chapter three

the evaluation of speculations

3.1 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.

3.2 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 satify 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 alternative 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.

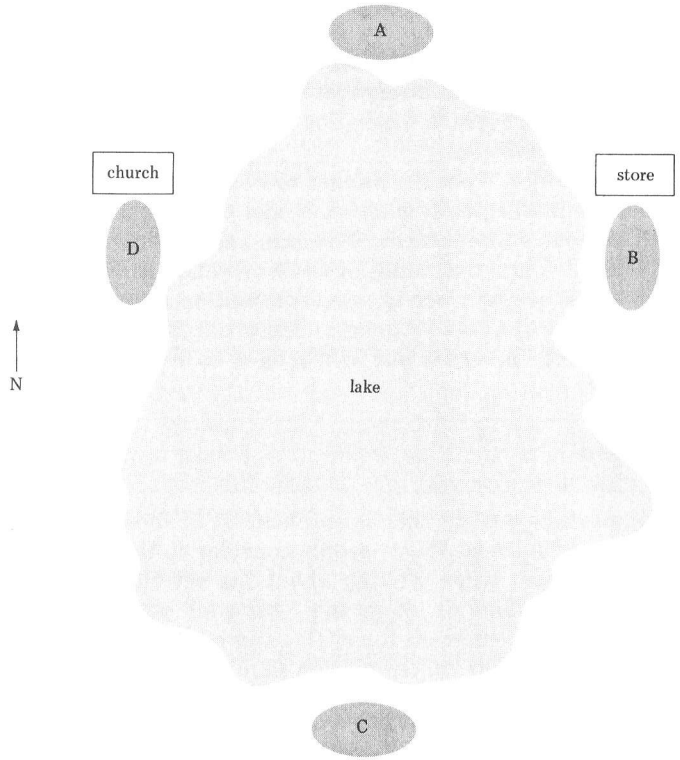

Figure 3.1: A hypothetical village.

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?

3.5 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).

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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.

(b) Make up a critical fact that, if it were true, would tend to support one theory while contradicting the other.
(c) Propose a third theory to explain student seating results and explain how you might test it against the other two theories.
(d) Comment on the relative beauty of the three theories.
(e) Comment on their relative justice.

3. In 1950 a study was made of 712 undergraduates at a large Eastern university. The study measured personal values and occupational preferences. Each student was classified as having either "people-oriented" values or "nonpeople-oriented" values. Similarly, each student was classified as choosing either a people-oriented occupation or a nonpeople-oriented occupation. The cross-classification of values and occupational preferences showed the following result:

		VALUES		
		People-oriented	*Nonpeople-oriented*	*Total*
Occupational choice	People-oriented	266	86	315
	Nonpeople-oriented	166	231	397
	Total	392	320	712

The same study was repeated in 1952 with the same students. In 1952 the cross-classification showed the following results:

		VALUES		
		People-oriented	*Nonpeople-oriented*	*Total*
Occupational choice	People-oriented	226	86	292
	Nonpeople-oriented	154	266	420
	Total	380	332	712

Summarize the basic results in the table. Outline a model that might be consistent with them. Are there any other data that might be useful to you to test your model? How would you evaluate the model?

4. In a study in 1948, voters were asked two questions about three months before the presidential election:

Question I
For whom do you intend to vote for President?

Question II
Which party do you think does best for people in your social class?

On the basis of answers to these questions, the respondents were divided into four groups:

Type A
People who believe the Republicans do best for their class and who intend to vote Republican (286 people).

Type B
People who believe the Republicans do best for their class and who intend to vote Democratic (10 people).

Type C
People who believe the Democrats do best for their class and who intend to vote Democratic (161 people).

Type D
People who believe the Democrats do best for their class and who intend to vote Republican (73 people).

In a follow-up poll in November the same people were asked how they voted, with the following results:

	%VOTING DEM.	*%VOTING REP.*	*%NOT VOTING*
Type A people	6	81	13
Type B people	50[a]	30[a]	20[a]
Type C people	76	3	21
Type D people	21	48	31

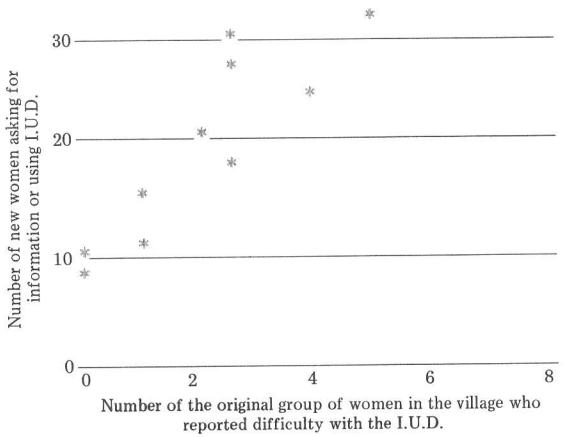
[a] Note the small number of cases involved.

(a) Summarize the basic results in the table.
(b) Produce two different models that would explain the results.
(c) Suggest how you would decide which model is better.

5. Recent efforts to reduce the birth rate in India have included the introduction of intrauterine devices (I.U.D.s) for preventing conception. In one test 10 villages of approximately comparable social characteristics were used. In each village 8 women chosen at random (there were about 50 married women of childbearing age in each village) were provided with I.U.D.s and instructions for their use. Over the following 6 months 2 counts were made: (1) How many of

the 8 women reported pain or other difficulty in using an I.U.D.? (2) How many of the other women in the village requested information on I.U.D.s or reported trying an I.U.D.?

The scatter diagram below shows the results. Each asterisk in the diagram is a different village.



You are to do three things:

(a) Summarize the basic results in the diagram.
(b) Outline *two* plausible models that would account for the results.
(c) Suggest how you would decide which model is better.

6. In these statistics from a recent sociological survey half the people had previously been diagnosed as mentally ill. The other half were not diagnosed as mentally ill. They came from three different income levels: extremely poor, very poor, and poor. The results of the survey appear in the following table. The numbers are the percentage of people who answered "yes" to the question "Do you think you will ever get a better job?"

	EXTREME POVERTY	*VERY POOR*	*POOR*
Mentally Ill	55	56	63
Other Group	35	44	49

(a) Summarize the basic results in the table.
(b) Outline two plausible models that would account for the results.
(c) Suggest how you would decide which model is better.

7. The football team has just lost a game. When the reporters interview the coach afterward, he explains. "I'm sorry. The problem was that our players didn't have enough fighting spirit, enough will to win." Is the coach's statement a good or bad model of his team's loss? Explain why.

8. Some psychiatrists have cited insufficient love as the principal cause of marital instability. Is this a good model? If so, how would you use it? If not, how would you make it useful?

(9–15) Problems 9 through 15 are basic observations that you might use as starting points for your model building. They are distinct and unrelated. For whichever observation you are assigned do the following:

(a) Make up two *abstract* models that would account for the observation.
(b) Generate a *total* of three interesting predictions from the two models and identify which model each prediction is derived from.
(c) Find some critical fact/situation/observation/prediction that will distinguish between the two models. It should be *observable*, and you should make it clear how you would observe it. It should involve a *natural experiment*. Please be very explicit as to why it *simultaneously confirms* one model while *contradicting* the other.

9. A few years ago, Detroit had a six-month newspaper strike that closed down all its newspapers. During the strike, Detroit's suicide rate fell very sharply (that is, there were far fewer suicides), but returned to its usual rate when the papers resumed publishing. (This is true, by the way.)

10. A group of women medical students reported that during the period of time when they had been trying to make up their minds about going to medical school, their parents had tried to argue them out of going to school. But once the girls had actually made up their minds to go to school, their parents became supportive of the decision.

11. No matter what kind of parents they have, children tend to think their own parents are among the worst. Very often, children and young adults can be heard to say to their friends: "You certainly are lucky to have such nice parents. Mine are terrible." Also, most children like their grandparents better than their parents. (*Hint:* Some possible natural experiments to consider are: communes, kibbutzim, children raised by their grandparents, adopted children, stepparents, orphanages, the difference between being raised as an only child and being one of many children.)

12. On a visit to the Smith family you notice that their three sons behave quite differently. John, the oldest, always does his chores

quickly and obeys his parents. George, the second oldest, obeys most of the time. Robert, the youngest, never obeys his parents.

13. Sociological evidence suggests that most people have more respect for doctors than for lawyers.
14. It has been observed that football players rather than scholars receive more attention and interest from other students.
15. The number of labor-saving home appliances has increased incredibly; the number of labor-saving, preprocessed foods has increased; and average family size has decreased. Yet the number of housework hours per week done by the average (nonworking) wife has not decreased very much over the past 50 years.

chapter four

choice