshmen dorms as well as in junior-senior dorms. Does it have any other implication?

> *STOP AGAIN.* **Think about it.** ***Hint:*** **what about changes in these friendship clusters over time?**

Since the chance of contact increases over time, the friendship clusters should grow in size as the school year progresses. You would expect the average friendship cluster to be relatively small in October, bigger in December, and still bigger by May. To test this prediction, you would have to run questionnaires at two or three separate dates. If you did so and discovered that the prediction was correct, the model would seem somewhat more impressive.

In summary: We made an observation (friendship clusters around adjacent rooms); we speculated about a model world (mutual selection by preexisting friends) to explain this result; we looked at other implications of the model world (no friendship clusters in freshmen dorms) to see if they were true. Since they were not true, we created a new model, with a new process inherent in it (similarity of values and opportunity to meet cause friendship), we then examined the implications of the new model world (cluster size increases over time) and found that they were true.

So far we have formulated a model of college students discovering similarities. We would now like to make our model more general, to find some new model that includes this model as an implication. Can you think of such a more general model?

> *STOP AND THINK.* **Remember you still want to include the predictions we made earlier and yet find a more general model that predicts new behaviors as well, perhaps beyond the campus scene.** ***Hint:*** **Look at the parts of the existing model that restrict its area of applicability.**

One possible approach to reformulation proceeds as follows: College students are people. Perhaps our speculation about college students is true about all people. Now our theory becomes:

> Most people have enough experiences, problems, and values in common that they are capable of being friends. Pairs of people are likely to discover these common characteristics when they live close to one another.

The model is a broad, powerful statement about the world. If it is true, does it have any nonuniversity implications? Racial integration is a potential area for its application. The model predicts more friendships between blacks and whites who live in integrated neighborhoods than would be found between blacks and whites who do not live near each other; it also predicts that opinions of blacks and whites toward each other will be more positive and favorable in integrated neighborhoods.

A group of social scientists decided to test some of these predictions.[1] They chose two housing areas—one segregated and the other integrated—to see whether there were differences in friendships and attitudes. Both areas were public housing projects; and both were carefully compared to assure that other variables that might also influence interracial attitudes would be similar in both projects.

The social scientists questioned white residents of the two housing projects about their relations with their neighbors and about their attitudes toward blacks. They found that whites living in the integrated project reported far more neighborly relations with blacks than was true of whites living in the segregated project. They also found that integration produced large changes in white

attitudes toward blacks. Among those whites who had originally held unfavorable attitudes toward blacks before moving into the housing project, 92% of those in the segregated project still had unfavorable attitudes, while more than half of those in the integrated project now held favorable attitudes toward blacks. Thus the predictions of the model were confirmed.

With the extension of our speculation from college students to people and from dormitories into neighborhoods, we have not yet exhausted the possibilities for developing the model.

> *STOP AND THINK.* **Reread the model, and then try to think of ways in which you might reformulate the ideas to make them even more general.** ***Hint:*** **Think about the process by which friendships are formed.**

Perhaps you thought of something like this. The reason people in neighborhoods discover each other's values is because they have contact through communication. Now our model becomes:

> Most people have enough experiences, problems, and values in common that they are capable of being friends. Pairs of people are likely to discover these common characteristics when they communicate with each other.

Thus people who communicate with each other will become friends. Now we can use our model not only to predict some features of college life and some features of residential neighborhood life but also some consequences of communication through visiting, writing, telephoning, or television.

> *STOP AND THINK.* **Speculate about the implications of the changing communication patterns in our society; for example, grandparents no longer live in the same household as their grandchildren, and children now leave home earlier and live farther away. Use the new extended model to predict the change in friendship patterns which might result from the change in communication patterns. Some of your speculations may seem false, but this is simply a sign that you are doing the job well and being imaginative. At this stage it is more important to be creative than to be critical. (You are on your own on this question—no answer will be given below.)**

But now suppose, finally, that a friend of yours proposes the following:

> Most people have enough differences in experiences, problems, and values that they are capable of being enemies. Pairs of people are likely to discover these differences when they communicate with each other.

Thus people who communicate with each other will become enemies.

In reviewing our original dormitory data, we see that this new model predicts that the size of enemy groups will increase over the course of the school year. That is, the number of people disliked by any one person will increase over the year. It is possible, therefore, to revise the model to take account of both effects (friend production and enemy production) by changing it to something like the following:

> Most people have enough experiences, problems, and values in common that they are capable of being friends. At the same time, most people have enough experience, problems, and values that differ that they are capable of being enemies. Pairs of people discover their common and differing characteristics through communication.[2]

At this point we have a broad, provocative speculation. We cannot stop here, however, for we now have to deal with a major problem implicit in this model: What determines the initial pattern of communication? How do two people happen to begin by discussing shared characteristics rather than conflicting characteristics? To what extent do expectations about others become self-fulfilling? That is do friends confine their communication to things they agree on, whereas enemies discuss each other's differences?

The fact that initially prejudiced whites changed their feelings toward blacks after moving into an integrated housing project is grounds for optimism. Perhaps communications about shared values are more powerful than communications about differences.

Perhaps closeness creates strong incentives to discover shared values. Or perhaps the experience of solving joint problems (for example, dirty streets, landlord problems, school issues) creates the incentive to discover shared values.

Since our current model places primary emphasis on the pattern of communication, you might wish to add some speculations of the following kinds:

1. Friends tend to communicate about common values; enemies communicate about differing values. As a result, two people who start out being friends (either through chance or positive expectations) will become better friends; two people who start out being enemies will become worse enemies.

2. Situations in which there is general social agreement about appropriate behavior and appropriate interpretations of behavior will more likely produce communication about shared values than will situations in which there is less general agreement. Thus two persons who initially meet in a well-defined, normatively regulated situation will be more likely to become friends than if they had met in normatively unregulated situations. (Could this be a possible reason why stable societies impose relatively elaborate politeness rules for first encounters among people?)

3. Strangers would rather be friends than enemies (because enemies are more "expensive.") Thus two people initially try to communicate about shared values. "Mistakes" occur when a person guesses wrong about which values are shared, or when he is forced to communicate to an audience of several different people. Thus two persons from similar cultures are more likely to become friends than two persons from different cultures. On the average, the smaller the group within which a first encounter between two persons occurs, the more likely they are to become friends. On the average, the larger the group of strangers, the more inane the conversation. This is one reason why, counter to intuition, large parties of strangers are duller than small parties of strangers, per gallon of liquid served.

STOP. **If you have taken the time to exercise your imagination at each step of these examples, you should now have a sense of the basic nature of the model-building procedure that we are presenting and its pleasures. You may find it useful at this point to retrace the process and devote some time to your own speculations rather than ours.**

2.3 ROCKS, LAKES, AND RIVERS

Not all speculation concerns human behavior. We can play the same game with observations made about the physical world. Figure 2.1, for example, shows an excavation in Southern California. Other excavations near this particular area all show the same structure: parallel layers of rocks with smaller rocks and sand between them. Why does the excavation look like this? What kind of geological process might have produced this end result? How did the rocks get there? Why are they layered the way they are?

STOP AND THINK. **Try to think of some geological process that might have produced this result.**

A possible process might be:

This area is actually the bed of an ancient ocean; the layers are the result of successive deposits of rock and sand washed there by the ocean; then the land was pushed up out of the ocean by some kind of geological upheaval.

This imagined process is a speculation about a prior world. *If* the real world had once been like our model world, then the observed facts would have been a logical consequence. Thus we have found a model, a process, that accounts for the facts.

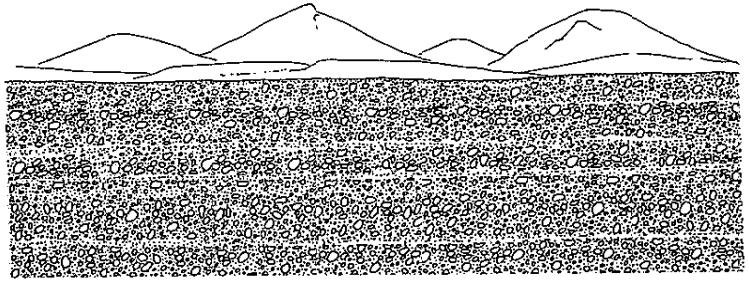

Figure 2.1: Gravel pit wall with stratified layers of rock. There are mountains in the background. Adapted from Geology Illustrated *by John S. Shelton. W. F. Freeman and Company. Copyright © 1966. Reproduced with permission.*

If our speculation about the prior world is true, are there any other facts that we should also observe?

STOP AND THINK. **Think of some other consequences that follow from the model. What are its other observable geological implications? Try to think of at least one other implication before you continue reading.**

If this were an ancient ocean bed, there should also be marine debris as well as rocks, for example, fossils of some kind. A careful examination of the excavations, however, shows no fossils or other marine debris. This causes us to doubt the ocean-bed model. A further cause of doubt is that the surface of the ground is exactly parallel to the rock layers exposed by the excavation. It is unlikely that the land would have been raised exactly straight up out of the ocean or that subsequent erosion of the surface could have worn it exactly parallel to the former floor.

So our speculation, or model, about the origin of this area is in trouble. The model correctly explains the layers of rocks, but, unfortunately, it also predicts two things that are not true. Thus it is unlikely that our model is correct. Let us try to think of some other model that might have generated the observed result.

STOP. **Can you think of an alternative?**

An alternative possible model is:

> The area in the picture was formed by rocks washed down from the mountains in the background; torrential rains and flooding carried the rocks from the mountains; successive layers represent successive floods.

Could this alternative version of the prior world have created the known results? It does explain the layers of rocks; it predicts the lack of marine fossils; and it also predicts that the surface should be exactly parallel to the rock layers, since the process is presumably still going on in a slow fashion. But is there anything

else that this new version of the prior world would predict? If the process we have imagined were true, would it have led to any other results?

STOP AND THINK **about this for a moment.**

If the model were true, we might also expect that the type of rocks in the excavation will be the same as the type of rocks found in the mountains. We might also expect that excavations closer to the mountains will show larger rocks than the ones in the drawing, since the large rocks could not have been washed so far. And, finally, we might also expect to find a very slight upslope from this area toward the mountains. All three of these predictions were confirmed by field work. The last model then appears to be a reasonable speculation.

2.3.1 A MODEL OF THE MODEL-BUILDING PROCESS

You should now have some notion of what a model is and how models are created. A model is a simplified representation of the real world. Models are created by speculating about processes that could have produced the observed facts. Models are evaluated in terms of their ability to predict correctly other new facts.

Models are simplified representations of the world because it is impossible to represent the full complexity of the world (notice that the geological model did not specify the dates of the floods, the amount of water in each, the types of rocks washed down, the names and ages of any trees that might have been uprooted, and so on) and also because minute details are unnecessary. Our simple model has only enough detail to make it applicable to other situations.

If you think back over the procedure we used to build the model, it works as follows (though usually not nearly so neatly):

Step 1
Observe some facts.

Step 2
Look at the facts *as though they were the end result of some unknown process* (*model*). Then *speculate about processes that might have produced such a result.*

Step 3
Then *deduce other results* (implications/consequences/predictions) *from the model.*

Step 4
Then ask yourself *whether these other implications are true and produce new models if necessary.*

First we started with some facts (the rock formations exposed by the excavation) that we wanted to explain. Next we constructed an imaginary model world (the ocean bed) that could have produced these observed facts. We then asked if there were other consequences or predictions implied by the imagined model world. We found two such predictions (presence of fossils and surface irregularity) but discovered that neither prediction was confirmed in the real world. So we rejected our initial guess about the prior world and imagined an alternative prior world (floods from the mountains). This alternative model not only accounted for all of the known facts, but from it we also predicted three new results, which were all confirmed. Thus we now feel confident that the process we imagined is what actually produced the result that we wanted to explain. Therefore, we have a good model because it explains why the rocks in the excavation look the way they do.

The explanatory procedure should now be relatively clear: It involves a constant interplay between the real world and the model world. The main difference between this explanatory procedure and the kind of thinking we usually do is that this procedure is more systematic and more creative. In ordinary thinking when we have a result to explain, we are usually content to think of some simple explanation and then stop. This is incomplete thinking; it stops before the process is fully carried out. The real fun is to continue thinking and see what other ideas the explanation can generate, to ask ourselves: *If this explanation is correct, what else would it imply?* Once you learn to do it easily, you will find genuine creative enjoyment associated with this interplay between explanation and prediction.

2.4 *RESPONSIBILITY CORRUPTS*

Governments frequently appoint task forces or commissions to study serious, complex issues such as crime, unemployment, education, narcotics, or student unrest. Sometimes such commissions are appointed because the sheer complexity of a problem makes concentrated, impartial study a necessity. Sometimes they are appointed for political reasons in an effort to bury a currently controversial, but probably short-lived, issue. And sometimes they are appointed to rubber stamp and legitimize a program that an administrator has already decided he wants to implement. The make-up of these commissions is usually very diverse: One often finds conservative businessmen, lawyers, professors, civil servants, and liberal labor union leaders all mixed together. In spite of the complexity of the issues being investigated, in spite of the variety of motivation for appointing the commissions, and in spite of the diversity of their memberships, there is a common pattern in the final reports of task forces or commissions. They often end up criticizing the policies of the government that appointed them; they usually make recommendations that can be characterized as moderate; and the members usually agree unanimously or nearly unanimously. That is, the diversity of opinions on the commission is usually resolved in a moderate, action-oriented direction, apparently by changing the opinions of the participants, particularly those of the more doctrinaire members.

For example, the report of President Nixon's Commission on Campus Unrest was published in 1970. Among the commission members were a police chief, a governor, a newspaper editor, an attorney, a law school dean, a retired Air Force general, a university president, a professor, and a graduate student. The commission did not issue the kind of report that might have been expected given the probable initial biases of its members. The report expressed a good deal of criticism not only toward students but also toward the government and universities. It said:

> Most student protestors are neither violent nor extremist. . . . The roots of student activism lie in unresolved conflicts in our national life, but the many defects of the universities have also fueled campus unrest. . . . The university's own house must be placed in order. . . . Actions—and inactions—of government at all levels have contributed to campus unrest. The words of some political leaders have helped to inflame it. Law enforcement officers have too often reacted ineptly or overreacted. At times, their

> response has degenerated into uncontrolled violence. . . . We recommend that the President seek to convince public officials and protestors alike that divisive and insulting rhetoric is dangerous.

In the next few pages we will show the kind of thought processes carried out by one of the authors as he tried to understand why commissions behave the way they do. Some of the steps that follow took longer to formulate than others, and some are slightly expanded to make the thinking more explicit.

> ***STOP.*** **Think about the observation. Why would commissions be moderate (and critical) in their reports? See if you can form some speculations of your own.**

The reading of the newspaper story about the commission on student unrest and the observation that moderation and a tendency to criticize the government were common to such commissions was the observed *result* I wanted to explain. I asked myself *how* such a result could occur; what *process* could have led to this result? Thus my first try at an explanatory process was:

> People on commissions who hold diverse opinions ultimately decide to compromise a little bit. They do so in a kind of trading process in which each gains a little and each gives up a little. Thus the final report represents a middle ground among the diverse views.

I next tried to broaden the model, to make it more general and abstract. The first step was to look at all of the verbs and nouns in the model to see if they could be made less specific. "Commission" and "final report" were broadened first, since it seems possible that the compromise process is true of all group behavior. My second try was:

> People who hold diverse opinions will tend to compromise their differences and end up supporting some opinion in the middle, in order to obtain common agreement.

Notice that "commissions" was dropped altogether and that "final report" was broadened to become "opinions." This model is broader than the first try, though it is limited to opinions. Could

any other verbs or nouns be broadened? It seemed possible that behavior might be changed as well. So the language was broadened to include actions as well as opinions. The third try was:

> People with conflicting goals and opinions will tend to compromise their differences in order to obtain common agreement.

The third try was substantially broader than the first, and I now had a model with applications in the whole area of human decision making. Does the model work? Are its predictions correct?

The simplest prediction is that we should observe evidence of compromise in the final reports of task forces. There was such evidence of compromise—the reports always seemed to endorse some position in the middle of the spectrum of original opinions held by the participants. But something else was also apparent. There were rarely any strong dissenting "minority reports." Nor were there many instances of commission members "repudiating" a report upon their return to private life. Perhaps most of the participants had actually *changed* their opinions rather than simply compromised them for the sake of the report. If this were true, it was not a result that would be predicted by the model. Some other process must be involved, therefore, and the model must be modified to take account of it or else be discarded in favor of a different model.

> ***STOP AND THINK.*** **How would you modify the model? What sort of process might lead to an actual change in personal opinions?**

Why would the opinions of the people on the commission be changed as a result of their participation in the activities of the commission? My first try at a new model was something like this:

> It is easier to hold extreme views if you are not confronted with their consequences and if you are not exposed to alternative views. People on commissions do have the strong possibility of having their reports implemented and hence are forced to think about the actual consequences of their decisions. It is hard to cling to extreme ideas when faced with the possibility of human misery resulting from them.[3]

This seemed to be an interesting beginning, and I next tried to broaden it. The model should apply to all decision-making situations, not only to commissions, and it should apply to actions as well as opinions. A second try was:

> People in positions of responsibility tend to moderate their beliefs and actions as a result of confrontation with actual consequences and exposure to alternative ideas.

The model now suggests a reason why idealists, of either the right or the left, tend to modify their ideological purity and become more moderate once they are given real world responsibilities. What about other possible predictions from the model? It predicts the same moderating effect on successful candidates for public office, and there is at least some casual evidence of this if we look at campaign utterances and compare them with subsequent actions while in office. It also predicts that leaders of radical movements (of either left or right) will tend to disappoint their fellows if they achieve office in a larger sphere. They will probably be viewed as "sell-outs" to the establishment.

For other predictions I tried to think of examples of offices with differing amounts of responsibility and power. The model says that it is easier to maintain extremist views in relatively powerless offices. Thus the president of a local chapter of a minor political social group can easily maintain right-wing views in spite of being president. Likewise, an antibusiness member of Congress may have his views only slightly moderated by his being a congressman, for he is only one vote out of 435. But the model does say that a congressman will exercise the greatest moderation of his views in those areas in which he has committee assignments (since committees are more powerful and carry greater responsibility); and similarly the model predicts that on those occasions when Congress overrules a committee, the congressional action will be more extreme (in either direction) than the committee recommendation. Finally, the model predicts that really powerful and responsible positions such as Chief Justice of the U.S. Supreme Court or President of the United States will have the most effect upon the men or women who hold them.

STOP. **Review the argument and the derivations. Are there other speculations that might explain our original observation? Are the others better or worse than this set of ideas?**

2.5 THE CASE OF THE DUMB QUESTION

Suppose you are sitting in class when the person next to you asks a really dumb question. This is your observed fact. Can you imagine a process that might produce such an observed event? Let us suppose that you also know that the person next to you is a football player. Then you might begin with a simple model, particularly if you are not a football player:

> Football players are dumb.

Using this as a base, can we generalize it into a more interesting idea? You might want to begin by broadening "football player" to "athlete," producing the following new statement:

> Athletes are dumb.

The change has made your model more general (but not necessarily more correct), but the model still has no sense of process. Why might athletes appear dumb? Is appearing dumb an inherent characteristic of people who are good at sports? Is it due to something that happens after people take up sports in a serious way? Or is there some other explanation?

STOP AND THINK. **Is there some possible process that would make athletes appear dumb?**

One possible model for our observations might be:

> Being a good athlete requires large amounts of practice time; being smart in class requires large amounts of study time. The amount of free time is so limited that you cannot both study and practice well.

This is a much more general explanation. It makes a variety of interesting predictions. Not only does it explain why athletes appear dumb in class, but it also predicts that any time-consuming activity

will produce the same effect. Thus people who spend large amounts of time on student government or the school paper will also appear dumb in class. Of course, this is not the only possible model. An alternative might be:

> Everyone wants to feel successful. Achieving recognition in any one area is enough to make most people content.

According to this model, athletes will not work hard to achieve recognition in academic work because they already have recognition as athletes. Thus they will appear dumb in class. It also predicts that other individuals who are successful in school in important activities (for instance, student politics, social events) will appear dumb in class.

Or you might have imagined a quite different process:

> We tend to be jealous of success in others. When we are jealous of someone, we attempt subconsciously to lower his apparent success in class by interpreting his questions as "dumb."

According to this model, athletes (who are correctly identified as athletes) will ask questions that appear simplistic to other persons (who are relatively unsuccessful in athletics). Other individuals who are successful in other nonacademic pursuits will also ask what appear to be dumb questions.

> ***STOP.*** **Now we have three different models explaining the dumb football player, and undoubtedly you have thought of others. Which of the models is best? We will consider this question in the next chapter, but you might think a little about it now.**

2.6 *THE CASE OF THE SMART WOMEN*

The data collected to test the various ideas of this partially true story were often casual and nonrigorous. A social scientist noticed that women having a particular religious background tended to do better academic work at his university than women having other religious backgrounds. Religion Z maintains a private educational

system that many of its members attend instead of public schools. The Z schools have a certain amount of religious content, are often relatively strict, and are usually segregated by sex.

> ***STOP.*** **Why do Z women do better academic work than non-Z women? What kind of process could produce this result?**

The social scientist who made the initial observation immediately thought of two possible explanations:

> ***Model 1.*** Z women are inherently smarter than non-Z women.
>
> ***Model 2.*** There is something special about Z high schools that prepares students better for college work.

Model 1 is not a good model because it has no sense of process to it. Nonetheless, there is a possible test to check it out. We might simply give IQ tests to random samples of Z and non-Z girls in order to test the assumptions of the model. As a general rule, however, we will discourage assumption testing as a way of validating models. A little bit of imagination devoted to looking for testable predictions will generally be more profitable. In this case we suspect, from general biological knowledge, that if there were a systematic genetic-linked difference between the intelligence of Z women and that of non-Z women, there would be a similar systematic difference between Z men and non-Z men. Now we can avoid the tedious task of administering intelligence tests to everyone. Instead, we simply (and cleverly) check to see if Z men have better grade records than non-Z men. We do so and discover that there is no difference between the two groups of men. This leads us to doubt Model 1.

Model 2 asserts that there is something superior about the Z schools. But if this were true, then again we would expect Z men to be outstanding compared to non-Z men. Perhaps it is only the Z women's schools that are special, however. Casual conversation with Z men and women did not reveal any plausible differences between the Z schools that they attended. Thus Model 2 does not seem valid

either, although we might want to keep it in mind. The differences between schools might be subtle. Are there any alternative models?

STOP AND THINK. **What other explanations might there be for the social scientist's observation?**

If you have read any modern discussions on educated women, you might have thought of the following model, which was also suggested by one of the Z women:

> *Model 3.* Men seem to confuse masculinity and intelligence; a smart woman is threatening to them. So when a woman shows her intelligence, she gets criticized or ignored. After a while, women who want male approval learn to act dumb so as not to offend men. Since the Z schools are segregated by sex, their women graduates haven't been conditioned to be quiet in class and play dumb. With only other women around they get more chance to develop their intellectual potential.

Is this a good model? The process is certainly clear, and it does account for the original observation of disproportionately smart Z women and average Z men. Can we now make some interesting predictions? The essential variables in the model seem to be the degree of contact with men and the values of the men contacted. This in turn suggests some possible natural experiments:

1. Z women should gradually, over time, become conditioned by their new college environment. So the difference between Z women and non-Z women should be much smaller in senior classes than in freshmen classes.
2. There are many noncoeducational colleges. Graduates of women's colleges should do better in graduate school than women graduates of coeducational colleges.
3. Some women are largely indifferent to additional male approval, perhaps because they are strongly career oriented, perhaps because they are certain of their standing (either high or low) among men. Women in career-oriented programs will do better than women in liberal arts programs; women who are married will do better than women who are not; women who are distinctively unattractive to men will do better than others.

STOP. **Is Model 3 a good one? Or are there other models? Perhaps professors like the way in which Z women deal with teachers. Maybe you can think of some other explanation. See what predictions you can derive from your own model.**

2.7 ON BECOMING A SOCIAL SCIENTIST

Recruitment into college majors is not a random process; rather, there are systematic biases in the motivations, attitudes, and abilities of students who select certain majors. Students make choices that at least in a modest way match their expectations about a field with their own aspirations and their own views of their personal abilities. Counseling from parents, friends, and teachers guides a student into a commitment that is relatively consistent with his talents. As a result, students with greater interest and aptitude in art are disproportionately represented among art majors, and students with greater interest and aptitude in mathematics are disproportionately represented among mathematics majors. In a reasonably efficient "market" these simple mechanisms serve to attract students to interests and careers that are generally consistent with their abilities; but, as we know well from an examination of the ways in which sex biases permeates such a system, the market is far from perfect.

STOP. **Think about how you might form a model of the process by which people become committed to a field of study. *Hint:* Maybe they learn to like what they are good at.**

Consider the following simple model of the process:

1. There exists a set of alternative fields (for example, political science, history, mathematics).
2. There is a set of basic ability dimensions (for example, verbal fluency, problem solving, imagery). Success in the various fields depends upon the possession of some combination of these talents; the talents leading to success in the various fields overlap considerably, though they are not identical. There is also a random component (error) in success within each field.

The magnitude of the random component varies from field to field.

3. Each child is characterized by a value (score) on each basic ability dimension. Although the correlation among these values is strongly positive, it is not perfect.
4. Initially, a child has no preferences among these fields; children develop preferences on the basis of experience, tending to prefer those in which they are successful; they modify subsequent experiences (insofar as possible) to increase the time spent in fields that are preferred.

Within the model the process by which preferences are developed is simple. A child is presented with a series of opportunities to choose an academic interest; a choice is made on the basis of initial preferences; some level of success or failure is experienced, depending on the relation among the child's abilities, the abilities necessary for success in the field, and some random component; preferences among the various alternative interests are modified on the basis of success.

Such a model is hardly adequate to explain all features of the choice of major; it does, however, capture (or at least is consistent with) the major features of currently received doctrine about (1) individual abilities, (2) the relation between talent and performance in a field, and (3) individual learning of preferences.

STOP AND THINK. **What does the model leave out? Are there important factors omitted by this simplification?**

You may have noted two conspicuous factors that have been ignored by our gradual commitment model.

1. *Market Value.* A strict adaptation model ignores anticipations of future economic and social successes associated with various occupations and thus with various fields. At least some of the enthusiasm for medicine as a career stems from expectations on the part of students (and their parents) of the economic and social position that such a career confers.
2. *Social Norms.* The appropriateness of certain fields (and certain talents) for certain people is regulated by social rules as well as by adaptation to intrinsic talent. Most conspicuous among rules are the regulations related to ethnic group status and sex. Moreover, expectations with respect to the match between ethnic group or sex on the one hand and performance on the other form a major filter for the interpretation of success.

This description of an individual adaptation model subject to the outside press of the market and social norms is reasonable. It is also prima facie efficient and neutral; the process will tend to match up abilities and interests.

The model also predicts some other things. For example, it predicts that the speed of commitment by an individual to a field will depend on the variance of abilities in the individual (that is, those whose abilities are relatively specialized will become committed earlier than those whose ability levels are relatively equal for a wide range of fields); on the relative specialization of the field (that is, fields requiring abilities that are not required by other fields will tend to secure commitment relatively early); on the general level of ability of the individual (that is, those with relatively high ability will tend to become committed before those with relatively low ability); and on the magnitude of the random component in determining success in a field (that is, fields with a high random component will tend to secure later commitment and to attract relatively less able individuals).

According to this model, the social and behavioral sciences, for example, will tend to recruit those students with high abilities in relevant areas, although it will lose some students having high social science ability to other fields when those students also had high abilities relevant to the other fields (particularly to fields with heavy overlap in the abilities required for success). Subject to "errors" in allocation due to chance elements in rewards, time limitations on experience, variations in market values, and social norms, the process allocates students to the places in which their abilities lie.

The errors of allocation, however, are important. If we are interested in understanding some features of how one becomes a social science major, we may be particularly interested in discovering features in the process that might produce systematic errors in the choice of social science.

STOP. **Review the process we have specified. Can you see any way in which the selection of a social science major might be systematically biased?**

If our model is correct, development of interest in behavioral and social science is subject to several sources of error:

1. Virtually nothing of the behavioral and social sciences is taught in the first 12 years of American schools. The exceptions are small and somewhat misleading: Geography (that is, maps, place names, and the distribution of natural and human resources), civics (that is, constitutional and legal forms), and modern history comprise the normal fare (perhaps supplemented with an exposure to sex and family living). In some schools there is an effort to introduce a bit of economics, psychology, cultural anthropology, or sociology; but these efforts touch an insignificant number of students rather late in their precollegiate days. "Social studies" in the American school is frequently history with an hour's discussion of current events on Friday.

2. The skills required in the social and behavioral sciences are far from unique to those fields. If we assume that the skills required for a modern social or behavioral scientist include the skills of analysis, model building, hypothesis forming, speculation, data interpreting, and problem solving, it is clear that social science deals in widely demanded skills. In particular, it seems obvious that such skills are highly correlated with the skills involved in mathematics, natural sciences, history, and creative writing.

3. Social norms leading students toward social science tend to be antianalytical. The behavioral sciences are associated (quite appropriately) with human beings and social problems. As a result, they are associated (quite inappropriately) with a rejection of things, quantities, abstractions, and special skills. The norms tend often to be relatively "antiprofessional."

4. The social sciences appear to have a relatively high random component in their evaluation procedures. The reliability of grading appears to be less than in some other fields. As a result, students of relatively low ability do, on the average, better in social science than in other fields—even if the average preformance and average ability levels are held constant.

When we superimpose these facts on the basic model, we obtain a series of predictions about possible errors in the choice of social science as a field of interest:

1. Since the abilities appropriate to the social and behavioral sciences are similar to, or correlated with, the abilities appropriate to fields more commonly offered at the precollegiate level (for example, mathematics, natural science, history, English), many students with high potential for work in social science will have learned to prefer (and have a commitment to) another field by the time they come to college.
2. A disproportionate share of those students who say they want to be social scientists on entering college will be "residual students," students who have not as yet found a field for commitment. In effect, this means that many will be students who are not particularly good at mathematics, physics, chemistry, English, history, or biology.
3. Insofar as a student has learned to prefer social science in his precollegiate training, he will have learned to prefer social science in terms of some combination of current events, social and human problems, and institutional description, or (disproportionately) because of error in the earlier evaluation scheme.

The fundamental conclusion can be stated in a grossly simple way: If our model is correct, many social science students will be either inept at necessary skills or persuaded that those skills are irrelevant; many students with the skills necessary for social science will be strongly committed to competitive fields long before college or graduate school. This will be true in general, but it will be less true of individuals (for instance, women, blacks) who are channeled into social science by social norms than of other groups; it will be less true of fields that provide good economic prospects (for instance, economics, law) than other fields.

We have pondered the implications of such a model for the teaching of social science. As teachers, we have sometimes feared that some of our students might be expecting the wrong things from social science; that some students who would be good social scientists never took the right courses; and that some of the enthusiasm and intelligence of our students was buried beneath learned instincts for pedantry. This book, in fact, is a partial response to these concerns.

We have also pondered the implications of the model for understanding why we became social scientists. Was it really because we were not very good at anything else? We do not think so, and we have taken solace in the observation that good models of

human behavior are rarely precise interpretations of individual actions.

For example, suppose one of our models generates the following prediction: Wealthy people tend to be more politically conservative than poor people. This is a good prediction about human behavior. But it does not necessarily describe an individual. Former Mayor Lindsay of New York is both wealthy and liberal. So are many other people. We do not expect such a model to predict individual human behavior; we only expect it to predict appreciably better than chance. If we questioned wealthy people about their political views and discovered that 60% were conservative, while only 20% of poor people were conservative, we would say that the model did a reasonably good job of predicting aggregate human behavior.

The prediction that wealthy individuals will tend to be politically conservative is still useful and interesting even if you know some wealthy individuals who are not. Thus if you were soliciting votes for a liberal cause, you would know that your chances of obtaining support from wealthy people would be relatively low. You might concentrate your efforts on other segments of the population and advertise in *Newsweek* rather than in the *Wall Street Journal*.

Thus although our model of how errors are made in the discovery of an interest in social science suggests that there will be more mistakes in social science than in some other fields, it does not necessarily apply to us, or to you. On the other hand, even if it does apply and we are here for all kinds of "erroneous" reasons, we have nevertheless rather grown to like it; and you might also.

2.8 THE POLITICS OF POPULATION

Human societies sometimes face a population problem. A population problem exists when it is generally agreed within the society that the natural processes of birth and death are creating economic or social difficulties and should be modified. Historically, different societies have reacted to this situation in different ways. For example, some societies have increased the average life expectancy of their citizens through improved health-care systems. Some societies have increased the death rate selectively with respect to age, sex, and social class through wars, infanticide, or inefficient health care. Some societies have decreased, or increased, the birth rate through modifying social norms with respect to homosexuality

or marriage, through encouraging women to work outside the home or to stay home, through contraceptives, or through moral persuasion.

> ***STOP.*** **Since this kind of question is profoundly important ethically, we might wish to speculate about the process by which societies arrive at different solutions to the population problem. Under what circumstances will societies engage in infanticide, birth control, medical research, women's liberation, or war? What is the process involved?**

A possible way of looking at the problem follows. Since any population is limited by some kinds of scarce resources, a society decides who will share in those resources. One aspect of that decision is the question of who will live and who will not. Any combination of policies with respect to health care, birth control, work, war, and social norms is a decision about whose life will be relatively favored in the society and whose will be relatively unfavored. In this sense every society discriminates in favor of some people and against others.

Suppose we think of society as consisting of various age groups (for example, old people, young adults, children, unborn). Various possible population control procedures clearly have different consequences for the different age groups. A society that invests money in research on cancer and heart disease, for example, discriminates in favor of middle- and old-age people. A society that practices infanticide discriminates against babies. A society that practices birth control discriminates against the unborn.

If we look at the problem this way, our task becomes that of identifying a process by which a society might come to discriminate in one way or the other.

> ***STOP AND THINK.*** **Can you form any hypotheses about the decision process within a society?**

You might have said something like this:

Individuals and groups within a society pursue their own self-interests. It is in the interest of every individual to promote

discrimination in favor of his own age group and other age groups to which he expects to belong. Each group of individuals within the society has a certain amount of power. The greater the relative power of a group, the greater the discrimination in its favor.

A moment's reflection on the power structure within societies immediately suggests two predictions:

1. All societies will tend to discriminate against the unborn. That is, faced with an overpopulation problem, they will tend to prefer birth control to increasing the death rate.
2. The broader the sharing of power within the living society (for example, the more democratic it is), the greater the discrimination against the unborn.

The first of these predictions sounds interesting and provocative, but it is not easy to evaluate. The second, however, can be examined. A social scientist who did not have this specific problem in mind has invented a measure of the democracy of a political system and has applied it to some modern political systems. His results are presented in Table 2.1 along with crude birth and death rates.

Our model says that relatively democratic countries will discriminate more against the unborn than will relatively undemocratic countries. This means that we would expect to find that relatively democratic countries had relatively low birth rates and relatively long life expectancies. Is this the case?

STOP. **Think about how you would decide whether these data support the model.**

One procedure that might have occurred to you is to plot pairs of observations as we have done in Figures 2.2 and 2.3. In Figure 2.2 each country is a point. Each country is located on the figure according to the democratic index for that country and the crude birth rate for that country.

STOP AGAIN. **What does the model predict about such a figure?**

TABLE 2.1 Democracy, Birth Rates, and Death Rates

COUNTRY	DEMOCRATIC INDEX	CRUDE BIRTH RATE	DEATH RATE 60–64 YR. OLD (MALES)
Great Britain	236.3	18.3	27.6
France	231.4	17.7	26.1
Finland	229.2	16.9	34.6
Sweden	225.8	15.9	18.6
Netherlands	220.9	19.9	33.1
Belgium	214.9	16.4	29.1
Japan	212.7	18.6	—
Luxembourg	210.1	16.0	24.7
Norway	209.7	17.5	16.5
New Zealand	209.4	22.8	26.3
Denmark	205.7	18.0	19.3
Israel	203.2	25.8	26.8
W. Germany	199.4	17.9	—
Italy	198.6	19.2	21.8
Canada	196.8	21.4	23.5
United States	190.9	19.4	29.2
Venezuela	188.3	—	—
Austria	186.9	17.9	—
Chile	184.6	32.8	—
Ireland	181.4	22.1	27.0
India	172.7	—	—
Switzerland	169.3	18.8	25.6
Mexico	121.9	44.2	41.8

Source: Deane E. Neubauer, "Some Conditions of Democracy," *American Political Science Review* 61 (1967) 1002–1009. Reprinted with permission.

According to our model more democratic countries will discriminate *more* against the unborn. Thus a high democratic index should lead to a low birth rate. This appears to be generally true. One quick and inelegant way of checking is to draw a vertical line through the middle (*median*) value with respect to birth rate. These are the dashed lines in Figure 2.2. These lines divide the space into four rectangular areas. If our model is correct, we should find that the points are concentrated in the upper left and lower right areas. If you check, you will find that there are fourteen points in these two areas and only four points in the other two.

In Figure 2.3 each country is again a point. Here the points are located according to the democratic index for that country and the crude death date for 60–64-year-old males in that country. We have drawn the equivalent dashed lines.

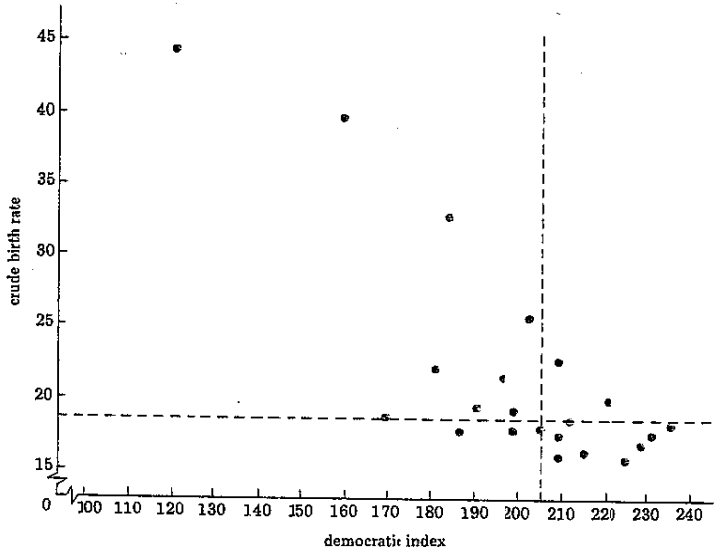

Figure 2.2: Democracy and birth rates.

STOP. **What does the model predict?**

Our model predicts that the more democratic countries will discriminate *less* against 60–64-year-olds. Thus we predict that a high democratic index will be associated with low death rate. This does not appear to be true. Our data arrange themselves so that there are exactly four points in each of three of the quadrants and five points in the fourth.

STOP. **Can you generate any other predictions that might be wrong? So far we have talked mostly about good predictions, but much of the art of model building lies in finding bad predictions.**

At least one other problematic prediction occurs to us. We have talked entirely about age groups and the relatively weak

political position of the unborn. In effect, we have developed the implications of a pure political model in which the powerful discriminate against the less powerful. There are other political groups that are relatively weak. Consider blacks in the United States, who have, by almost any plausible measure, less political power on the average than whites. Thus, according to the model, you would expect that age-specific death rates would be higher and age-specific birth rates lower among blacks than among whites. In fact, the first proposition is true, but the second is not.

One possible explanation is that this is something unique to the problems of blacks in America. However, this thought can be quickly dispelled. Spanish-speaking Americans also have less political power on the average than do Anglos. Yet birth rates and death rates are both high among Spanish-speaking Americans. Such a situation appears to have been true historically for many minority groups within the United States. American society seems systematically to discriminate against living members of ethnic minority groups and against unborn children of dominant social groups.

Thus it is possible that our model is simply wrong. One of the important realities of model building is that not all predictions

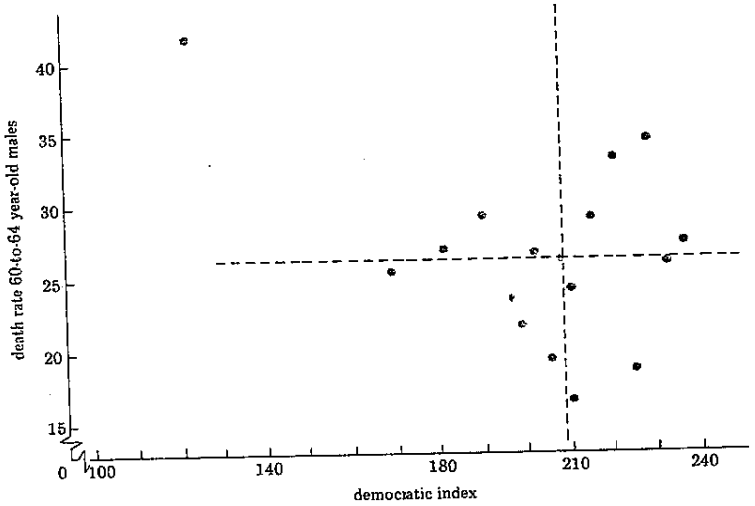

Figure 2.3: Democracy and death rates.

are correct. Indeed, as we will suggest in more detail in the next chapter, although we enjoy being right, most theoretical development comes from being wrong.

9 THREE RULES OF THUMB FOR MODEL BUILDING

Model building as you have done it in this chapter is not a novel activity. It is something we all do all the time. We speculate about things that happen to us or that we see happening to others. It is not mysterious, but it probably can be improved by a little attention to some elementary rules. In Chapter Three we will suggest some more detailed rules of thumb. Here we will simply note three general rules that we have been using repeatedly in making the speculations in this chapter. They are probably sensible much of the time, though they are not absolute truths.

> ***Rule 1: Think "Process."*** *A good model is almost always a statement about a process, and many bad models fail because they have no sense of process. When you build a model, look at it for a moment and see if it has some statement of process in it.*

Example

Your chemistry professor shows up in class but has forgotten to bring along last week's homework papers. He apologizes, and you turn to the person next to you and say, "What can you expect from absent-minded professors?" This is your explanatory model for the professor's behavior. This is a common, ordinary, but poor model. Look at it for a moment. Where is the process? One way to put a process into the model is to ask *why* professors are absent-minded. If you think about it for a moment, you will be able to think of a number of processes that might produce absent-minded professors.

> ***Model 1.*** Busy people try to devote their limited time to the things they consider most important. The professor does not consider teaching important, and so he did not bother to go by his office and find the homework papers.
>
> ***Model 2.*** You become a professor by learning to be a good problem solver. Good problem solving involves almost single-minded concentration. So the professor occasionally forgets to do one thing because he is concentrating on another.

The models are different from each other, but each involves a sense of process, or relationship. One way to be certain that your models involve a sense of process is to see if you can derive general relational statements from them, that is: The greater X is, the greater Y will be. Thus Model 1 contains the following general relational statement: The busier someone is, the more likely he is to concentrate on important things. And Model 2 contains this general relational statement: The tougher the problem and the harder someone is concentrating on it, the more likely he is to forget other things.

> ***Rule 2: Develop Interesting Implications.*** *Much of the fun in model building lies in finding interesting implications in your models. In the problems associated with this course you will repeatedly be asked to develop interesting implications from some model. Whether something is considered interesting obviously involves a judgment, but there is a good strategy for producing interesting predictions: Look for natural experiments.*

Example

An uninteresting prediction from Model 1 would be: Make the professor value his students more, and he will then become less absent-minded. Or from Model 2: Get the professor to work on easier problems, and he will become less absent-minded These are relatively uninteresting because they ask us to run an experiment in a situation in which we probably cannot.

The way to find more interesting predictions is to think about the process involved in each model and then look for natural instances in which the key variables in the process vary. In Model 2, for example, it is not simple to vary the difficulty of the professor's problems, but you can easily find instances of similar situations and hence can predict that people (business executives, architects, football coaches) in other occupations that demand concentrated, abstract thought will occasionally forget things, too. Or you can predict that the professor will be just as absent-minded when engaged in his laboratory research as when he is engaged in teaching.

Or, for Model 1, you cannot easily make the professor value

some given class of students more, but you can search for natural occurrences of this event. For example, if you believe that he values the students in his graduate research seminar more than the students in his freshman introductory class, you would predict less absent-minded behavior with respect to the graduate students. Suppose you did make such observations and discovered that he was equally forgetful in his graduate classes; and furthermore that his freshmen lectures are well prepared, that he seems to have great quantities of careful notes, and that he often spends so much time answering questions after the freshman class that he is late for his next class. You would then be highly skeptical of the truth of Model 1.

> ***Rule 3: Look for Generality.*** *Ordinarily, the more situations a model applies to, the better it is and the greater the variety of possible implications. Finding generality involves the ordinary process of generalizing nouns and verbs.*

Example

Expand "college professors" to "busy people"; expand "forgetting homework papers" to "forgetting anything"; expand "bringing papers" to "one kind of work." Finding generality also involves asking repeatedly why the process we have postulated is true. We ask: Is there another model that, if true, would include our model as an implication? That is, we look for a more general model that predicts our model and other things as well. Model 2, for instance, can be generalized to a large family of learning models that can be formulated to predict what would happen if people learned to be good social scientists (see Section 2.7) or executives (see Chapter Six).

From such simple heuristics, a little experience, some playfulness, and a bit of luck come good models, and some bad ones. Indeed, it is the creativity with which we specify bad models that leads us to good ones.

References

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Arthur L. Stinchcombe, *Constructing Social Theories* (New York: Harcourt Brace Jovanovich, 1968).

Josephine Tey, *The Daughter of Time* (London: Macmillan, 1951).

Notes

[1] Martin Deutsch and Mary Evan Collins, "Interracial Housing," in William Peterson, ed., *American Social Patterns*, (Garden City, N.Y.: Doubleday, 1956).

[2] Actually, the process implicit in this model should be clarified somewhat. We are *not* saying that out of every 100 people there are 70 who are inherently like us and who could become our friends and 30 people who are inherently different from us who could become our enemies; and communication allows us to identify the two different groups. Rather, the model says that almost anyone is capable of becoming either a friend or enemy, depending on whether you communicate about your similarities or your differences.

[3] Note an alternative theory: People on commissions want to have their reports implemented. They believe (from experience?) that extreme reports rarely are implemented.

Problems

A Note for Instructors. The problems in this book are designed to stimulate thought. For many of the problems, especially those in Chapters 2 and 3, there are no unique correct answers; rather, there are only thoughtful and nonthoughtful answers, or creative/noncreative answers. The amount of written material in the book has deliberately been kept terse to allow more time for thought. In effect, we postulate a Gresham's Law of Study: Faced with a choice of reading about something versus thinking about it, people will choose reading. Reading drives out thinking. Reading is a well-defined technology at which most of us are relatively competent; it provides easily recognized benchmarks of progress and completion, and it can be accomplished with certainty in some easily predicted time period.

Reducing the necessary reading time is only part of the solution, though. We also need to make thinking more attractive and rewarding. One way to do this is the formation of small problem-set groups. Each group meets outside of class to discuss the problems and ultimately turns

.1 INTRODUCTION

In Chapter Two we asked you to consider which of several models for the dumb football player was "best." It is a tough question. Possible complications in evaluating models fill large sections in libraries. This is a short book and, as a consequence, we clearly will not do justice to the complexity of scientific methodology. As a further consequence, we are free to present a somewhat personal interpretation of the evaluation of models.

The construction and contemplation of models are aesthetic experiences. Like other aesthetic experiences they become richer and more enjoyable with an appreciation of their nuances. The dicta of methodology are nothing more mysterious than rules of thumb for improving the artistry of speculations. What we present here are some rather simple points of view about truth, beauty, and justice that we, and others, have found helpful in heightening the pleasures and usefulness of model building in social science.

.2 TRUTH

Some of the pleasures of social science come from the difficulty of discovering models that are *correct*. Because this is hard work we devote a good deal of imagination and effort to discovering how one model might be more correct than another. The skills and techniques we use are similar to those of a clever and thoroughly responsible detective—"clever" because we need some imagination in inventing theories of what is happening and fitting them to the facts; "thoroughly responsible" because we need to find not only one explanation of the facts but the best possible explanation among many.

We can start by asking how we assess the correctness of any single model. How do we determine whether a model is consistent with reality? In order to assess truth value, we must be able to compare assertions of the model with observations of the real world. In short, a good model must be testable; it must make assertions that can be verified or disproved.

An introductory social science class was asked to make models that might explain protests and riots by college students during the late 1960s and to explain how their models might be tested.

STOP AND DO IT. **Determine what kind of answer you would give. Make up at least one model; then describe how you would test it.**

Following are three poor answers that were submitted by the students. Read them critically. Try to figure out what makes them poor.

Answer 1

Model. "People resent being told what to do and will express this resentment if they get a chance. College students are told how to run their lives by both their parents and college authorities and both parents and authorities use various kinds of threats to prevent the expression of resentment; the recent change to permissive regulations at colleges gives students a chance to express resentment."

How to Test the Model. "Distribute a questionnaire among college students and ask them if they resent being told what to do. You could also ask parents if they use threats to control behavior."

STOP AND THINK. **Can you see what is wrong with this answer? It could be either the model, the testing procedure, or both that are at fault.**

Although the model in Answer 1 is potentially testable, the testing procedure is weak. The proposed test is an attempt to examine the model's assumptions by interviewing the people involved. To test a model you generally want to test the truth of its derivations, rather than the truth of its assumptions. Assumptions are a part of your model, and you would probably prefer them to be true rather than false. Our reasons for suggesting that you test derivations rather than assumptions are mostly tactical. First, many good models are based on seemingly unreasonable assumptions, and we do not want you to reject potentially fruitful ideas too rapidly. Second, testing assumptions is likely to be uncommonly difficult because they are often assertions about

things that cannot be observed directly. Third, leaping to test assumptions is likely to keep you from trying to figure out what derivations the model has. Learn to exercise the model before you start testing it. The trick is to test the whole model, including all its derivations.

In addition, Answer 1 has lazy testing procedures. The mistake is asking the people involved why something has happened. There is nothing wrong with this as a way of getting some ideas. But even if all students claim that parents use threats to control behavior, this does not make the statement true. You must still find out whether what the students believe (or answer) is the correct theory. Interviewing is an important technique in research, but the circumstances under which respondents are good theorists are limited.

When we look for interesting derivations to test, we note that the key variables involved in the process are the degree of threat and people's sensitivity to the threat. So you look for natural instances in which these two key variables vary.

Some colleges have stricter regulations and harsher penalties for student infractions than other colleges. The model says that there will be fewer riots on the stricter campuses. On any given campus some students are more sensitive to administrative threats than other students are. Students nearing graduation have more to lose through suspension than freshmen do. Students without definite career plans and those who have only marginal needs for a degree also have less to lose through suspension. Hence we can make some predictions about the relative likelihood that different students will take part in riots.

Answer 2

> **Model.** "People become unreasonable when they are frustrated. Attempts by college students to make changes at the college are usually ignored or postponed by college administrators.
>
> **How to Test the Model.** "Examine the record of student riots on many campuses to see if the model is true."
>
> ***STOP AND THINK.*** **Can you see what is wrong with this answer? It could be either the model, the testing procedure, or both that are at fault.**

The model given in Answer 2 is good, but again the testing procedure is not. What would you look for and how would you interpret it? There is too little information given to judge the adequacy of the test. A reasonable test of the model might be as follows: The model predicts that there should be much less student unrest on those campuses where student attempts at change were successful. Examine the recent history of many colleges and divide them into two groups—those in which student attempts at change were successful and those in which they were not. If the model is valid, the successful group should have a lower incidence of student unrest.

Answer 3

> **Model.** "The taxpayers make great sacrifices to provide free education for students. Students, therefore, owe it to the taxpayers not to abuse this freedom."
>
> **How to Test the Model.** "Find out what percentage of the state and federal budgets goes to support higher education. Determine if there are other things that taxpayers would rather spend the money on."
>
> ***STOP AND THINK.*** **Can you see what is wrong with this answer? It could be either the model, the testing procedure, or both that are at fault.**

Answer 3 is weak on several counts. First, it is obvious that the test proposed is a test of the model's assumptions rather than of its predictions. A more fundamental difficulty is that the model has no process; it has nothing to do with predicting student behavior. It is not a statement about how people actually behave, but rather a statement about how people ought to behave. It is not an explanation of the causes of student protest but simply a condemnation of them.

With these comments in mind the student reformulated Answer 3 as follows:

> **Model.** "The taxpayers make great sacrifices to provide free education for students. People only value what they pay for.

Since students do not pay for their education, they are willing to disrupt it by protesting."

The student also derived some predictions to test the model:

"1. Taxpayers will place a higher value on education than the people who are getting it and will be more upset than students when it is disrupted.
2. Those students who are working to pay for their education will be much less inclined to participate in disturbances.
3. Raising tuition so that more students will be forced to work will decrease the number of protest incidents."

This is a very good answer (though this is not to say that it is necessarily correct). The model is well formulated, and the predictions are interesting. Testing the first and second predictions is comparatively easy. The third prediction will require some ingenuity to test, since we may have to wait for "nature" to perform the experiment.

There is elaborate debate in the social sciences on the question of what it means to say we "understand" or "explain" human behavior. We do not intend to entangle you in the debate. You should know, however, that one school of thought equates the ability to predict with the ability to understand; according to another school of thought, prediction per se is less critical. We propose a somewhat less doctrinaire rule: A model that has empirically correct derivations is better than a model that does not unless you have other strong reasons for thinking it is unsatisfying. When you think you understand some type of human behavior but your predictions keep turning out wrong, and you keep having to add more special exceptions to your model, you should check to see how much of your "understanding" was only self-delusion.

3.2.1 CIRCULAR MODELS

Think about the following model: When the Rain Dance ceremony is properly performed, *and all the participants have pure hearts*, it will bring rain.

STOP AND THINK. **Is this a testable model? Why?**

As ordinarily used, the model is not testable. It cannot be disproved. If the ceremony occurs and it does rain, then the model is verified; but if the ceremony occurs and there is no rain, then the model is also verified because we take the lack of rain as evidence that some of the participants must have had evil hearts. No matter what happens, the model can account for it; it is always "correct" because it is circular. For our purposes it is a bad model because it does not satisfy the fundamental requirement of testability.

Circular models can take other forms as well. Consider, for example, statements of the following general form: "People pursue their own self-interests." We used such a statement in one of the models in Chapter Two. There is a rather elaborate literature and an even more extended history of cocktail-party conversations on the question of whether this statement is true or false.

STOP AND THINK. **What do you believe? How did you decide? What are the issues?**

If you answered that the statement is true, you may well have meant either of two things:

1. Whatever people do must be in their self-interest or they would not do it.
2. Models that include a self-interest assumption turn out to make correct predictions.

Either of these meanings is perfectly sensible, but they are fundamentally different. The first is a definition of an observational procedure. It says that we can discover something about a person's values by observing his behavior—if he does X instead of Y, it is probably because he values X more. However, we can easily get into trouble if we take this first meaning to be an assertion about human behavior as well, for we will be liable to the circularity of inferring someone's values from their behavior, and then predicting the same behavior from the values we have just defined.

The second meaning says that self-interest assumptions are often useful in our models; they help produce correct predictions. However, we must be careful that the observational procedures used to test a model's predictions are carefully specified in advance, for again it is easy to fall into the circularity of allowing a loose definition to confirm any possible empirical result.

The possible circularities in either meaning of self-interest are, of course, no more defensible than the beliefs about rain and evil hearts.

3.2.2 CRITICAL EXPERIMENTS

So far we have considered the case of testing a single model. Although such situations arise, we generally prefer to *compare alterative models* rather than accept or reject a single model. Suppose we consider the models produced to explain the dumb question in Section 2.3. What do we need to do to examine the comparative correctness of these models? Recall that we had three alternative models, each of which was consistent with the observation that a football player asked a dumb question.

Model 1. Being a good athlete requires large amounts of practice time; being smart in class requires large amounts of study time. The amount of free time is so limited that we cannot both study and practice well

Model 2. Everyone wants to feel successful. Achieving success in any one area, for example, athletics, is enough to make most people content.

Model 3. We tend to be jealous of success in others. When we are jealous of someone, we attempt unconsciously to lower his apparent success in class by interpreting his questions as "dumb."

To choose among different models, each of which explains the same event, you must find some new question to which they give *different* answers. Such a question defines a "critical experiment," that is, an observation that will allow us to choose among alternative reasonable models. For example, when the football season is over the first model predicts that football players will have extra time to study and their questions will improve. The second and third models predict that the behavior will be unchanged, since recognition presumably extends beyond the football season.

STOP AND THINK. **Suppose we obtain some new data: Football season has ended, and the classroom questions of football players have improved substantially. Given this new information, which of the three models is correct? Why? Why are these new data critical?**

Up until now the three models looked equally good—each provided a clear explanation of the original observation (the dumb question). The new data are critical because the three models do not provide equally good explanations of it. In fact, only Model 1 explains (is consistent with) the new data. Models 2 and 3 are contradicted by it.

Another possible critical experiment occurs in schools that de-emphasize athletics. Suppose that athletic success is a matter of indifference to a student body, but scholarly success is valued very highly. Model 1 predicts that athletes will still ask dumb questions during football season because of the time constraints on them; Model 2 predicts that athletes will work hard to get their recognition in the academic area and will tend to ask better questions than Model 1 predicted; Model 3 predicts that the questions asked by athletes would appear better than in Model 1.

We have now found two situations in which Model 1 makes different predictions from Models 2 and 3. Can we find any situation that differentiates between Models 2 and 3?

Yes, we can. One possibility is the following: Suppose we distinguish between football players who are easily recognized as football players (for instance, by the sweaters they wear, by their size, by their language, and so forth) and other kinds of athletes (for instance, fencers, soccer players, and so forth) who are not easily recognized as athletes. Then Models 1 and 2 predict that both groups will ask dumb questions; Model 3, however, predicts that they will not.

So we can construct Table 3.1. Now you can collect the appropriate data and decide which model is best (although you may find that none of them is very good).

In order to have a critical experiment, you need at least two different models. It is obviously more work to figure out two possible explanations than to figure out one, but there are substantial benefits associated with this extra bit of work. If you have two possible explanations, you will be forced to decide which is better. You will have to look for some situation in which they predict different outcomes so that one model may be supported and the other contradicted. The process of figuring out what might be such

TABLE 3.1 Truth Table for the Dumb Question Models

QUESTION	MODEL 1 Limited Time	MODEL 2 Need Success	MODEL 3 Jealousy
Will athletes ask dumb questions "out-of-season"?	no	yes	yes
Will athletes ask dumb questions in schools that de-emphasize athletics?	yes	no	no
Will athletes who do not look like athletes ask dumb questions?	yes	yes	no

a critical event will clarify your explanations. You will have to sharpen the models, define them more precisely, and clarify their underlying processes before you can discover critical events. Doing your speculative thinking in this way will generally help you develop more interesting predictions.

3.2.3 THE IMPORTANCE OF BEING WRONG

You may have noticed the difference between the fundamental logic of model building and the fundamental logic of debate. The difference lies in the indispensability of being wrong. That is, having tried as hard as we can to define a true model, we are then (contrary to any reasonably normal human behavior) expected to delight in finding out what is wrong with it. The problem is to avoid "falling in love" with our own models, or prejudices. We must evaluate them rather than simply defend them. Most of us have difficulty doing this.

In our experience there are three major ways in which we can protect ourselves from the insidious tendency to defend, rather than destroy, models. The first of these is to think as much as possible in terms of *alternative models*. We have already suggested that such thinking sharpens the models and defines the kinds of critical observations to which we should devote our observational effort. At the same time, it is a powerful emotional aid. By testing alternative models in a critical experiment, we are, at least in principle, guaranteed to have one model succeed as the other fails.

A second way to make the pursuit of truth more possible is to make it less important. One of the reasons for considering alternative criteria for evaluating models in social science is to

relieve the pains of failure with respect to discerning truth. Even if beauty and justice were not important in their own rights, belief in them would still provide a basis for admitting failures with respect to the truth criterion.

A final protection from the danger of believing too fervently in a theory is to be intellectually *playful*. Model building is a serious pastime with serious consequences. For this reason it should not be done "seriously." The importance of the work and our own pride in it guarantee that we will not ignore information about correctness. Playfulness about ideas in general blurs our commitment to any specific ones and increases our willingness to recognize when they are wrong.

3.3 BEAUTY

Truth is an important quality that is emphasized in most treatises on the evaluation of models. Many people consider it the most important quality, at least when writing about the activity of model building rather than doing it. It is the least ambiguous quality. But truth is not the sole criterion for evaluating our efforts.

Models are art. Their contemplation should produce aesthetic pleasure. Many wise words have been written on the general problems of aesthetics, and several gifted theorists have described the importance of beauty in their own work. Such commentary should be savored directly rather than summarized. We will simply call your attention to three important aspects that seem significant to us in our own understanding of the pleasures of beauty.

3.3.1 SIMPLICITY

A beautiful model is simple. A theory that has a small number of assumptions is more attractive than one having a large number of assumptions. For example, suppose we have the map of a village shown in Figure 3.1. All of the people in the village live along the shore of the lake, and a visiting anthropologist has noticed that they can be divided into four groups:

Group A
Lives on the north end of the lake. A-type people generally travel clockwise to the store and counterclockwise to the church.

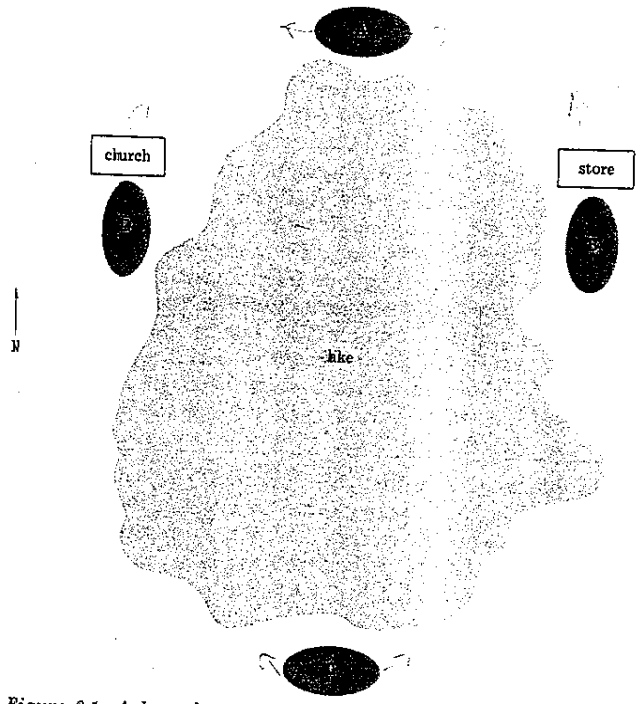

Figure 3.1: A hypothetical village.

Group B
Lives on the east shore of the lake. B-type people generally travel in a counterclockwise direction regardless of where they are going.

Group C
Lives on the south shore of the lake. C-type people generally travel clockwise to the church and counterclockwise to the store.

Group D
Lives on the west shore of the lake. D-type people generally travel in a clockwise direction regardless of where they are going.

We might propose the following model as an explanation of the observed behavior:

> Individuals have innate preferences for walking in a clockwise or counterclockwise direction. Among a group of neighbors these preferences will be shared. Group A prefers to go clockwise to shop and counterclockwise to pray. Group C prefers the opposite. Group B prefers always to go counterclockwise. Group D prefers the opposite.

Such a model does, in fact, produce the observed facts as an implication. Compare it, however, with the following model:

> Humans try to accomplish their goals with the least possible effort.

Quite aside from its other attractive properties, the "least effort" model has the beauty of simplicity.

Or consider the following observation: Most parliamentary democracies outside the Anglo-Saxon world utilize some form of proportional representation. That is, the election system is designed to produce an assignment of parliamentary seats to the various parties such that each party has about the same proportion of votes in parliament as it received in the last election. Most Anglo-Saxon electoral systems are not systems of proportional representation. How might we explain this difference?

There are many possible explanations involving a variety of variables, including national character, socioeconomic conditions, historical development, class structure, and political maturity. One simple model, however, is as follows:

> Assume that a democratic political system acts to satisfy the following constraints on the rules that assign seats to parties on the basis of votes received:
> 1. The labels attached to the parties should be irrelevant. No party should be discriminated against.
> 2. Party legislative strength should depend only on its voting strength. It should depend neither on considerations other than the vote nor on the way the rest of the vote is distributed among other parties.

It can be shown that these assumptions imply proportional representation for any country having more than two parties. For a country having only two parties (a frequent condition in Anglo-Saxon countries) the model predicts a large number of possible systems (including the one observed in the United States and the United Kingdom). Thus we can predict the relative frequency of proportional representation in two-party and multiparty countries from nothing more than the assumption that the system is constrained by our two requirements.[1]

On the whole, the social sciences have had difficulty in keeping models simple. Partly, this is because the world is complex but it is also because we are too close to its complexity; we are frequently overly concerned about the adverse consequences of abstraction and not sufficiently attentive to the elegance of simplicity. We can list a small set of precepts for increasing the simplicity of speculations:

1. Do not try to say everything you know every time you speak. Some things will be omitted. This is in fact your goal.
2. Do not worry about counterexamples to your assumptions. The object is to interpret behavior, not to describe it.
3. Remember your listeners have less time to devote to this problem than you do, and they may not be too much smarter than you.

3.3.2 FERTILITY

A beautiful model is fertile. It produces a relatively large number of interesting predictions per assumption. For example, think about the following model:

> When Mr. Jones is angry, he kicks his cat.

The model is not very attractive because it is too limited. It applies only to one person (Mr. Jones); even so, it only describes his reaction to one kind of emotion (anger) and to one kind of being (his cat). A more fertile model would be:

> People kick pets when they feel bad.

This model applies to more people, more kinds of emotions, and more kinds of animals. It is still limited to animals though. A still more fertile model would be:

> Unhappy people vent their feelings on objects that cannot retaliate.

This is obviously a more fertile model than we started with. It produces a wide variety of specific predictions—for example, the conditions for wife beating.

To be fertile a model must be general. As we suggested in Chapter Two and further illustrated here, the problems of generality are susceptible to some elementary devices that should not be secrets. They involve nothing more profound than using your knowledge of language to make both nouns and verbs somewhat more general. For example, assumptions in a model are often stated as sentences in the form: *A person of type P will do behavior B in situation S.* Thus: Little men often start an argument in the presence of a big man. We wish to make this assumption more fertile by making P, B, and S more general. We look for nouns and verbs that include our original nouns and verbs as "special cases."

Consider the following development of our original statement:

> Little men often start an argument in the presence of big men.
>
> ↓
>
> Little *people* often start an argument in the presence of big *people*.
>
> ↓
>
> Little people often are *verbally aggressive* in the presence of big people.
>
> ↓
>
> People who are *physically disadvantaged* often are verbally aggressive in the presence of *physically advantaged* people.
>
> ↓
>
> Among people, *inequalities* in one domain lead to aggression in another.

The device of substituting more general words has helped us to build a more general model.

This specific chain is not the only possible way in which the original observation could have been made more fertile. But from an original, very narrow assertion, we now have another rather general addition to our "theory" of aggression. It predicts, for example, that a person will be more sharp-tongued about intellectual matters in the presence of others who are sexier than he (or she) than in the presence of others who are about equal in sexiness; and that a person will be more aggressive sexually in the presence of

others who are intellectually more adept than he (or she) in the presence of intellectual equals.

We find fertility also by looking for a more general model, a process that implies our first set of ideas. For example, suppose we have confidence in the truth of the following model:

> Commuters choosing between alternative ways of getting to work will give strong preference to the fastest mode of transportation

This model has some important implications (deductions) about the possibility of ever getting commuters to give up their cars and use public transit. But it is a very restricted model. It only applies to certain kinds of decisions (What kind of transportation should I use?) by certain kinds of people (commuters). So we work backward and see whether we can find a more general model that implies this model as one of its deductions as, for example:

> People try to minimize the amount of time spent on unpleasant or unproductive activities.

This second model clearly has the first model as one of its deductions (if we assume that commuting is regarded as an unpleasant or unproductive activity). But is it otherwise fertile? To check its fertility we ask if it can make interesting predictions about the world. It can. If the second model were true, it would imply:

1. In urban areas where walking is regarded as a means of getting between two points and hence as unproductive time, people will make straight-line paths; in parks, on the other hand, where walking is an end in itself, the paths people make will tend to meander.
2. If low speed limits are posted in a scenic area, they will tend to be ignored by local residents, who have learned to take the scenery for granted and to view travel as just a means of getting around; tourists, on the other hand, who find the view pleasant and productive, will obey the speed limits.
3. Time-related occupational specialties should arise in societies whose people are described by this model. These will include inventors who try to discover faster ways of doing things; efficiency experts who try to find faster ways of producing the inventor's products; and finally advertising men who write jingles about the "new, *time-saving* miracle ingredient, Super XZ Plus."

3.3.3 SURPRISE

A beautiful model is unpredictable. It produces some interesting implications that are surprising to us and that are not immediately obvious from the assumptions. Suppose, for example, that any system of international relations must satisfy these four axioms of alliance:

1. Friends of my friends are my friends.
2. Friends of my enemies are my enemies.
3. Enemies of my friends are my enemies.
4. Enemies of my enemies are my friends.

Assuming that such a tendency toward consistency holds and that each country has feelings about every other country, what are the possible patterns of alliances within an international system consisting of 50 countries?

> ***STOP AND THINK ABOUT IT.*** **Can you predict the pattern of alliances from this set of assumptions?**

In fact, it can be shown that according to this model there are 562,949,953,421,312 possible patterns of alliances. But each of them is characterized by one simple property—it is *bipolar*. The model predicts that the world will always be divided into no more than two groups of countries. Each of the countries within a group will be a friend of every other country within that group and an enemy of every country in the other group. (The model may become slightly more hopeful if you note that included among the 562,949,953,421,312 possibilities is one in which all countries belong to the same group and are friends—that is, one of the two bipolar groups has no members.) Thus polarization in a system of international alliances can be derived from what appear to be rather innocuous assumptions. The model has the beauty of surprise.

Or consider the following model:

Suppose we have a society with two clans (A and B). A is much larger than B. Intermarriage between the two clans is discouraged but occurs at a rate that is proportional to the frequency of contact. Contact between the two clans is limited but occurs at a rate that is proportional to the product of their relative sizes (that is, [size of A] × [size of B]). Children whose parents are both from the same clan also belong to that clan. Children whose parents are from different clans are raised as members of Clan B. Birth rates are the same in each clan.

What can we expect to see happen over time?

STOP AND THINK. **Can you say anything about the implications of such a model? What about future marriage patterns or the relative growth of the two clans?**

You might have noted the following interesting, possibly nonobvious, implications of the model:

1. Clan B will grow larger over time. In fact, Clan A simply will grow smaller and smaller until it vanishes.
2. The proportion of marriages within each generation that are *interclan* (that is, that involve spouses who are from different clans) will increase up to some point and then decrease. That point will be reached when the two clans are equal in size.
3. The proportion of Clan B members who are involved in interclan marriages will be relatively high early in the time period studied but will decline steadily thereafter. The proportion of Clan A members who will be involved in interclan marriages will be relatively low early but will rise steadily later. At the same time, the proportion of members of Clan B who will have one parent from the other clan will be relatively high early in the time period but will decline steadily later.
4. All of these phenomena are true regardless of the degree of limitation on contact between the clans or on intermarriage (so long as some occurs). However, the *rate* at which changes take place depends on the contact and intermarriage rates.

STOP AND THINK. **Go back over the model and the derivations. See if you can reconstruct how they were derived. Can you discover any others? Can you think of any possible applications of such a model? Is there any similar situation in our society?**

The description of a society with Clan A and Clan B is an abstract description, but it is not completely unrelated to some real world situations that might have occurred to you. For example, suppose that there were two religious groups in a society (for instance, Catholic and Protestant), that intermarriage between them was discouraged but did occur, that the children stemming from a marriage between members of the different religions were raised mostly as members of one of the groups (for instance, Catholics), and that that same group was initially much smaller than the other.

For an even more profound example, suppose that there were two racial groups in a society (say, black and white), that intermarriage between them was discouraged but did occur, and that the children of racially mixed marriages were defined to be members of one of the groups (say, black).

Each of these cases seems close enough to our abstract model to suggest that the surprises of the model may even be related to potential surprises in the world of our own experience.

Finally, consider the following examination of the consequences of parental preferences for male babies:

Suppose
that each couple agreed
(knowing the relative value of things)
to produce children
(in the usual way)
until each couple had
more boys
(the ones with penises)
than girls
(the ones without).

And further suppose
that the probability
of each coupling
(technical term)
resulting in a boy
(the ones with)
varies from couple to couple

but not from coupling to coupling
for any one couple.

And
(we still have a couple more)
that no one divorces
(an Irish folk tale)
or sleeps around
(a Scottish folk tale)
without precautions
(a Swedish folk tale).

And
that the expected sex
(technical term)
of a birth
if all couples are producing equally
is half male, half female
(though mostly they are one or the other).

Question:
(Are you ready?)
What will be the ratio
of boys
(with)
to girls
(without)
in such a society?

Answer:
The sweet truth is
(given the supposings)
that we end up with
more girls
(without)
than boys
(with).

(That's beauty, baby.)

STOP AND THINK. **The conclusion is that there will be more girl children than boy children despite the explicit contrary desire. In fact, there will be more girls than boys *because* of the contrary desire. Try to figure out why this is true if you can. It is not tricky, but it is difficult.**

Think about possible birth sequences that might occur in the absence of any desire to regulate the sex ratio. For example:

1. M, M, M, M, M, M, M, M, . . .
2. F, F, F, F, F, F, F, F, . . .
3. M, F, M, F, M, F, M, F, . . .
4. F, M, F, M, F, M, F, M, . . .
5. F, F, F, M, M, M, M, M, . . .
6. M, M, M, F, F, F, F, F, . . .
7. and so on.

In the absence of any general decision rule, all possible sequences can occur up to some point at which individual couples stop having children. But once you adopt the rule "stop having children once boys outnumber girls," you produce a surprising result. Sequences in which males might dominate are cut off early (many of them after only one child). Since the model assumes variation in the propensity of couples to produce boys or girls, those couples who are more likely to produce boys tend to have smaller families than other couples. Thus the result is that society ends up with more girls than boys, while most couples end up with more boys than girls! General theorem: Simple rules sometimes have surprising consequences, and justice is sometimes served by mistake.

One thing that may have occurred to you is that the unpredictability of many models comes primarily from the fact that they are stated in a way that allows for some relatively powerful tools of analysis. Perhaps, surprisingly (!), precision and surprise go hand in hand. So long as we are restricted to the analytical language of everyday discourse, the beauty of surprise is largely denied us. We are limited to the less pleasing device of saying outrageous things that may surprise others. By using some analytical power, however, we can shift to the beauty of discovering an unanticipated implication of an ordinary set of assumptions.

We can illustrate the reality of the advantages of even very elementary technical precision by a simple example pointed out originally by Bertraud de Jouvenal. It involves one of the most brilliant of modern philosophers, Jean Jacques Rousseau. His writings heavily influenced both modern political thought and modern political institutions. One of his concerns was population problems.

He formulated a simple model of population growth for eighteenth-century England. His model contained three assumptions:

1. The birth rate in London is lower than the birth rate in rural England.
2. The death rate in London is higher than the death rate in rural England.
3. As England industrializes, more and more people leave the countryside and move to London.

STOP AND THINK. **Assume that all three of these assumptions are true and will continue to be true over a long period. What will happen to the *total* population of *England* over time? Will it increase? Decrease? Wobble?**

Rousseau reasoned that since London's birth rate was lower and its death rate higher and since rural people continued to move there, that the population of England would eventually decline to zero.

STOP AND THINK. **Is Rousseau's conclusion correct? Does it follow his three assumptions?**

Rousseau was a brilliant philosopher, but he was unaccustomed to thinking in numerical terms. This particular problem needs numerical thinking. As de Jouvenal has observed, Rousseau's derivation is false. To explain why it is false we need to define some quantitative concepts. "Birth rate per thousand" can be defined as the number of children that would be born to 1000 typical people during one year. Thus if the birth rate is 35, we know that a city with 1000 people in it would have 35 new children during the year, and a city of 100,000 would have 3500 new children. "Death rate per thousand" can be defined as the number of deaths that will occur among 1000 typical people during one year.

If the birth rate is 35 and the death rate is 20, then the population is increasing at the rate of 15 people per 1000 (1000 at the beginning of the year — 35 new children — 20 deaths = 1015 people at the end of the first year; 1030 by the end of the second; 1046 by the end of the third; and 2000 after about 45 years). So long as the birth rate is greater than the death rate, population will increase. If the differences between the two rates is large, then population will grow rapidly; if the difference is small, then population grows slowly.

Now consider Rousseau's model. Suppose that the birth rate in rural England were 35 and the birth rate in London were only 30. Thus we satisfy Rousseau's first assumption. Suppose the death rate in rural England were 20 and the death rate in London were 25. This satisfies his second assumption. Suppose that his third assumption were also true. Now what happens? The rate of population growth in rural England would be 15 per thousand (35 — 20 = 15), and in London it would be 5 (30 — 25). Thus Rousseau's prediction is incorrect; the English population would continue to grow. It is true that the population of London would not increase as fast as the rural population, but it would increase—it must do so provided the birth rate exceeded the death rate.

The result is not surprising perhaps, but it would have surprised Rousseau (and, in our experience, most people). What appeared to be obvious turned out to be not only not obvious but also not true. By using some analytical power we discovered an unanticipated implication of an ordinary set of assumptions.

Thus we add one final precept on the production of beauty: Play to your analytical strength. Do not be afraid of twisting a phenomenon around a bit to make it fit into an analytical scheme that can derive some implications for you. Do not hesitate to look for phenomena that can be examined usefully with the models and techniques you have. The warnings you have had against letting technique dominate substance are all right in their place. Here, however, they usually seriously underestimate the importance of beauty in social science.

3.4 JUSTICE

Not only should we like to be correct and beautiful, but we should also like to be just. We should like to be able to say that our models contribute to making better, not worse, worlds. The idea is a quaint and complicated one. As in the case of truth and beauty, a major consideration of the concept of justice is beyond the scope of both this book and these authors. All we will attempt to do is to remind you of the importance of justice in the construction of social science

theory and to outline some possible elementary approximations to its pursuit.

Like truth and beauty, justice is an ideal rather than a state of existence. We do not achieve it—we pursue it. In this pursuit we accept some responsibility for the social myths by which we live. Our models are not neutral. They establish our perception of the world, and they condition our attempts to act. We use them to describe others as well as ourselves. Though we need to be suitably humble about the prospects for justice and our contributions to it, we do not need to be shy about trying to pursue it.

Suppose, for example, that a nation contains people from two different cultures and that one of the culture groups makes up a clear majority of the population. Members of the minority culture do not do as well in school as members of the majority culture. Their grade averages are lower, and they are less likely to go on to college and graduate school. Suppose some social scientists observe the situation and come up with two possible explanatory models.

> **Model 1.** The two cultures are quite different from each other. They have different habits of speech, different home circumstances, and different values. Schools are controlled by the majority culture and correct education is defined to be consistent with the values and habits of the majority culture. Thus the poor school performance of the minority students is due to judging members of one culture by the standards of another.
>
> **Model 2.** Members of the minority culture are inferior to members of the majority culture. They do badly in school because their average intelligence is inherently lower.

When the two models are evaluated on the truth criterion, the results are sometimes ambiguous. IQ tests given to members of each culture may indeed show that members of the minority have lower average scores, but the tests were designed by the majority culture and embody its values and language habits. It is in fact quite difficult to judge the comparative truth values of the two models.

The justice implications of the two models are radically different, however. Government policy based on Model 1 would concentrate on new techniques of schooling, better early education, and multicultural education. Government policy based on Model 2 might simply be that since the minority is inferior, there is nothing to be done other than creating enough simple, menial jobs to keep the minority employed.

Independent of the truth value of the two models, they have quite different justice values. They produce different actions, and the social consequences of those actions do not depend entirely on the degree to which the models are correct. Nor is this problem solved in any significant way by combining our alternative models to produce a more correct one. Correctness is not the problem here. In a world in which we never have complete knowledge two equally correct models may have radically different action implications. In the present case Model 1 is better than Model 2; it leads to better behavior.

The problems of justice in models of social science are no where more conspicuous than they are in our models of individual human behavior. These models are the myths we use in dealing with other people and with ourselves as well. If the models impute unattractive features to people, we are likely to do the same in our ordinary life.

Consider, for example, the following model of interpersonal behavior:

> Power is the ability to induce other people to do something you want in a situation in which they would not ordinarily do what you want; and the ability to do what you yourself want in a situation in which other people want you to do something else. Human beings aspire for power and direct their behavior primarily toward gaining a favorable power balance with respect to other people. Power is secured by offering resources, or promises of resources (for instance, support, money, respect) in exchange for acquiescence.

Such a model has some interesting features. It is simple; it predicts some important aspects of behavior. But it makes a series of predictions about human behavior that are unattractive as a basis for dealing with other people. For example, it predicts that:

> Most favorable statements made in an interpersonal situation are probably lies. This is particularly true of statements reporting supportive behavioral intentions or positive feelings with respect to other people. The probable truthfulness of an insult is much higher than the probable truthfulness of praise.

Insofar as we come to believe such a series of assertions, we almost certainly make our daily life less pleasant and ourselves less attractive as human beings.

Consider similarly the following assertion common to a rather large number of models of individual behavior:

> Adult human behavior is understandable in its basic forms as stemming primarily from experiences of early childhood.

Such an assertion seems eminently plausible. It may even be true. Yet, if believed, it has at least two curious side effects. First, it leads parents and children to believe that parents should accept primary credit (and blame) for a child's beliefs, character, and general intellectual and moral performance. School report cards become more important to parental self-respect than to the child's; parents are valued in terms of their children's behavior. As a consequence, parent-child relations combine the worse features of juvenile blackmail (children threatening to behave in such a way that parents will lose respect) and parental repression (parents determined to manage their children).

Second, belief in the model seems likely to create a retrospective and static bias in personal self-analysis and development. Individuals who believe the "formative years" hypothesis seem quite likely to consider the problem of personal identity to be a problem of discovering a preexisting real self rather than one of creating an interesting self. The idea of discovery is biased against adult change. A person who believes his basic character has been formed at an early age can have little serious expectation of being able to modify his style of life as an adult. He is protected by his model of personality development from the dangers and pleasures of continuous personal change.

Consider finally the following assertions, which form a part of a relatively large number of familiar models of individual behavior:

> Things are not what they seem. Human beings are guided by a number of unconscious motives that affect their behavior in subtle ways.

Such assertions seem reasonable. They may be true often enough to warrant consideration as useful models of human behavior. What makes them unattractive from the point of view of

justice is the basic ambiguity a belief in them introduces with respect to human action. We are led to ask: What does he *really* mean? Indeed, we are led to ask: What do *I* really mean? By introducing substantial elements of affective ambiguity into interpersonal communications, we undermine trust as a basis for dealing with people. We each become a little more paranoid.

> What do I mean
> When I say
> I love you?
>
> Is it a convention,
> Like "Good morning"?
> Or "How are you?"
>
> Or a wage
> That you earn
> With praises, or money, or smiles?
>
> Or a cover
> For my distaste
> Meant to conceal it,
> Barely?
>
> What do I say
> When I mean
> I love you?[2]

It is not easy to define a simple set of rules by which we make life better through speculation. Certainly the injunction to seek justice demands more than that we merely dress our prejudices up and call them theories. It requires some subtle choices between interpreting behavior offensively in order to change it and interpreting behavior positively in order to provide a new perspective for ourselves. It requires a sweet appreciation of the limitations of human wisdom. We are probably incapable of meeting the demands of justice; but better worlds are made by elementary attempts.

In particular, we may want to ask ourselves about any proposed model:

> If we come to accept this model as a good interpretation of behavior by individuals, groups, or institutions, will our own behavior become more human and our commitment to each other more profound?

.5 THE SEARCH

That, in brief is something of the nature of the search for truth, beauty, and justice. It involves a continuous interplay among the real world, the world of aesthetics, the world of ethics, and the model world. To make a speculation about human behavior you begin by working backward. You explain an observed fact by imagining what kind of process would, if it were true, produce such a fact. Then you assume your imagined process is correct and infer some additional facts that should be observable. Then you check those predictions in the real world. At the same time, you assess the justice and the beauty of your speculations. At this point you usually have to start over again.

Such a description, of course, makes the procedure sound much more orderly than it is. The previous paragraph is, in fact, a model of model building rather than a description of it. It avoids mentioning the many complications in imagining processes and in comparing truth, beauty, and justice. As you come to appreciate the model, you will also come to appreciate both the complications and the interesting idiosyncracies that distinguish individual artists and specific performance within the general frame and to develop your own style in such a way that both the composition (model) and the individual performer (you) are recognizable.

References

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John Rawls, *A Theory of Justice* (Cambridge, Mass.: Harvard University Press, 1971).

Eugene J. Webb, Donald T. Campbell, Richard D. Schwartz, and Lee Sechrest, *Unobtrusive Measures* (Skokie, Ill.: Rand McNally, 1966).

Notes

[1] It should be noted that most students of election systems would probably argue that the electoral system affects the number of parties at least as much as the number of parties affects the electoral system.

[2] It may have occurred to you that one of the persistent sources of problems with respect to justice arises from the variety of possible models. Thus amateur psychologists can select among the alternative models and choose the model that places them in a favorable light relative to the person behaving, as: "You are being defensive" or "You are only playing a game with me." This can be an easy way to make your friends uncomfortable, but we do not consider it an interesting or productive use for models in social science.

Problems

1. A simple childhood theory of personality says that a person's basic personality and character are formed between the time he is born and age five and that this basic personality and character remain substantially unchangeable for the remainder of his life. A simple conditioning and growth theory of personality says that a person's basic personality and character are formed continuously by his daily experience. Hence, he may change over time in response to changing environment, and it is possible to change adult personality and behavior radically.
   (a) Make up two facts (that is, derive two specific predictions) that, if they were true, would tend to confirm the childhood theory.
   (b) Make up two facts that, if they were true, would tend to confirm the conditioning and growth theory.
   (c) Make up a critical fact that, if it were true, would simultaneously contradict one theory and support the other. It should be an observable fact in a natural experiment.
   (d) Examine the relative *justice* of the two theories, assuming they are equally correct.
2. It has frequently been observed that students coming into a lecture hall will tend to fill up the rear of the hall first. Here are two possible explanatory processes that predict this kind of behavior.

   Process I

   People try to minimize effort; having entered at the rear of the hall, they sit there rather than walk to the front.

   Process II

   General student norms say that it is undesirable to be deeply involved in school work. Sitting in front would display interest in the class, whereas sitting in the rear displays detachment.

   (a) Make up two facts (that is, derive two specific predictions) that, if they were true, would tend to support the model in Process I. Then do the same thing for Process II.