

Theories and models: Explanation and discovery

Among those activities which are probably essential to the development of a scientific discipline, two which seem especially interesting to political scientists are model-building and theory-construction. There are several reasons for analyzing them in the same chapter. On the one hand, models and theories are structurally and, up to a point, functionally similar. On the other hand, their similarity often leads, as we will argue, to the unwarranted conclusion that they are identical. For instance, the social scientist Herbert Simon once began a paper entitled "The Uses and Limitations of Models," with these words: "In contemporary usage

the term 'model' is, I think simply a synonym for 'theory.' I am to speak, then, on 'Theories: Their Uses and Limitations.'"¹

As a matter of fact, it is useful to make a methodological distinction between theories and models because, as they are used by political scientists, they have different purposes, and the failure to realize this difference can lead to confusion and perhaps even disillusionment. Thus, in addition to analyzing the nature of models and theories, each important in its own right, this chapter will attempt to demonstrate that the student of politics is aided in his studies if he understands the difference between them.

The distinction between models and theories is in many ways not a hard-and-fast one. However, given the normal activities of political scientists—all scientists, for that matter—the following proposition seems in order: theories are used primarily to explain political facts, models to discover them. This implies a more basic distinction between scientific explanation and discovery, a distinction which will be analyzed in more detail later in the chapter. At this point, let us simply keep in mind that how a political scientist develops an hypothesis (discovery), and how he goes about confirming and explaining it, are logically distinct activities.

Theory

It might be useful to begin an analysis of scientific political theory with two distinctions, one important but often ignored, the other misleading yet widely circulated.

The first distinction points out that the political theory now under consideration is not the same as that venerable activity which often goes under the same name but which in Chapter 1 was labeled political philosophy. Let us recall the normative character of political philosophy, its emphasis on ought questions; What should be the goals of the political system? What is the best political system? These activities can be contrasted with the scientific-empirical nature of political theory, that is, theory that has to do with is questions. Confusion arises from the traditional interchangeability of political philosophy and political theory. While an ever-increasing number of political scientists are accepting one form or another of the distinction just mentioned, the confusion lingers on. This is

attributable not so much to the failure of political scientists to understand the nature of scientific theory, although this is one source of difficulty, as to the continued substitution of theory for philosophy, based on the unquestioned assumption that the two refer to the same activity. It is our point that they don't; the subject of this section is empirical political theory, not normative political philosophy.

A second distinction, the misleading one, is often made between theory and practice. As manifested in the widely heard statement, "That's fine in theory, but it won't work in practice," it assumes that theory or theoretical thinking is false or unrealistic. The student of political theory Arnold Brecht has put it another way: "The relation between practice and theory is well indicated in the popular saying that we learn best through 'trial and error.' Trial is practice; error refers to theory. When theory miscarries in practical trials it needs correction . . ."²

This chapter will attempt to demonstrate that there is no divorce in the above sense between theory and practice. Rather than being unrealistic or false, a sound theory is the basis for reliable knowledge of politics. Theories help us explain and predict political phenomena, and therefore, ultimately, to make well-founded practical decisions.

A second related and more sophisticated interpretation of the "theory versus practice" distinction views the former as the result of speculation. Its catch-phrase is, "That's fine in theory, but will it work in practice?" The distinction is still a fundamental one, but theory is given a higher status. Now, at least, a theory is not necessarily false, for according to this interpretation it is in effect an elaborate hypothesis, a set of guesses to be tested. Thus to be theoretical is to be hypothetical, *potentially* true. While this view is more generous than the first, it too is misleading in ways which will become more evident as we move along.

THE NATURE OF POLITICAL THEORY

Having discussed what political theory is not, it is time to discuss what it is.³ There seem to be several variations which are popular

² Arnold Brecht, *Political Theory* (Princeton, N.J.: Princeton University Press, 1959), p. 19.

³ For a good introduction to social science theory, see Paul D. Reynolds, *A Primer in Theory Construction* (Indianapolis: Bobbs-Merrill, 1971).

¹ L. D. White, *The State of the Social Sciences* (Chicago: University of Chicago

among political scientists. Quentin Gibson has given a definition of theory which is indeed basic: "Sets or systems of statements logically inter-connected in various complex ways."⁴ In a similar vein, Nelson Polsby et al. have written that, "A scientific theory . . . is a deductive network of generalizations from which explanations or predictions of certain types of known events may be derived."⁵ The simplest interpretation of theory, then, views it as a set of related empirical generalizations. Therefore, several generalizations about a particular area of politics can be classified as a theory. Take, for instance, the laws which have come out of the voting studies.⁶ Since each law describes the relationship between a social, economic, political, or psychological variable and a type of voting act (men tend to vote more than women), the conjunction of several can explain in a more general way voting behavior. Or one may view David Braybrooke's "miniature axiomatic system" as a theory, at least a potential theory, of party behavior.⁷ It is an attempt to relate a number of generalizations from the literature of party behavior, and organize them into a systematic theory.

The notion of political theory as a collection of empirical generalizations about a particular field or subject is a popular one among many political scientists. To others it represents a simplified version of that interpretation of theory which is more commonly accepted by the scientific community at large. According to this interpretation, a theory is characterized by the use of theoretical constructs about which we have spoken in Chapter 5. Thus, a theory might be defined as, "A set of generalizations containing concepts with which we are directly acquainted and those which are operationally defined; but in addition, and more important, theoretical concepts that although not directly tied to observation are logically related to those concepts that are." This provides the basis for a distinction between theories and empirical generalizations. While

⁴ Quentin Gibson, *The Logic of Social Enquiry* (London: Routledge & Kegan Paul, 1960), p. 113.

⁵ Nelson Polsby et al., eds., *Politics and Social Life* (Boston: Houghton Mifflin Co., 1963), p. 69.

⁶ See, for instance, the list of propositions in Bernard R. Berelson et al., *Voting* (Chicago: University of Chicago Press, 1954), appendix A. This, of course, does not include the significant generalizations developed in Angus Campbell et al., *The American Voter* (New York: John Wiley & Sons, Inc., 1960).

⁷ David Braybrooke, "An Illustrative Miniature Axiomatic System," in Polsby et al., *Politics and Social Life*, pp. 119-29.

the latter can be empirically tested (confirmed or rejected), because their concepts are directly tied to observation, we can't test in the same way a generalization which contains theoretical (or, by definition, nonobservable) concepts. However, this is not to say, as we will see, that theories cannot be tested and evaluated.

Despite their characteristic use of theoretical concepts, sound theories are empirical. We can say that a scientific theory has two features, one structural, the other substantive; one referring to the relationship between its concepts, the other to its empirical content. Carl Hempel has provided a more technical description of the elements of scientific theory: "Any . . . scientific theory may be conceived of as consisting of an uninterpreted, deductively developed system and of an interpretation which confers empirical import upon the terms and sentences of the latter."⁸ We might begin, for instance, with a purely formal logical system such as Euclidean geometry, in which concepts are implicitly or internally defined, and then directly define (tie to observables) some of its concepts. This would then give the other concepts, those we have labeled theoretical, indirect empirical import. There is a difference, then, between an uninterpreted mathematical or logical system and a scientific theory, and the difference is the latter's empirical nature.

THE FUNCTIONS OF THEORIES

Since theories are empirical, they can be evaluated according to their soundness. A close analysis of a proposed theory should indicate whether it is properly constructed and empirically based. But perhaps a more fruitful approach to the nature of scientific theory is through an examination of the functions it performs, for one way to evaluate a theory is to determine how well it is doing what it is expected to do. Several comments have already suggested that a theory's major function is explanation—to explain singular facts and occurrences, but perhaps more importantly to explain empirical generalizations. This latter function is what gives the scientific theory its power.

Very briefly, a theory can explain empirical generalizations because it is more general, more inclusive than they are. The great

⁸ Carl G. Hempel, *Fundamentals of Concept Formation in Empirical Science* (Chicago: University of Chicago Press, 1952), p. 34.

power of Newtonian mechanics, demonstrated over the centuries, is based upon the ability of a rather small set of theoretical laws to explain a great number of empirical laws about bullets, missiles, and other moving objects. "Explain" here means, following the logic of the last chapter, that the empirical generalizations are deductively implied by the theory. The same situation could exist in political science, although at the present moment it is misleading to talk about an existing theory of politics (in the second, more sophisticated sense of theory). Let us suppose that general stimulus-response learning theory⁹ is able to explain a wide range of empirical laws, all the way from the voting behavior of individuals to the military activity of nation-states. The point is, once again, that if learning theory were a sound theory of political behavior, a set of general laws using such theoretical concepts as "demand" and "habit" would explain or imply a number of generalizations which previously had appeared to be independent, or at least not closely related.

This implies that in one sense a theory is not to be judged true or false, but more or less useful as an explainer of empirical laws. Since laws describe our knowledge in a particular field, the sound theory explains the knowledge more generally and completely, indicating to us the interconnection between seemingly isolated facts.

In taking this position, we cannot overlook a controversy which exists among philosophers of science over the status of theories.¹⁰ Some say they are true or verified in the sense that empirical laws are. That is, they are real descriptions of the world of observation. This position, usually labeled the *realist*, recognizes no logical or philosophical distinction between theoretical and nontheoretical concepts, since they both refer to real entities. The opposing school of thought, the *instrumentalist*, takes another position, closer to one we adopted in the last paragraph. Briefly, it argues that there is no point in trying to determine whether a theory is true or false, since it is neither. It does not describe the world, but rather explains or predicts worldly phenomena. A theory is tested according to how well it performs its major functions; thus the label "instrumental." This is close to our notion of theory. However, the strict instrumentalist's complete rejection of the reality of theories is questionable.

⁹ See Chapter 10 for an analysis of learning theory.

¹⁰ For a thorough discussion of this controversy, see Abraham Kaplan, *The Conduct of Inquiry* (San Francisco: Chandler Publishing Co., 1964), chap. 8.

For while a theory contains theoretical concepts, it is also tied to observation through an empirical interpretation. Thus it more or less describes the world. The theoretical concepts fill in the gaps and allow the theory to explain in more general terms that which has been explained by individual empirical laws.

Lurking behind explanation is another function of theories. Scientists use theories to organize, systematize, and coordinate existing knowledge in a particular area or field. According to the first notion of theory, a set of related empirical generalizations, a theory is in itself a systematization. A theory of voting behavior would be a set of relevant generalizations which have been collected and put into logical juxtaposition. According to the higher level notion of theory, a theory organizes as it explains. As several diverse generalizations are accounted for by the theoretical propositions of the theory, they are also related and made parts of a system of knowledge.

Theories explain and organize existing knowledge. They also suggest potential knowledge by generating hypotheses. A theory can, on the basis of its highly abstract generalizations, often predict an empirical generalization—predict that a particular relationship holds. The hypothesis can then be tested and accepted or rejected. Thus it can be said that in addition to its explanatory and organizational functions, theory has an heuristic one—to suggest, to generate hypotheses.

THE PLACE OF THEORY IN POLITICAL SCIENCE

In determining the role of theory in political science, we ought to keep in mind the two notions of theory, for a different conclusion may be arrived at in regard to each. The first question which confronts us is, Do we have any scientific theories in political science? From what has been said in this chapter, the answer would appear to be no if we are talking about the higher-level notion of theory. But if this is the case, is there any point in spending time talking about theories? There are probably other methodological topics more significant to contemporary political scientists, is one reply. While, because of limited resources and time, there is some wisdom in this position, it is perhaps too restrictive. For even without a sound scientific theory in hand, the political scientist is not wasting his time if he takes an interest in theory-construction. That is, there is a payoff

in asking such questions as, What would we have if we had a sound high-level theory? What would be its structure and what functions would it perform? And then, given the characteristics of scientific theory, are there any potential or near-theories awaiting further development in the literature of political science? The first set of questions has been touched upon in this chapter; the last question is one which will be of some relevance to the more substantive analyses contained in part three.

If "theory" means a collection of empirical generalizations, then our answer to the original question about the existence of political theories can be more generous. For, there are theories, or at least near-theories, of certain kinds of political behavior—consider once again our knowledge of voting behavior. Finally, let us recall the relationship between the lower- and higher-level notions of scientific theory. The implication is that a collection of laws can serve as the foundation of an abstract theory. Thus, if the higher-level notion is accepted as the standard of theory, the collected laws of voting behavior can be legitimately classified as a near-theory. In any case, the condition of theory in political science is not as bleak as might appear, although at this point in the discipline's development the political scientist's time and effort might be more profitably spent on pretheoretical activities, such as those discussed in Chapters 5 and 6.

Models and the process of discovery

The philosopher of science May Brodbeck notes in answer to the question, "What exactly is a model and what purposes does it serve?" that "I venture to suggest that ten model builders will give at least five different, or at least, apparently different answers to this question."¹¹ It is probably the case, then, that definitions of model are so numerous that we cannot mention all of them. However, there is one notion of model which does merit initial consideration. It is more rigorous than the others and usually serves as their foundation, often in a very indirect way. However, as we will see, in its fully developed form this notion of model is not the most widely accepted (or even recognized) in political science.

The technical, or what might be called the professionally accepta-

¹¹ May Brodbeck, "Models, Meanings and Theories," in Leonard Gross, ed., *Symposium on Sociological Theory* (Evanston, Ill.: Row, Peterson, 1959), p. 374.

ble meaning of model is based on the notion of isomorphism, which in simplest terms refers to the similarity between one thing and another (its model). More technically, isomorphism requires: (1) that "there must be a one-to-one correspondence between the elements of the model and the elements of the thing of which it is the model," and (2) that "certain relations are preserved."¹² Models of this sort are found in all areas of life (for instance, scale-model airplanes); in science the isomorphism is usually thought to hold between two theories, or more explicitly, their laws. This is what we will take as the core meaning of model. If the elements (generalizations or concepts) of one theory are in one-to-one correspondence to those of another theory and the required relations hold, the one may be called a model of the other.

This type of model—an isomorphism between two empirical theories—is for all purposes nonexistent in political science; the reason is clearly the lack of any sound scientific theories of politics. However, following May Brodbeck, we can mention another notion of model that also involves isomorphism, this time between an empirical theory (in the sense of a set of empirical generalizations) and a set of purely arithmetical truths. "If this is the case, then the latter is called an arithmetical representation of the empirical theory."¹³ This meaning may be more relevant to political science, largely because of the increasing use of game theory, which may be considered as such an "arithmetical representation." We will have more to say about this later in this chapter and in Chapter 11.

Besides these isomorphic models, there are, as Brodbeck notes, several other common usages of the term, none of them directly involving isomorphisms.¹⁴ (1) "Any as yet untested or even untestable theory may be dubbed a 'model.'"¹⁵ (2) Model may also be used to refer to abstracted theories, like those about economic man." (3) Theories making use of ideal entities such as perfectly straight lines are often called models. (4) When numbers can be attached to the concepts of a theory, it is often called a model. Brodbeck calls these uses of model unnecessary. However, it would seem that they, or combinations and variations of them, are what political scientists

¹² *Ibid.*

¹³ *Ibid.*

¹⁴ *Ibid.*, p. 381ff.

¹⁵ *Ibid.*, p. 381.

have in mind when they use the term *model*. For instance, in speaking of the model-building activity, William Riker writes, "The essential feature of this method is the creation of a theoretical construct that is a somewhat simplified version of what the real world to be described is believed to be like."¹⁶ Riker's idea of model doesn't appear to emphasize an isomorphic relationship; this is the key point. Rather, he, along with many other political scientists, uses model in the idealizing and abstracting sense mentioned by Brodbeck (usages two and three).

The basic argument of this section, that models are unlike theories in that they do not explain, assumes that model means either arithmetical representations or idealized or abstracted theories in the general sense we just described. Isomorphism of theories will not be considered because, as we have already noted, there are few if any theories in political science. Some might say we are subverting the real meaning of model. However, we are primarily interested in what political scientists attempt to do with models. Furthermore, even the subverted notions of model are remotely based on isomorphisms. An idealization or simplification of something is in a sense a rough isomorphism, because the former resembles the latter to a greater or lesser degree. Perhaps a way out of this controversy is to substitute another word for model; "conceptual scheme" is one in widespread use. Thus "model" would be saved for those cases in which there is an isomorphism between theories. However, because most political scientists continue to use the term model, we will also.¹⁷

THE USE AND MISUSE OF MODELS

Our argument begins with the realization that those political scientists who construct models often characterize them as unrealistic or idealized. In fact, this seems to be the most popular use of model or conceptual scheme in political science (although it diverges from the more technical meaning). While asserting its idealized nature, the political scientist will often attempt to use his model to explain

¹⁶ William Riker, *The Theory of Political Coalitions* (New Haven, Conn.: Yale University Press, 1962), p. 7.

¹⁷ See Ralph M. Stogdill, ed., *The Process of Model-Building in the Behavioral Sciences* (New York: W. W. Norton, 1970), for a practical guide to model building. Also see Charles A. Lave and James G. March, *An Introduction to Models in the Social Sciences* (New York: Harper, 1975).

phenomena. Or, more accurately, the creator of a model realizes its limitations as an explanatory device, while those who come after and use the model for their own purposes are prone to make more extravagant claims about its explanatory usefulness. Our point is that these claims, in their extravagance, are unfounded.

We will now attempt to show why the function of models is not to explain. Let us first consider arithmetical representations. Our primary example will be game theory, since it is one of the most popular and promising models in political science. Game theory is arithmetic because it defines rationality—maximizing one's gains and minimizing one's losses—in terms of probability calculus and set theory. It is supposedly isomorphic because the political scientist attempts to connect it to laws about political behavior. In this regard, Anthony Downs has provided a model of party politics,¹⁸ William Riker of coalition formation,¹⁹ and L. S. Shapley and Martin Shubik of power in a committee system.²⁰ However, as May Brodbeck has noted, "The trick for the social scientist . . . is to find appropriate descriptive terms which when coordinated to the arithmetical ones result in true empirical laws of human behavior."²¹ We would argue that, thus far, the confirmed empirical laws have not been discovered. But more important, the model-builders usually admit that their models are unrealistic. For instance, Anthony Downs says of his model of rational decisionmaking, "The model is not an attempt to describe reality accurately. Like all theoretical constructs in the social sciences, it treats a few variables as crucial and ignores others which actually have some influence."²² Notice that besides the model's isomorphic nature (not obvious from this quote) there is reference to idealizing and abstraction. Returning to our central point, even while admitting that his model is unreal, Downs claims that, "It proposes a single hypothesis to explain government decision-making and party behavior in general."²³ And at another point he argues that, "Theoretical models should be tested primarily by the accuracy of their predictions rather than by the reality of their

¹⁸ Anthony Downs, *An Economic Theory of Democracy* (New York: Harper, 1957).

¹⁹ Riker, *The Theory of Political Coalitions*.

²⁰ L. S. Shapley and Martin Shubik, "A Method For Evaluating the Distribution of Power in a Committee System," *American Political Science Review*, vol. 48 (1954).

²¹ Brodbeck, "Models, Meanings and Theories," p. 391.

²² Downs, *An Economic Theory*, p. 3.

²³ *Ibid.*, p. 33.

assumptions."²⁴ Our criticism of this argument rejects the explanatory power of models. In admitting that his model is ideal, unreal, and so forth. Downs has articulated its inability to explain political phenomena. Constructing a theory of rational behavior and then stating that no one really behaves rationally undercuts the model's explanatory value.

At this point we can draw several preliminary conclusions about models and explanation. In the first place, attempts to make arithmetic theories, such as game theory, models of actual political behavior force the political scientist to frame unrealistic assumptions. In admitting that his model does not fit the real world, the model-builder admits, consciously or not, its lack of explanatory power. A mathematical model such as game theory can explain if the actual political world operates in accordance with it—if the two are isomorphic.

Furthermore, models such as game theory contain idealizations referring to concepts like "rational political behavior." Insofar as they are unreal—because they leave out variables—they cannot explain. May Brodbeck has said of such ideal types in economics, "The better the theory, the more knowledge we have about the conditions under which the neglected variables do or do not make a difference. If there are no economic men or if the ideal type of capitalism does not exist, then certain suggested theories are false. Calling the models will not make them truer."²⁵ Here we reach the heart of the matter; the formulators of such models often use them as if they were theories; in other words, they confuse models with theories.

Let us recall the nature of scientific theory. If a theory is viewed as a system of related empirical generalizations, then we must conclude that models are not theories, for the former are not constituted of confirmed empirical generalizations. And since confirmed generalizations are essential to explanation, models cannot be granted the same explanatory status as theories. However, what about the more refined and probably more widely held conception which views a theory as a system of generalizations containing directly observable and operationally defined concepts, but in addition theoretical concepts which although not observable are logically related to those that are? Are the idealizations and speculations

of models logically similar to theoretical concepts? This is the crux of the issue; for if they are, then it would seem that theories are not entitled to a superior explanatory status.

Our answer is that idealized concepts which are admittedly unreal cannot be equated with theories which contain theoretical concepts. A theoretical concept is so labeled, not because it is divorced from reality, but because it is derived from observational terms within a theory: "Theoretical notions cannot be understood apart from the particular theory that implicitly defines them."²⁶ Furthermore, to be explanatory, such a theory must have some empirical content, so that the theoretical constructs are linked, at least indirectly, to observational phenomena. In this sense, the theoretical concepts are not nonempirical, idealized, or admittedly unreal, but instead not observable; they fit within the empirical theory.

Thus we see that a model (in the idealizing sense) is not an empirical theory. Idealized concepts are not equivalent to theoretical concepts. Insofar as they are ideal they are unreal. The gist of all this is that empirically sound theories refer to experience; thus they can explain experience. If a mathematical model is truly isomorphic with a segment of political phenomena, then it will have empirical referents, and so be able to explain; at this point, following our usage, it becomes a theory.

We have now argued that models, as they are usually construed by political scientists, do not explain as theories can; this includes both notions of theory—a set of related observational-empirical laws, or a set of theoretical laws. But, in criticizing the assumption that models in political science explain, we have not meant to detract from their overall scientific value. For models such as game theory can be of heuristic value. It is not difficult to see how. If the political scientist is trying to accumulate basic knowledge in his field, it probably helps to have something available which stimulates his imagination and sharpens his insight. In fact, it is probably not an exaggeration to say that in a relatively immature discipline like political science, such stimulation and sharpening is absolutely necessary. These functions are admirably performed by some models. If the model is a simplified interpretation of reality, the researcher is forced to consider what the situation would be like if the

²⁶ Ernest Nagel, *The Structure of Science* (New York: Harcourt, Brace & World, 1961), p. 87.

²⁴ *Ibid.*, p. 21.

²⁵ *Ibid.*, p. 21. "Models, Meanings and Theories."

model did describe reality and to what extent the model is unreal. If the model is based on a formal theory such as game theory, he has a host of relationships suggested which can be tested. If a model of politics is based upon a structure or theory in another area, a biological model for instance, the researcher has a potentially rich supply of hypotheses generated as he compares his field with the other.

The reason for our earlier assertion that all models are basically isomorphic now comes to the surface. Actually, models in political science are suggestive primarily because they are representations of something else. The heuristic use of models generally takes the following form: we observe theory or system A; we see certain similarities between it and our own area of interest, B (they appear to be isomorphic to some extent); so, we begin to wonder if some of the relationships which hold in A also hold in B. We recognize that certain adjustments and additions are probably necessary, but at least the model we derive from A will provide a basis for the formulation of hypotheses and the organization of our study of politics. It is at this point that the "familiarity" argument which we rejected in Chapter 7 as a sound criteria for explanations becomes relevant. If we use a familiar system, let us say the game of poker, to organize our study of an unfamiliar situation or area, international politics for instance, then progress has been made. The model, in this case simple game theory, opens the door.

The distinction between the explanatory and heuristic value of theories and models is based upon the more fundamental distinction between scientific justification and discovery.²⁷ Throughout our analysis of the nature of generalizations and explanation and the function of theories in political inquiry, we have been dealing with scientific justification, the relationship of evidence to hypotheses. As we have seen, this is amenable to logical analysis. There are methods of distinguishing between a good and a bad explanation or no explanation at all, between a sound or unsound theory, and between an acceptable and unacceptable generalization. Scientific discovery, on the other hand, has to do with where the concepts, hypotheses and theories come from; how does the scientist conceive of them. This deals with the psychology of scientists and so is an activity which emphasizes creativity, imagination, even genius.

²⁷ Hans Reichenbach analyzes the two scientific activities in greater depth in *Experience and Prediction* (Chicago: University of Chicago Press, 1938).

Therefore it is a more difficult process to analyze; so difficult that some have concluded it is impossible. Donald Schon in writing about those who have studied the subject of innovation in science, notes that their "theories on the subject fall into one of two categories: either they make the process mysterious and therefore intrinsically unexplainable; or they regard novelty as illusory and, therefore, requiring no explanation."²⁸ However, since models are an integral part of the process of discovery, and since models can be analyzed, it follows that certain aspects of the process can be analyzed.

If models are mainly of heuristic value, if their primary function within the scientific enterprise is to suggest relationships between concepts—to generate hypotheses—then they belong in the realm of scientific discovery and not explanation. This is our major conclusion. The objective of our analysis has not been to question the importance of models but only to point out that they have a different role to play in the development of scientific knowledge. And given the fact that there are few if any developed theories of politics, the significance of any device which does suggest possible relationships cannot be exaggerated.

MODELS AND OTHER HEURISTIC DEVICES IN POLITICAL SCIENCE

We have evaluated game theory in very general terms as a model of politics. But there are others less explicit and more speculative. Part three, which begins with the next chapter, is a discussion of some of the more popular and promising models, conceptual schemes, or approaches used in the study of politics. But we will consider a few models here to make the argument more meaningful. Several are rough attempts at isomorphism, while others are idealized models or conceptual schemes. Their inability to explain, often realized by their creators, will become obvious, but their possible heuristic value will be emphasized.

Kenneth Boulding has examined several models of social conflict. He labels two of them the "ecological" model and "epidemiological" model.²⁹ The former draws attention to "the similarity between

²⁸ Donald A. Schon, *Invention and the Evolution of Ideas* (London: Social Science Paperbacks, 1967), p. 3.

²⁹ Kenneth Boulding, *Conflict and Defense: A General Theory* (New York: Harper, 1962), esp. chaps. 6 and 7.

the conflict of groups in human society and the competition of species in biological ecosystems."³⁰ The latter compares the spread of contagious diseases through a population to certain types of group conflict, such as conversion.³¹ The chapters that Boulding devotes to these models are, in the main, provocative discussions of suggestive similarities between different systems of phenomena. No explanations or potential explanations are forthcoming. This Boulding admits. "In applying simple mechanical models such as we have explored in this and in previous chapters to the enormously complex dynamics of conflict in society, we should look for insights rather than for exact correspondences."³² The key word is "insights," for it indicates the heuristic emphasis of model building.

More ambitious claims have been made by some social scientists interested in general systems theory.³³ The comparing of systems of social behavior with chemical systems and biological systems, for instance, seems to some to lay the foundation for explanation. ". . . Models and theories are never perfect but simply approach the limit of correct explanation . . ." ³⁴ But we would argue that the mere noting of similarities between systems explains nothing. Analogies and metaphors are often enlightening, but they account for no facts. Once again, we return to the heuristic value of models. Anatol Rapaport has written in this regard, "Metaphor and analogy, although they cannot be accepted as scientific 'explanations' are sometimes important aids in the sense that they prepare the mind to make more precise investigations."³⁵ This applies as well to the much more sophisticated systems analyses of political scientists such as David Easton.³⁶

There is another kind of model building in political science that is

³⁰ *Ibid.*, p. 123.

³¹ *Ibid.*, p. 124.

³² *Ibid.*, p. 137.

³³ One attempt to apply general systems theory to the study of society is James G. Miller, "Toward a General Theory for the Behavioral Sciences," *American Psychologist*, vol. 10 (1955), pp. 513-31.

³⁴ *Ibid.*, p. 531.

³⁵ Anatol Rapaport, "Various Meanings of 'Theory,'" *American Political Science Review*, vol. 52 (1958), p. 984. For a thorough analysis of various uses of metaphors in political science, see Eugene F. Miller, "Metaphor and Political Knowledge," *American Political Science Review*, vol. 73 (1979), pp. 155-70.

³⁶ David Easton, *A Framework of Political Analysis* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1965).

seemingly remote from isomorphic analysis. It is characterized instead by idealized sets of assumptions about given areas of political phenomena. As we implied at the beginning of this section, this activity is perhaps the most prevalent of those that go under the name of model building. A sophisticated example, the decision-making approach of Richard C. Snyder and Glenn D. Paige, will be discussed in Chapter 12.³⁷ Less elaborate models, this time of party systems, are analyzed by Samuel Eldersveld.³⁸ He clearly uses them in a heuristic fashion to suggest relationships that can be tested. This use of ideal models can be traced back to the famous German sociologist Max Weber's notion of ideal types. In his studies of bureaucracy, Weber found that if he began with an idealized or perfect concept of bureaucracy, he could use it as a standard against which to compare real world bureaucracies. By "idealized" Weber meant "intentionally unreal." Likewise, the ideal models of modern political scientists are not meant to be descriptions of reality but useful heuristic devices.

As we have already implied, some political scientists call the kind of model we have just been discussing a "conceptual scheme." The term seems to imply a set of ideal assumptions about a given subject area. Thus William C. Mitchell has said in introducing his own "structural-functional" conceptual scheme: "A conceptual scheme or framework is an essential tool in all scientific investigation for it provides the elementary concepts, assumption, ideas, and directives that guide the selection and interpretation of facts."³⁹ Once again it can be seen that models or conceptual schemes are more important for their suggestiveness than their explanatory power.

In addition to idealized or speculative models, there are other heuristic techniques, that is, strategies of discovery which are available to political scientists. These are alternatives to models but they can often be used in a complementary manner. We will conclude this chapter with a brief discussion of some of them. This will, it is hoped, clarify the heuristic nature of models and indicate that there

³⁷ Richard C. Snyder and Glenn D. Paige, "The Decision-Making Approach to the Study of International Politics," in James N. Rosenau, ed., *International Politics and Foreign Policy* (New York: The Free Press, 1961), pp. 186-92.

³⁸ Samuel Eldersveld, *Political Parties: A Behavioral Analysis* (Chicago: Rand McNally, 1964), esp. part 3.

³⁹ William C. Mitchell, *The American Policy* (New York: The Free Press, 1962), p. 3.

are alternatives available. A popular heuristic device is *Verstehen* or empathic understanding.⁴⁰ According to its users, *Verstehen* suggests possible relationships by somehow "getting into" other people's heads in order to speculate about how others would behave in certain situations. There are several related techniques of discovery in political inquiry. One of the most popular is the construction of "alternative futures," grounded speculations about what the world will be like in 10, 20, 50 years, based on present trends. One of the most famous practitioners of this method is Herman Kahn. In the 1950s and 60s he predicted what the world would be like in the 1970s. That his predictions were not always accurate should not detract from the heuristic usefulness of his work; "as if" speculation is meant to be suggestive rather than predictive.⁴¹

A strategy which is somewhat similar to "as if" speculation but probably more empirically grounded has been described by Alexander George: "The analyst rehearses in his mind the different possible versions of a missing piece, trying to decide which version is more plausible, given the values of the pieces already known to him."⁴² This might be interpreted as the first step toward theory building, but note that it has to do with the discovery, not justification, of facts. It is one type of a broader category of heuristic techniques, called generically, mind experiments. We have all performed such experiments while sitting at our desks, driving our cars or day-dreaming in class. Let us quote J. A. Laponce, one of the few social scientists to think seriously about mind experiments. "In such an experiment the mind is treated as one would a laboratory; it is emptied of unwanted ideas, of unwanted variables, it is made to relate only the factors under study which are either left free to play and interact among themselves—or on the contrary have to interact according to specific rules. These experiments in the mind, these anticipatory experiments which, in a writer, produce plays and

⁴⁰ For a methodological critique, see Theodore Abel, "The Operation Called *Verstehen*," in Herbert Feigl and May Brodbeck, eds., *Readings in the Philosophy of Science* (New York: Appleton-Century-Crofts, 1953), pp. 677-87.

⁴¹ Herman Kahn, "Alternative World Futures" (New York: Hudson Institute, 1964). Also see *On Thermonuclear War* (Princeton, N.J.: Princeton University Press, 1960). For a wider-ranging example of Futurist literature, see Albert Somit, ed., *Political Science and the Study of the Future* (Hinsdale, Ill.: Dryden Press, 1974).

⁴² Alexander George, "Prediction of Political Action by Means of Propaganda Analysis," in Polsby et al., *Politics and Social Life*, p. 850.

novels, in a social scientist result in theories, formulae and computer simulations."⁴³

A more sophisticated yet less widespread heuristic technique is the mathematical and logical demonstration that a given type of political behavior is logically possible. This is usually done in regard to rational political behavior. For instance, William Riker has shown, by means of mathematical reasoning, that "Congress may act irrationally and probably does so occasionally."⁴⁴ Riker defines rationality as transitivity of preferences and then presents a mathematical proof that shows how congressional preferences can be intransitive.⁴⁵ Thus, this scientific technique indicates to the political scientist that certain political outcomes are logically possible and so are potential explananda.

We will consider one more heuristic strategy in political inquiry. It is the increasingly employed technique of simulation.⁴⁶ In a simulation run, an artificial political situation is fabricated or an actual situation is reproduced, and either individuals act out political roles or a computer makes a series of decisions based on data and decision-criteria that have been programmed into it.⁴⁷ The result in either case is a possible outcome, given the data. Simulation is important both in producing such possible outcomes and in providing hypotheses about how decisions are made. However, some political scientists seem to equate simulation runs with empirical experiments.⁴⁸ According to our analysis, this is slightly misleading, for the simulation situation is not analogous to the experimental laboratories of the physicist and chemist.

The analysis of this chapter has attempted to draw a distinction

⁴³ J. A. Laponce, "Experimenting: A Two-Person Game between Man and Nature," in J. A. Laponce and Paul Smoker, eds., *Experimentation and Simulation in Political Science* (Toronto: University of Toronto Press, 1972).

⁴⁴ William H. Riker, "Voting Methods and Irrationality in Legislative Decisions," in John C. Wahlke and Heinz Eulau, eds., *Legislative Behavior* (Glencoe, Ill.: Free Press, 1959), pp. 97-108.

⁴⁵ The basic works in this area is Kenneth Arrow, *Social Choice and Individual Values* (New York: John Wiley & Sons, Inc., 1951). Also see Robert A. Dahl, *A Preface to Democratic Theory* (Chicago: University of Chicago Press, 1956), pp. 41-42.

⁴⁶ A good book of readings on simulation is Harold Guetzkow, ed., *Simulation in Social Science: Readings* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962).

⁴⁷ For an example of the latter type of simulation study see Ithiel deSola Pool et al., *Candidates, Issues and Strategies* (Cambridge, Mass.: M.I.T. Press, 1964).

⁴⁸ For a stimulating presentation of this view, see J. A. Laponce's "Introduction" to Laponce and Smoker, *Experimentation and Simulation in Political Science*.

Chapter eight

between explanatory theories and heuristic models, a distinction based on the difference between scientific justification and discovery. Part 3 will devote more time to the latter. The next few chapters will examine a number of approaches, ways of organizing our study of politics, which are to some extent more or less sophisticated models and to some extent potential theories of politics.