CHAPTER 6

The Contribution of Expected-Utility Theory to the Study of International Conflict

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The study of international conflict has languished without appreciable evidence of scientific progress for more than two millennia.[1] Diplomatic and military histories found in the Old Testament and in the writings of such ancient scholars as Thucydides or Kautilya as well as those of more modern authors such as Clausewitz, Creasy, Richardson, and Morgenthau indicate that good foundations have been laid and give hope that such progress can be made. A common theme runs throughout the classics of international relations. That theme is the self-interested pursuit of gain by national leaders on their own behalf and on behalf of their nations. This is also the theme of research concerned with exchanges in markets. Indeed, Adam Smith's description of the operation of markets as an invisible hand guiding production and investment decisions through self-interested choice is a widely used description of the interaction of nations. Here, I apply a version of that perspective—expected-utility theory—to the study of international conflict.

INTRODUCTION TO EXPECTED-UTILITY THEORY

Expected-utility theory originated as an explanation of microeconomic behavior. Although the subject of some controversy (Tversky and Kahneman 1981), expected-utility theory is widely recognized as being at the core of contemporary microeconomics. Its prominence is partially due to the great success its proponents have enjoyed in predicting the aggregated economic decisions of individuals and partially due to its logical elegance.

The essence of expected utility theory is that

1. individual decisionmakers are rational in the sense that they can order alternatives in terms of their preferences;
2. the order of preferences is transitive so that if A is preferred to B and B p C (where "p" is to be read as "is preferred to"), then A p C;
3. individuals know the intensity of their preferences, with that intensity of preference being known as utility;
4. individuals consider alternative means of achieving desirable ends in terms of the product of the probability of achieving alternative outcomes and the utility associated with those outcomes; and
5. decisionmakers always select the strategy that yields the highest expected utility.

These five conditions can be understood as setting out two straightforward circumstances. Decisionmakers' choices among opportunities are constrained by the prospects of success and failure and by the utility, or intensity of motivation, they feel for achieving one objective or another. Thus, structural factors and individual psychology come together to shape choices.

Some students of politics believe expected-utility theory provides explanations of political decisions. Probably the best-known efforts to explain political phenomena in this way are concerned with voting (for example, Riker and Ordeshook 1973; Ferejohn and Fiorina 1974), legislative decisionmaking, and campaign strategies (for instance, Shepsle 1972). Others have become interested in the applicability of expected-utility reasoning to the study of international conflict (see, for instance, Bueno de Mesquita 1981; Gilpin 1981; Brito and Intriligator 1985). Particularly noteworthy in this regard are studies of deterrence (Russett 1963; Ellsberg 1969; Kugler 1984; Huth and Russett 1984; Petersen 1986) and of war termination (Wittman 1979; Mitchell and Nicholson 1983). Additionally, several colleagues and I are trying to construct a general theory of conflict using an expected-utility approach (Altfeld and Bueno de Mesquita 1979; Berkowitz 1983; Bueno de Mesquita 1981, 1983, 1985; Kugler 1984; Bueno de Mesquita and Lalman 1986; Bueno de Mesquita *et al.* 1985; Morrow 1985; Petersen 1986). Of course, it remains to be seen how successful that endeavor will be. I hope to demonstrate that there is reason to be optimistic.

EXPECTED-UTILITY MODELING

Before turning to an examination of specific expected-utility models of conflict behavior, let me briefly review the basic structure of decisions as seen from this perspective. I begin with an abstract example of a choice between a sure thing (which I will denote O_2 for outcome 2) and a risky lottery. Then I turn to an illustrative application of the expected-utility model to a real historical circumstance. Later, I explore the general uses of such a theory in trying to understand conflict decisionmaking.

I posit three outcomes, O_1, O_2 and O_3, such that O_1 p O_2 p O_3. This is equivalent to saying that outcome 1 is valued more highly than outcome 2, and that outcome 2 is valued more highly than outcome 3. Using notation as a shorthand we can say, then, that $U(O_1) > U(O_2) > U(O_3)$ where U denotes utility. Let the probability of attaining O_1 be P, and let the probability of attaining O_3 be $1 - P$. A decisionmaker chooses between accepting O_2 for sure or selecting a strategy that has some chance (P) of resulting in the most desirable outcome (O_1) and some chance ($1 - P$) of resulting in the least desirable outcome (O_3). The decision to pursue O_1 at the risk of ending up with outcome 3 is called a lottery. In a lottery there are two or more possible outcomes, each of which will occur with some probability, such that *the sum of the probabilities must be 1.0*. That is, some outcome must occur and all feasible outcomes are represented. This is why the probability of O_1 (P) plus the probability of O_3 ($1 - P$) must equal 1. An expected-utility-maximizing decisionmaker will select the risky lottery between O_1 and O_3 over the sure outcome O_2 if the anticipated return from gambling on the lottery is believed to be larger than the assured value of getting outcome 2. The strategic decision to gamble on getting O_1 can be represented with notation as follows:[2]

$$PU(O_1) + (1 - P)U(O_3) > U(O_2) \tag{6.1}$$

By the same expected-utility logic, the decisionmaker will select the sure outcome (O_2) if

$$PU(O_1) + (1 - P)U(O_3) < U(O_2) \tag{6.2}$$

and will be indifferent between the alternatives if

$$PU(O_1) + (1 - P)U(O_3) = U(O_2) \tag{6.3}$$

Of course, I do not suggest that real decisionmakers *consciously and explicitly* make the numerical calculations implied by the expected-utility model. Rather, the argument is that people inherently act *as if* they make such calculations. This is equivalent to saying that a mathematician could write equations that describe the trajectory of a tennis ball hit with top spin

at a specific velocity and aimed at a particular portion of a tennis court. John McEnroe surely would not recognize those equations as being any part of his tennis game. Yet, he acts *as if* he makes such calculations with remarkable precision and frequency.

How might the simple principle illustrated by Equations 6.1, 6.2 and 6.3 help us understand real decisions? Consider, by way of illustration, Miltiades' exhortation to his fellow generals on the eve of the battle of Marathon. They were faced with the choice of initiating or not initiating combat with the superior forces of the Persians. Miltiades argued as follows for fighting in the face of very poor odds:

> Never since the Athenians were a people, were they in such danger as they are in at this moment. If they bow the knee to these Medes, they are to be given up to Hippias [this is equivalent to O_3, the outcome if they do not fight], and you know what they then will have to suffer. But if Athens comes victorious out of this contest, she has it in her to become the first city of Greece [this is equivalent to O_1]. Your vote is to decide whether we are to join battle or not. If we do not bring on a battle presently, some factious intrigue will disunite the Athenians, and the city will be betrayed to the Medes [this is equivalent to O_2, which in this instance is the same as O_3]. But if we fight, before there is anything rotten in the state of Athens, I believe that, provided the Gods will give fair play and no favour, we are able to get the best of it in the engagement. [Herodotus 1954, lib. vi, sec. 109; comments in brackets have, of course, been added for illustrative purposes.]

Here we have the essence of an expected-utility decision problem. While not intended to indicate any special insight that is gained from formalism, let me structure this quotation as an expected-utility analysis to make clear why that perspective leads to the expectation that the Athenians would have fought against seemingly insurmountable odds.

Miltiades' position boils down to the conclusion that defeat in battle did not represent an inferior outcome to capitulation, while engaging in battle held out hope of a superior result. Miltiades' claim was straightforward. If the Athenians "do not bring on a battle presently . . . the city will be betrayed to the Medes." This, presumably, represented an extremely undesirable outcome. If the Athenians fought and lost, then they would again be delivered up to Hippias and the Medes, representing the same undesirable result. Call the utility of that outcome L. Of course, by fighting, the Athenians had some slim chance of winning. Call the utility of that outcome W and denote its probability as P where, as with all probabilities, P is between 0 and 1. Clearly, the utility of L is less than W. The choice facing the Athenians as described by Miltiades was between L for sure and $[PW + (1 - P)L]$. Miltiades made clear that he did not believe P was zero

("I believe that, provided the Gods will give fair play and no favour, we are able to get the best of it in the engagement"). Miltiades' claim was that there was nothing to lose and potentially something to gain by fighting. Symbolically, this is equivalent to the expected-utility statement that $[PW + (1 - P)L] > L$. Therefore, since the value of the lottery was larger than the value of the sure outcome (surrender to the Medes), the Athenians chose to engage in battle.

The particular example of the decision to fight at Marathon is very simple. Indeed, it is evident that the formalism adds nothing new to the interpretation or understanding of the decision of the Athenian generals. But it does help show what the logic is that underlies expected-utility theory. I might, however, have chosen a more contemporary example to show how expected-utility theory does lead to new insights. For instance, we know that great powers engage in warfare far more often than do lesser states, particularly as third-party entrants to ongoing wars. It would be beneficial to have an explanation of this observation that is compatible with a broad array of other phenomena.

The decision to enter an ongoing war is, as I demonstrate formally later in this essay, a function of the intensity of one's preferences for the goals of the combatants. It is also a function of one's perceived prospect of influencing the outcome (Altfeld and Bueno de Mesquita 1979). Great powers, by definition, have a high a priori expectation of being able to influence the outcome of conflicts among weak states. The United States leadership, for instance, seemed to believe that it had a high probability of influencing the outcome of the war in Vietnam. As the perceived probability of success in war increases, the utility for success can decrease and still satisfy the critical threshold level of expectation at which one is willing to commit troops to combat.[3] This means that *great powers have a higher probability of fighting in wars whose outcome is not of great significance to them* than do lesser powers. Weaker states cannot rationally engage in such wars. They are limited to fighting in disputes in which they perceive their stakes to be quite large.

Protests to United States involvement in Nicaragua—as with protests to the war in Vietnam—that depend on claims or demonstrations that political outcomes in those parts of the world are not vital to the national interest are likely to fall on deaf ears. This is certainly one important strategic implication that follows directly from an expected-utility theory of third-party participation in war. Similarly, fears of American involvement in such places as Nicaragua are also warranted by the expected-utility approach. Those who wish to prevent such involvement make a mistake by focusing attention on the absence of vital security risks emanating from Nicaragua. If protestors hope to succeed, they would be better off focusing on the

possibility that the President's perceived probability of success may be too high. In Vietnam, the United States miscalculated its chances for success. The danger of such miscalculations is the important lesson from Vietnam for those who wish to prevent the prospect of American combat troops in Nicaragua. And, for those who wish to encourage such involvement, the lesson from expected-utility theory is that they must examine closely the bases for their expectations of success. Claims that Nicaragua is vital to American security interests are not essential to the ultimate decision to become or not become involved in combat there. But, such claims can serve as an effective counterargument to those who maintain that we will not succeed. If the stakes are great enough, decisionmakers will choose to become involved even in a losing effort.

STANDARDS FOR EVALUATING SCIENTIFIC PROGRESS

Most of the remainder of this essay focuses on a general explication of how the expected-utility approach helps bring new insights to the forefront and how it can provide a foundation for accurate forecasting and for policy formation. My goal is to present evidence that shows that an expected-utility approach provides a more comprehensive explanation of generalizable results than do its extant alternatives. At the same time, I hope to show that an expected-utility viewpoint is integrative, encompassing the key insights of many other perspectives, while yielding important generalizations and significant benefits as a precise tool for forecasting and case study analysis.

I will make substantial claims here for the efficacy of a deductive, axiomatic approach to the study of international conflict. At the outset, however, let me be very clear about the important limitations of such an approach and, especially, about the complementarity between mathematical models of conflict and less formal but often more subtle and more detailed studies of particular events. Formal models are not intended to illuminate the rich details and texture of events. Rather, they are designed to specify a simplified, ordered view of reality that reveals internally consistent and externally useful general principles. Formal models are not a substitute for rich information about the events studied. But they can complement the richness of detail, providing more order and strengthening the ability to generalize. In doing so, formal models do sacrifice details for breadth and specificity for generality. When combined with expert knowledge, a powerful synergy results in which the level of insight is often greater than can be gleaned from expert judgment or from formal models alone. Indeed, in

several years of close collaboration with area specialists, I have found that expected-utility analyses informed by expert knowledge and interpreted with the expert's eye for nuance yields results not only well beyond those of the modeler's interpretation, but also well beyond those of the area expert working without benefit of the model's structure and logical rigor.

Important limitations of any decisionmaker-oriented perspective arise out of the difficulties of attributing policies to specific leaders. If, as is usually done, we speak of *national* policy, we must be conscious of the assumptions made regarding the aggregation of preferences. Policies are often the product of discussion and compromise among competing elites. Groups of individuals, each behaving in an individually rational way, may produce policies that are contrary to the interests of many, possibly even all. This occurs because cycles yielding intransitive social orderings are possible if issues are multidimensional or, on unidimensional issues, if utilities are not single peaked. The well-known Condorcet paradox draws our attention critically to any endeavor that assumes collective rationality. Behaviors such as bluffing in the face of war may be explicable on strategic grounds, but they may also be the consequence of cyclical preferences among competing elites or bureaucracies. These problems are not insurmountable, but they do remind us of the limitations inherent in applying rational choice theories to collective action.

Other limitations arise out of controversy over the axioms of expected-utility theory (Tversky and Kahneman 1981) and over the assumption of independence across decisionmakers. This, perhaps the most serious shortcoming in my research to date, ignores the game-theoretic implications of interactive, contingent behavior. There is an impressive, growing body of research on international relations that relies on a game-theoretic framework (Axelrod 1984; Brams 1985; Morrow 1987; Wagner 1982; and Zagare 1987). Recent developments in the theory of sequential games with limited information (Kreps and Wilson 1982a,b) open up new possibilities of sophisticated theoretical investigations of problems that are particularly well-suited for students of international relations (Morrow 1987). I anticipate that my own future research will draw much more heavily on the theory of sequential games with imperfect information (Bueno de Mesquita and Lalman 1988).

The main objective behind the construction of a theory is the identification of lawlike statements. Sometimes, individuals with different epistemologies make the mistake of believing that differences in their intellectual goals reduce to claims about the relative usefulness or meritoriousness of their endeavors. Often this is a problem among students of international conflict. Some researchers are motivated by a desire to explain and understand a specific event and to isolate its unique qualities. Others are

motivated by an interest in commonalities across events. Each is an entirely reasonable and important concern, although sometimes each is incommensurable with the other. In this regard, a distinction—not always sharp—should be made between what is meant by science and what is meant by wisdom.

By science I mean the explanation of classes of events through an appeal to logically consistent arguments (lawlike statements) that are parsimonious in the relationship between assumptions and how much they explain and are buttressed by observations of replicable relations among variables without appeal to special (ad hoc) factors in individual cases. Scientific knowledge can be transmitted without the recipients personally experiencing the phenomenon being investigated. Science requires generalizations, and these generalizations must be corroborated by empirical evidence.

Wisdom, as a quality of a wise individual, is an appeal to special or particular knowledge and insight that is not necessarily buttressed by lawlike statements or by multiple observations (or replications) of the relations among variables. Wisdom often depends on personal experience. It does not require corroboration from an empirically diverse base of evidence. As such, personal wisdom is rarely transmissible or replicable, but it is almost always detailed and insightful about individual events.[4] There can be wisdom without science; science almost always proceeds from wisdom.

Scientific progress requires some broadly agreed upon standards for evaluating competing explanations of like phenomena. This is as true in the study of international relations as it is in the study of the physical universe. An interesting feature of most standards of scientific progress is that they require evidence from many events rather than from a single case history. Virtually all widely utilized means of evaluating the gains from scientific inquiries focus attention on the implications that follow from the *preponderance* of evidence. This is as true of studies rooted in the methodology that leads to the accumulation of many case histories as it is of those whose methodology encourages statistical significance testing. The particular standard for measuring scientific progress that I use is that suggested by Lakatos:

> A scientific theory T is *falsified* if and only if another theory T' has been proposed with the following characteristics: (1) T' has excess empirical content over T: that is, it predicts *novel* facts, that is, facts improbable in the light of, or even forbidden by, T; (2) T' explains the previous success of T, that is, all the unrefuted content of T is included (within the limits of observational error) in the content of T'; and (3) some of the excess content of T' is corroborated. [Lakatos 1978, 32]

It is these criteria—that a new theory explains more than rival theories—that I apply in evaluating the contribution of expected-utility theory to understanding international conflict. I begin with a comparison of expected-utility theory to the most prominent theories in international relations, namely those that propose relationships between the distribution of power among states and the incidence of war.

THEORIES OF POWER, ALLIANCES, AND WAR

Two prominent views of war emanate from balance-of-power theories (Gulick 1955; Morgenthau 1973; and Waltz 1979) and from power-preponderance theories (Organski 1968; Organski and Kugler 1980; Keohane 1980, 1984; Gilpin 1981; Modelski and Morgan 1985). These perspectives lead to fundamentally different hypotheses about the factors leading to war (or peace) and the motives underlying the selection of allies. For instance, many balance-of-power theorists hypothesize that

1. a balance of power tends to produce peace and an imbalance of power tends to produce war;
2. alliances tend to be nonideological, power-seeking arrangements; and
3. alliances tend to be short lived.

Some power preponderance theorists hypothesize that

1. a balance of power tends to produce war and an imbalance of power tends to produce peace;
2. alliances tend to be ideological rather than power-seeking arrangements; and
3. alliances tend to be long lived.

These propositions seem diametrically opposed and appear to be incompatible, and there has been considerable debate regarding competing views of the relationship between power distributions and war. An expected-utility theory of conflict choices, however, provides the foundation for deducing the conditions under which each of these seemingly incompatible propositions is true. This is a bold claim. My burden is to demonstrate that this claim is supportable in the face of Lakatos' criteria for assessing scientific progress. Let me turn to a demonstration of this important assertion.

EXPECTED UTILITY, POWER, AND WAR

Let us assume that decisionmakers calculate the expected utility associated with challenging and not challenging a putative adversary. For those in a threatening situation, assume that the probability of them escalating the pressure they bring to bear in pursuit of their objectives increases as a strictly monotonic, differentiable function of their expected utility. The more they believe they stand to gain, the more likely they are to use force in pursuit of their objectives. Then, as has been shown elsewhere (Lalman 1988; Bueno de Mesquita and Lalman 1986), the functional form of the probability of escalation by nations i and j is as in Figure 6.1.

We may now define the probability of various types of conflict in accordance with the probability that i, j, or both choose the strategy of escalation over the strategy of negotiation. Let

$$P(\text{War}) = P^i(\text{Esc}_i) \times P^j(\text{Esc}_j) \tag{6.4}$$

$$P(\text{Intervention}) = \left\{P^i(\text{Esc}_i) \times [1 - P^j(\text{Esc}_j)]\right\} + \left\{P^j(\text{Esc}_j) \times [1 - P^i(\text{Esc}_i)]\right\} \tag{6.5}$$

$$P(\text{Peace}) = [1 - P^i(\text{Esc}_i)] \times [1 - P^j(\text{Esc}_j)] \tag{6.6}$$

$$P(\text{Violence}) = 1 - P(\text{Peace}) = P(\text{War}) + P(\text{Intervention}) \tag{6.7}$$

Equation 6.4 says that the probability of war [P(War)] is equal to the product of the probability that i intends to escalate its level of threat against j [$P^i(\text{Esc}_i)$] and j intends to escalate its threat against i [$P^j(\text{Esc}_j)$]. The probability of an intervention (that is, Equation 6.5 for the asymmetric use of force) is equal to the probability that one nation will escalate beyond a verbal threat while the other nation selects a posture that does not include the use of force. The other definitions have analogous interpretations.[5] It is evident from Figure 6.1 that two points exist in which expectations about the consequences of challenging an adversary (and its coalition of supporters) are balanced. From Equation 6.4 we see that the probability of war is high at the point marked A on Figure 6.1 because the probability of escalation to the use of force is high for both nation i and nation j. At the point marked B, the probability of war is low. Balance-of-power theorists fail to differentiate between these two conditions under which balance has radically different implications. Likewise, areas C and D represent situations of imbalanced expectations in which one adversary expects far more than the other from a conflict. In one such instance (area C) the probability of war is high. In the other instance (area D) the probability of war is low.

Points A and B depict the crucial moment of the "power transition" in which one hegemonic nation is surpassed by another (Organski 1968;

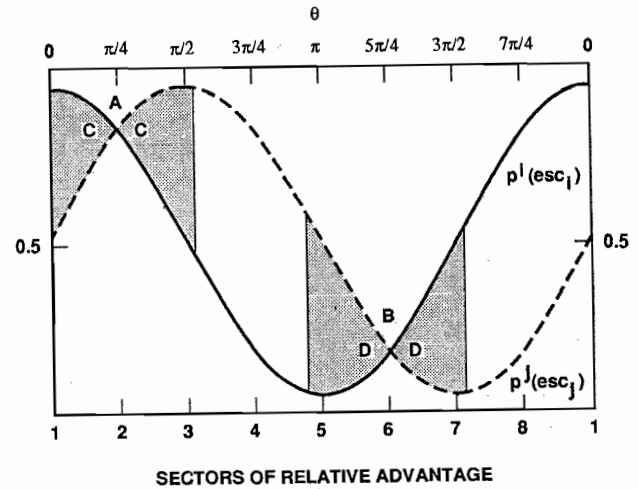

FIGURE 6.1. *The probability of conflict escalation.*

Organski and Kugler 1980, 1986). At point A, j overtakes i. At point B, i overtakes j. These two transitions are accompanied also by a high and a low probability of war, respectively. The empirical attention of those supporting a balance-of-power perspective seems focused on situations typified by point B or area C. Power-preponderance theorists seem to have their attention drawn to situations characterized by point A or area D. Preponderance theories do not isolate such circumstances as point B or area C in which balanced expectations lead to peace. Balance-of-power theories overlook conditions under which balance implies war (point A) or imbalance implies peace (area D). The expected utility framework, however, does make these distinctions. Consequently, it has the potential to differentiate between situations when preponderance or balance encourages peace or war. A critical aspect of Figure 6.1 is that it differentiates situations with high or low risks of war as a function of the expectations of gains by adversaries. Most power-oriented theorists make the mistake of assuming that if both sides have the same expectations, each side's probability of victory is 0.5. Subjective and objective probabilities of victory then become confused (Blainey 1973). Of course, i may believe its prospects of victory are high at the same time that j's expectations are high (for example, point A in Figure 6.1), or both i and j may believe that their prospects for victory are very low (for example, point B). In neither of these two examples is it the case that balanced expectations are equivalent to i and j having a probability

of victory equal to 0.5. The historical record should be—and is—consistent with the expected-utility perspective.

Debates over how the distribution of power affects the prospects for peace persist largely because of two limitations of "realist" theories. One common shortcoming of power-centered perspectives is their conviction that understanding power alone is sufficient to comprehend relations among nations. As one observer astutely notes,

> [I]t is dangerous to put in a key position a concept which is merely instrumental. Power is a means toward any of a large number of ends (including power itself). The quality and quantity of power used by men are determined by men's purposes. . . . The "realist" theory neglects all the factors that influence or define purposes. Why statesmen choose at times to use national power in a certain way (say a policy of "imperialism") rather than in another is not made clear. The . . . beliefs and values which account in great measure for the nation's goals and for the statesmen's motivations are either left out or brushed aside. . . . Similarly, internationally shared beliefs and purposes are left out. [Hoffmann 1960, 31]

Expected-utility theory shares the view that focusing on power alone is not enough. It takes into account power through the estimation of probabilities of success and failure, but it also takes into account values and purposes through the estimation of utilities.

A second limitation of most power-based theories is rooted in misunderstandings about the actual driving force behind the relationship between system structure and international conflict (Bueno de Mesquita 1978). Theories about the balance of power and war, or about bipolarity and peace, for instance, are not really theories about structural determinants of conflict at all. The assumptions underlying such theories are generally about how people respond to uncertainty and to risks. What makes these theories appear systemic in character is the tendency to assume that everyone responds to risks or to uncertainty in the same way (Kaplan 1957; Waltz 1964; Deutsch and Singer 1964). According to many balance-of-power theorists, for instance, the incentive to wage war is diminished by the belief that the chances for success are only fifty-fifty. This is similar to the statement that decisionmakers facing the choice of waging war act as if they are generally risk averse. Conversely, many preponderance theorists seem to subscribe to the belief that war is most likely when opposed forces are roughly equal, implying that decisionmakers generally act as if they are somewhat risk acceptant. Such assumptions of uniform responses to uncertainty or to risks are very restrictive and certainly inconsistent with the expectations that follow from psychological research or from common observation. Expected-utility theory allows for the possibility that decisionmakers may be risk acceptant or risk averse; they vary in their willingness to take chances. The willingness to take risks is described by the shape or curvature of each decisionmaker's utility function. Unlike most power-centered theories, risk-taking propensities are not implied by assumption in expected-utility theory; risk-taking propensities are variable. Consequently, the expected-utility approach demonstrates that the distribution of power—independent of utilities—has no direct theoretical bearing on the likelihood of war. This is easily shown by recognizing that expected utility is always the product of the probability of alternative outcomes and the utility associated with those outcomes.

Assume that the probability of success in war is a function of power, as is asserted by virtually all *Realpolitik* theorists. The expected-utility theory reveals deductively that rational national leader i can initiate a war if and only if

$$P_s^i \geq 1 - [U_s^i - E^i(U_{nc})]/[S_j(U_s^i - U_f^i)] \qquad (6.8)$$

where P_s refers to i's probability of success, U_s and U_f refer to the utility of success and failure, respectively, and $E^i(U_{nc})$ refers to i's expected utility from not challenging the putative opponent (Bueno de Mesquita 1985).

Equation 6.8 indicates just how small a chance of success a decisionmaker is willing to live with before deciding not to challenge a putative adversary. The right side of the expression evaluates how large a proportion of the total stakes (the denominator) in a dispute are representative of potential gains (the numerator). This "law" of conflict decisionmaking reveals that rational actors can choose to wage war even when their subjective (or real) prospects of victory are very small if they care enough about the issues in question.

For any probability of success (and, therefore, for any level of relative power), there is a possible set of utility values such that waging war is preferred to not waging war *or* such that not waging war is preferred to waging war (Hussein 1987). In other words, power by itself is neither necessary nor sufficient for a rational, *realist* leader to choose war over peace despite the arguments of *realist* theorists to the contrary. This is self-evident from an expected utility perspective.

Despite logical inadequacies in theories that link power directly to the likelihood of war initiation, such perspectives persist. Yet even a very simple empirical test demonstrates the superiority, in a Lakatosian sense, of expected-utility theory over, for example, balance-of-power theory. According to Kissinger, for instance, "Throughout history the political influence of nations has been roughly correlative to their military power. While states might differ in the moral worth and prestige of their institutions, diplomatic skill could augment but never substitute for military strength. In the final reckoning weakness has invariably tempted aggression and impotence

TABLE 6.1
Comparison of Balance-of-Power and Expected-Utility Propositions about War Initiators, 1816–1974[a]

Did the war comply with the balance-of-power or expected-utility theory?	Balance-of-power condition satisfied by *i*?	Expected-utility condition satisfied by *i*?
Yes	25	31
No	12	6

[a] This table is based on the first column of Tables 5.17 and 5.18 in *The War Trap* (Bueno de Mesquita 1981, 143).

brings abdication of policy in its train. . . . The balance of power . . . has in fact been the precondition of peace" (Kissinger 1979). As is true for so many balance-of-power theorists, Kissinger stipulates that war initiators are more powerful than their adversaries. Expected-utility theory does not impose this restriction, but rather requires that the gains expected by initiators are larger than their expected losses. As Equation 6.8 shows, this may be true even when the probability of success is very low provided that the value attached to success is sufficiently large. Using all wars as defined by Singer and Small (1972), I tested the relative merits of these two propositions. The test is "critical" in the sense that in all the cases analyzed the balance-of-power and expected-utility "rules" could lead to different results. Table 6.1 reports the relative goodness of fit between the two rules and the empirical record.

The expected-utility rule proves superior to the balance-of-power precept. Given the prospects of human error and the limitations of data, it is not surprising that neither provides a "perfect" fit. The strength of the expected-utility result is sufficiently greater than the support for the balance-of-power rule that the difference would have occurred by chance fewer than 1 in 100 times. As suggested by Lakatos, the cases corroborating the balance-of-power hypothesis also corroborate the expected-utility hypothesis, and some additional cases lend added value to the expected utility point of view.

EXPECTED UTILITY, POWER, AND ALLIANCES

The alliance hypotheses of the seemingly contradictory power theories can likewise be shown to be subsets of expected-utility theory. Consider the argument by Organski and Kugler:

> Most of the time alliances are simply not a realistic method of preventing threatening changes in the distribution of world power, given the skewness of relations between the great and the lesser nations, and also among the half-dozen great powers themselves. . . . It is clear that, if the intervals separating the nations in question are as large as we suggest, more probable alliances could affect only the size of the intervals between the strata, but could not alter the fundamental ranking of the great powers dominating the international system. [Organski and Kugler 1980, 25]

This stands in sharp contrast to Morgenthau's argument:

> It is true that the princes allowed themselves to be guided by the balance of power in order to further their own interests. By doing so, it was inevitable that they would change sides, desert old alliances, and form new ones whenever it seemed to them that the balance of power had been disturbed and that a realignment of forces was needed to restore it. [Morgenthau 1973, 197]

The key difference in assumptions about alliances set out by power-preponderance and balance-of-power theorists can be formalized. Let C_i be the power of the most powerful nation or alliance of nations. Let C_j be the power of i's rival j. Let C_k be the power of a third nation or coalition of nations. Organski and Kugler's argument that alliances are ineffectual in wars among the most powerful states is logically equivalent to

$$C_i - C_j > C_k, \ \therefore C_j + C_k < C_i$$

Given that C_i dominates the combined forces of j and k, alliances are more likely to be motivated by considerations of ideology or world view than by power, making them long-term arrangements. Morgenthau and other balance-of-power theorists, however, maintain that

$$C_i - C_j \leq C_k, \ \therefore C_j + C_k \geq C_i$$

Given this view, power considerations, rather than ideology, become the major factor in influencing the formation of alliances, making them short-lived, nonideological arrangements of convenience.

An expected-utility view of third-party choices to join side i or side j encompasses the generalizations of both balance-of-power and power-preponderance theorists. Assume that the choice to join i, join j, or remain nonaligned is determined by expected-utility-maximizing criteria. Also assume that the amount of effort third party k makes on behalf of i or j increases continuously and monotonically with k's expected utility for its choice. That is, the more k expects to gain from helping a nation at war, the

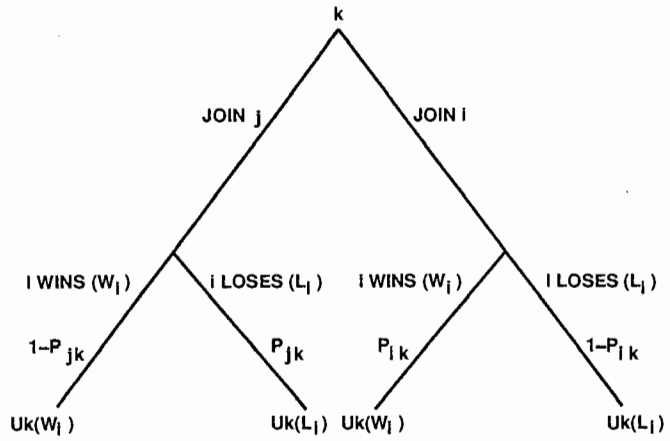

FIGURE 6.2. *Third-party decision problem.*

larger the commitment k is willing to make in pursuit of those gains. Figure 6.2 depicts the decision problem confronting third party k in choosing between side i and side j.

According to the model depicted in Figure 6.2, k's choice between joining i and joining j depends on the probability of i winning given help from k (P_{ik}), the probability of i losing even though k helps i ($1 - P_{ik}$), the probability of j winning (i losing) given that k helps j (P_{jk}), the probability of j losing (i winning) even though k helps j ($1 - P_{jk}$), and the utility—or degree of motivation—k attaches to the two possible outcomes. Let the utility to k of i winning equal $U(W_i)$, and let the utility to k of i losing and j winning equal $U(L_i)$. Expressed algebraically, k's expected utility for joining i or j, as depicted in Figure 6.2, equals

$$E(U)_k = [P_{ik}U^k(W_i) + (1 - P_{ik})U^k(L_i)] - [(1 - P_{jk})U^k(W_i) + P_{jk}U^k(L_i)] \tag{6.9}$$

The terms inside the first set of brackets in Equation 6.9 delineate k's expectations if it joins side i. The terms inside the second set of brackets delineate k's expectations if it selects the strategy of joining side j. By subtracting these two expressions we can see if joining i, joining j, or remaining out of the conflict is k's preferred strategy. If Equation 6.9 is positive, k expects more utility from joining i than j, and so k is predicted to join i. If Equation 6.9 is negative, k expects more utility from joining j than i, and so k is predicted to join j, and if the expression equals zero, then k is

indifferent between i and j, and so abstains from the dispute. The terms in Equation 6.9 may be rearranged by factoring to yield

$$E(U)_k = (P_{ik} + P_{jk} - 1)\,[U^k(W_i) - U^k(L_i)] \tag{6.10}$$

Equation 6.10 helps make clear that k, not surprisingly, always joins the side it prefers. Since $P_{ik} + P_{jk} - 1$ can only be greater than or equal to zero, the sign of Equation 6.10 is determined by the relative magnitude of the utilities or preferences of k for victory by i or j. How much effort k makes depends both on the intensity of k's preference for one or the other side and on k's power. To see this, assume no nation enters a conflict with the expectation of harming the side it chooses to join, so that the a priori probability of i winning if k abstains is not larger than the probability of i winning if k joins i, and, likewise, the a priori probability of j winning is not diminished by k joining j. That is, I stipulate that

$$P_{ik} \geq P_{ib};\ P_{jk} \geq P_{jb} = (1 - P_{ib})$$

where P_{ib} and P_{jb} are the respective probabilities of i and j winning a *strictly bilateral* dispute (as estimated by k).

Once P_{ib} and P_{jb} (which together equal 1.0 and represent the probabilities when i and j act alone) are subtracted (as dictated by $P_{ik} + P_{jk} - 1$ from Equation 6.10, all that remains is k's marginal contribution to the probability of the outcome. This can be seen most easily by adding an operational assumption. Let $P_{ik} = (C_i + C_k)/(C_i + C_k + C_j)$, where, as before, C refers to the capabilities or power of the subscripted actor. Similarly, let $P_{jk} = (C_j + C_k)/(C_i + C_j + C_k)$. Then,

$$(P_{ik} + P_{jk} - 1) = \frac{C_i + C_k}{C_i + C_j + C_k} + \frac{C_j + C_k}{C_i + C_j + C_k} - \frac{C_i + C_j + C_k}{C_i + C_j + C_k} = \frac{C_k}{C_i + C_j + C_k} \tag{6.11}$$

Now, under the power-transition condition stipulated previously and with the assumption that effort increases monotonically with expected utility, we see that C_k in Equation 6.11 is small compared to C_i and C_j. Therefore, holding utilities constant, k's expected utility must approach zero for a finite value of $U(W_i) - U(L_i)$ relative to the conditions stipulated for the balance of power (where C_k is ***relatively*** large). Given monotonicity of effort with expected utility, Equations 6.10 and 6.11 reveal that alliances are less important when third parties are weak compared to initial belligerents and are more important when third parties are relatively strong compared to initial belligerents. Thus, the balance-of-power and power-transition hypotheses are not incompatible at all. Rather, they are each special cases of behavior under the axioms of expected-utility maximization

as modified by the assumption of monotonicity. This means that each of these theories can be subsumed under the expected-utility framework, giving us a broader, more general theory. The expected-utility theory differentiates and encompasses circumstances that each of the other theories has to treat as contradictions.

Expected-utility theory satisfies the Lakatos criteria with respect to many balance-of-power and power-preponderance theories, at least with respect to the hypotheses about the likelihood of war and about the efficaciousness of alliances. It accounts for the facts accounted for by each, but excluded by the other. In this way, it has excess empirical content over either. Consider, for instance, the differences in empirical results between an expected-utility explanation of third-party decisions to join one side or the other in an ongoing war and the results reported by Siverson and King using essentially the same data, but a more power-oriented theoretical perspective. Table 6.2 contains the results for the Siverson and King test while Table 6.3 contains the results from Altfeld and Bueno de Mesquita's expected-utility test (Altfeld and Bueno de Mesquita 1979; Siverson and King 1980).

These two tables reveal that the expected-utility model fits better with the historical record, yielding a 66 percent reduction in error (over predicting the modal behavior every time) as compared to Siverson and King's 33 percent reduction in error. Additionally, the Altfeld and Bueno de Mesquita test explains not only whether nations would participate in ongoing wars (the dependent variable for Siverson and King), but also explains which side each third party would choose to join. As indicated by Equation 6.9, third-party choices seem consistent with expected-utility-maximizing behavior. Even with crude data, 16 of the 18 nations predicted to join the weaker side in an ongoing war actually did so, and of the 13 predicted to join the stronger side, 10 did so, suggesting that the theory was very powerful at discriminating who would join, which side they would join, and who would stay out of the fight (104 of 109 predicted to stay out of the war did stay out).

As a final note on expected-utility theory and third-party-alignment behavior, I should observe that other theoretical results can also be derived from Equation 6.10. For instance, equation 6.10 contains explanations of (1) why major powers are more likely to participate as third parties in wars than are minor powers and (2) why major powers are likely to participate in wars, such as the Vietnam War, where they do not have vital interests at risk. So, expected-utility theory provides a vehicle for making consistent the seemingly incompatible propositions of the balance-of-power and power-preponderance theories, does better at accounting for third-party-alignment decisions than do rival theories, and offers additional empirically supported

TABLE 6.2
War Participation Predictions Based on the Siverson and King Model

	Predicted war participant?	
	No	Yes
Actual war participant?		
No	211	12
Yes	32	35

SOURCE: Siverson and King (1980, Table 4).

TABLE 6.3
War Participation Predictions Based on the Altfeld and Bueno de Mesquita Model

	Predicted war participant?	
	No	Yes
Actual war participant?		
No	104	4
Yes	9	27

SOURCE: Altfeld and Bueno de Mesquita (1979, Table 2b).

deductions about major and minor power behavior. While some argue that a separate theory of major power war is required (Modelski and Morgan 1985; Organski and Kugler 1980), much of the evidence from research using expected-utility theory suggests that major power choices can be explained in the same way as minor power choices (but, for an alternative view, see Moul 1987) and that major and minor powers differ primarily in the magnitudes of their respective values on the utility and probability terms.

SOME SURPRISING RESULTS FROM EXPECTED-UTILITY THEORY

Power-based theories have been an important bedrock for accounting for war and peace decisions and for alliance formation choices. A large and closely related body of theory has grown up around the question of deterrence. Using no additional assumptions, expected-utility theory has proven to be a useful tool for explaining the successes and failures of efforts

to deter conventional or nuclear war. Huth and Russett, testing a number of formulations to account for successes and failures of deterrent efforts, note that their best-fitting result gives about the same predictions as those from my expected-utility formulation. More interestingly, Huth and Russett observe (1984, 503), "Some research suggests that the defender's previous behavior does not systematically predict either way subsequent behavior, but we still must take it into account in our analysis." The citation for those who claim that previous behavior is not a critical variable is Altfeld and Bueno de Mesquita. The counterintuitive proposition that demonstrations of resolve or other reputational effects are not consequential in the behaviors Huth and Russett examine is supported by *their* evidence. Their empirical investigations lead them to report that "the defender's past behavior in crises seems to make no systematic difference."

Other counterintuitive or seemingly anomalous behaviors are consistent with the expected-utility perspective of conflict decisionmaking. For instance, allies are shown to be substantially more likely to wage war (but not severe wars) against one another than are enemies (Bueno de Mesquita 1981). The potential advantages of nonalignment for a weak nation engaged in a dispute with a stronger adversary that has allies have been demonstrated, while at the same time I have shown that nonalignment can be a liability for a weak nation if the same adversary does not have allies to help it. Conditions under which nuclear proliferation decreases the threat of war have been identified (Bueno de Mesquita and Riker 1982; Intriligator and Brito 1981; Berkowitz 1985), while some circumstances under which arms control exacerbates the risks of conflict have also been isolated. Others have shown that behavior that complies with or deviates from standard norms within international treaty organizations can be predicted using expected utility theory (Berkowitz 1983; Altfeld and Paik 1986). That approach has also proven useful both in predicting escalatory behavior (Bueno de Mesquita 1985;.Bueno de Mesquita and Lalman 1986; Petersen 1986) and as an explanation of alliance-formation behavior in the face of threats (Iusi-Scarborough and Bueno de Mesquita 1988; Altfeld 1984; Newman 1985).

A particularly important set of results show that rational conflict initiation and escalation are consistent with decisionmaker misperceptions. Misperceptions are shown to have systematic and predictable effects on the likelihood of war (Bueno de Mesquita 1985; Bueno de Mesquita and Lalman 1986). These results call into question arguments that place misperceptions outside the realm of rational behavior (Jervis 1976). Instead, Lalman and I have shown the circumstances under which decisionmakers engage in actions for which the perceived probability of war is low when, in fact, the likelihood of war is high. And we have shown the conditions under

which nations engage in policies they think are highly risky when the actual likelihood of war is low. To see how this is so, refer back to Equation 6.4, which states that

$$P(\text{War}) = P^{i}(\text{Esc}_i) \times P^{j}(\text{Esc}_j)$$

Let us define the probability of war *as perceived by* i *and as perceived by* j as

$$P^{i}(\text{War}) = P^{i}(\text{Esc}_i) \times P^{i}(\text{Esc}_j) \qquad (6.12a)$$

$$P^{j}(\text{War}) = P^{j}(\text{Esc}_i) \times P^{j}(\text{Esc}_j) \qquad (6.12b)$$

Equation 6.4 says the probability of war is a function of *i*'s probability of escalating a dispute and *j*'s probability of escalating the same dispute. Equation 6.12a stipulates that *i*'s perception of the probability of war is a function of *i*'s probability of escalating the conflict and *i*'s estimate of *j*'s probability of escalating the dispute; *j*'s perception is derived analogously. Now, suppose *i* believes the two relevant probabilities are each equal to 0.6 and 0.9, while *j* believes the relevant probabilities equal 0.8 and 0.6. Then, *i* perceives the probability of war to be 0.54, *j* believes it is 0.48, with each viewing the opponent as the more hostile party. The actual probability of war is 0.36, substantially lower than they thought. Suppose *i* thought the probabilities were 0.9 and 0.6, respectively, while *j* thought they were 0.6 and 0.9. Each anticipates a 0.54 chance of war, yet the actual likelihood in this case is a much higher 0.81. Finally, suppose *i* perceives the probabilities of escalation as 0.6 and 0.7, respectively, while *j* perceives these probabilities as 0.9 and 0.8 respectively. In this case *i* perceives the situation to have a probability of war equal to 0.42, and *j* perceives it to be 0.72. In actuality, the probability of war is in between with a value of 0.48.

These examples illustrate the ability of the expected-utility formulation to incorporate perceptual variation in a rational choice framework and to use those perceptions to account for decisions, for instance, to initiate losing efforts. They help lend formal structure to Creasy's important observation: "We thus learn not to judge of the wisdom of measures too exclusively by the results. We learn to apply the juster standard of seeing what the circumstances and the probabilities were that surrounded a statesman or a general at the time he decided on his plan" (Creasy 1851, Preface).

POLICY FORECASTING, INSTABILITY, AND EXPECTED-UTILITY THEORY

A difficult test for any social science theory is its ability to forecast future events. "Explaining" events after the fact is the empirical basis for theory

testing, but predicting events before they happen dispels suspicions that "the theory was made to fit the data." The predictive ability of the expected-utility approach to international conflict is particularly difficult to test because hard data do not exist for many of its variables, especially the utility terms. Tests of the theory, therefore, must depend either on proxy indicators of utilities or on implications from the theory that do not require the direct observation of utilities.[6] I have used both methods to test the predictive potential of the expected-utility theory and have done so both in the context of current international disputes and in the broader context of intranational conflict and policy formation. I turn now to the value of the theory as a tool for forecasting policy decisions.

The key problem in applying the expected-utility approach to forecasting policy formation around the world, and the degree of contentiousness surrounding policy decisions, is that there are no preexisting data readily used to approximate probabilities or utilities. As a forecasting tool, the expected-utility model focuses on competition among groups (both within and across national boundaries). In particular, the model requires

1. the specification of the relative power (political, economic, military, or other) of each relevant group;

2. the enumeration of specific policy issues that are indicative of the questions one wishes to answer (for example, what will happen to civil liberties in Hong Kong after the Chinese regain sovereignty, or what restructuring of debt will the Mexican government negotiate with its creditors, or how stable will the new government be in the Philippines?);

3. each group's preferred policy outcome on the issue(s) in question; and

4. the degree of importance or salience each group attaches to the policy under discussion.

Here we have an opportunity to combine the greatest strengths of abstract theory and of detailed expert knowledge on particular situations or places. Data for forecasting purposes are developed in close consultation with area experts. They identify the groups, issues, and other variables required by the model (the policy preferences, or desired outcomes, held by each group on each issue; the relative power to influence decisions controlled by each group; and the salience, or level of importance, each group attributes to each issue).

Experts are not asked for their personal judgments about outcomes or about the contentiousness of the political situation. The model, not a Delphi technique, is used to answer these questions. The model also is used to estimate each group's willingness to take risks and to specify what kind of conflictual relationship (if any) is likely to emerge between each pair of groups. Each group's perceptions about what they can do and about what they believe others can or will do are also derived from the model using only the data specified previously. Indeed, the model allows the analyst to look at the world "as if" through the eyes of each group leader, assessing their perceptions of the situation. Because the methodology for achieving these ends is explained in great detail elsewhere (Bueno de Mesquita, Newman, and Rabushka 1985), it will not be discussed at this point. The key point here is that the model adds considerable information beyond that provided by the experts. Indeed, the model-based forecasts often differ from those of the very experts who provided the input information. When the experts and the model differ, the model's predictions have proven to be more accurate both in terms of the specification of policy decisions and in the delineation of the circumstances surrounding such decisions.

As a forecasting tool, the expected-utility model has proven to be highly flexible and reliable. Included among its successful applications are forecasts of events as diverse as those that follow.

1. It predicted the ascent of Yuri Andropov as successor to Leonid Brezhnev. The forecast was made while Andropov was still with the KGB, before his rise to the Politburo and well before he was viewed as a serious contender by most other analysts (Bueno de Mesquita 1982).

2. It predicted Italian deficit policy, and the attendant fall of the Spadolini government in Italy in 1982. The forecast predicted that Fanfani would succeed Spadolini and that his government would ultimately be threatened by a policy shift of the Communist Party of Italy toward greater support for austerity programs, leading to the rise of Craxi. Spadolini fell several months after the forecast analysis was completed. He was succeeded by Fanfani, who fell to Craxi on the heels of shifting economic policy by the Communists. The model's forecast of the Italian parliament's deficit policy for 1983 was within 99.2 percent of the actual policy, despite wide-ranging speculation at the time that the government would adopt a deficit program anywhere between 60 trillion and 100 trillion lira (Beck and Bueno de Mesquita 1985).

3. Successful elections were predicted for El Salvador in 1981 and again later. The model predicted that the Duarte government would fall to a coalition led by d'Aubisson in 1981, as it did, despite widespread speculation in the American press that the left would prevent the elections from occurring in the first place.

4. The shift in Iran of Rafsanjani from a hardline stand promoting a military solution to the Iran–Iraq war to his stance in favor of economic sanctions and a less bellicose resolution of the dispute was predicted in early 1984 (Bueno de Mesquita 1984). The same article also forecast increasing movement in Iran toward more open, free-market policies in response to pressures from the Bazaaris. Rafsanjani was described in *The Wall Street*

Journal in the summer of 1984 as having surprised everyone by his shift to a pacifist position on the war. And in August of 1984, the *Washington Post* reported that "Revolutionary leader Ayatollah Ruhollah Khomeini has come down firmly on the side of Iran's bazaar merchants in a simmering political and ideological dispute over whether they or the state should control the country's foreign trade. Western diplomats here described his intervention, which steers Iran away from further state monopolies and encourages free enterprise, as a development likely to determine the future course of its Islamic revolution." (the *Washington Post*, August 30, 1984, A38).

5. It predicted a dispute between Chen Yun of the ideological faction of the Communist party of the People's Republic of China and Deng Xiao Ping on the issue of free-market reforms. In *Forecasting Political Events*, my coauthors and I noted that "*the modernizers have seriously misperceived their ability to implement Deng's policies.* . . . [T]he modernizers believe they can resist the demands of the ideologues. . . . However [the ideologues] . . . believe they can successfully counter the modernizers. . . . Such perceptions will produce costly mistakes for Deng's successors among the modernizers. . . . Thus, domestic pressures will ultimately force Deng's successors to compromise with those seeking a more regulated economic system . . ." (Bueno de Mesquita *et al.* 1985, 149–150; the italics are in the original). In short, the analysis anticipated a serious dispute over market reforms between the ideologues and the Deng faction within the People's Republic of China. The analysis also anticipated a compromise settlement that was more favorable to the modernizers than to the ideologues. That these forecasts were surprising is highlighted by the fact that open disputes of this sort are, of course, rare in tightly controlled societies such as China. Yet, on the first page of the *International Herald Tribune* on September 24, 1985, it was reported that

> The Communist Party of China closed its national conference Monday with an unusual public airing of the policy differences that have created tensions between Deng Xiao Ping, the reform-minded veteran who is the country's paramount leader, and more doctrinaire figures in the party hierarchy. The conference was summoned by Mr. Deng to entrench his open-door economic policies in the five-year plan for 1986–1990. . . . It ended on a discordant note as Chen Yun, a Marxist conservative, made a brusque speech that challenged Mr. Deng's position on . . . the play given to market forces in the economy. With Mr. Deng seated on the podium nearby, Mr. Chen quoted Mao to warn of possible social disorder. . . . Still more sharply he reminded delegates that "we are a Communist country," and said that central planning had to remain the pillar of the economy, not market regulation that meant "blindly allowing supply and demand to determine production."

This sampling of forecasts highlights the ability of the model (1) to predict policy formation and political conflict accurately within democratic and authoritarian regimes in purely domestic, international, or mixed situations, (2) to deal with socialist and capitalist settings for decisionmaking, and (3) to cope with policy decisions in virtually every type of cultural, political, economic, and social setting. As such, it is further evidence of the potential benefits to be derived from the exploration of expected-utility theory as a paradigm for understanding international (and domestic) political conflict.

CONCLUSION

The search for knowledge is a quest for accurate description, explanation, and prediction. The fundamental quality of science is that we cannot know if an explanation is truly correct. We can only know if it "makes more sense" to us than alternative explanations. In the same way, we can be sure that no event is fully described. Reality is infinitely complex. Which facts are essential and which are peripheral in describing an event or a circumstance is a matter of judgment, not a matter of knowledge. So, the task of science is to devise descriptions, explanations, and predictions that *seem* superior to the rivals. This Lakatosian standard is the one I have tried to apply to the expected-utility approach to understanding international conflict.

Reasonable people can be expected to disagree about the quality of any explanation. Explanation depends largely on personal taste. After all, we have no way of discerning what the "right" assumptions are about the world. For those who reject a set of assumptions out of hand, any explanation that follows from them must, perforce, seem wrong. But, agreement should be possible on the consistency between competing explanations and the evidence. Surely the predictive power of alternative theories is not a matter of taste; it is a matter of empirical record. The application of conventional views of evidence lends strong support to my claims for the merits of an expected-utility approach. Many of the main streams of international relations research have been shown to fall within the perview of expected-utility theory. Perspectives that before appeared incompatible were shown to be special cases of expected-utility conditions. Events that seemed like anomalies have been shown to be consistent with more mundane events when viewed from an expected-utility perspective. A high percentage (around 90 percent) of policy forecasts and strategic scenarios, including many counterintuitive ones, have been borne out. The Lakatosian criteria of scientific progress seem to have been satisfied.

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The nature of science is that today's theoretical triumph is tomorrow's error. Ptolemaic astronomy fell before the weight of evidence for the Newtonian view. And Newtonian astronomy, likewise, fell before the greater power of Einstein's relativity. Today, the discovery of subatomic particles moving faster than light leads researchers to question Einsteinian physics. One can only speculate about what the future will bring. In international relations, the balance of power has reigned as the principle theory. Perhaps the community of scholars will, in time, conclude that it still reigns. Perhaps they will conclude that expected-utility theory has replaced it. Perhaps they will conclude that some other theory has replaced it. At the moment I can only claim that the evidence for an expected-utility view of decisionmaking about international conflict is too strong to be dismissed. We cannot help but remain conscious of the fact that science compels skepticism. And so, I conclude with the observation of St. Augustine:

> We should not hold rashly an opinion in a Scientific matter, so that we may not come to hate later whatever truth may reveal to us, out of love for our own error.

NOTES

1. I would like to express my gratitude to William T. Bluhm, Bruce Jacobs, and William H. Riker, my colleagues while I was at the University of Rochester, for their many helpful comments on this chapter. I would also like to thank Robert Keohane, Manus Midlarsky, Theodore Rabb, Robert Rothberg, and Robert Powell for their helpful suggestions. This is an extended version of an article published in 1988 by the *Journal of Interdisciplinary History*. The usual disclaimers, of course, apply.

2. I have not made explicit the terms for costs to keep the presentation as simple as possible. These expressions may be thought of in the context of equal expected costs across strategies or, again for simplicity, the costs may be thought of as endogenous to the calculations.

3. Here I make the assumption that the level of effort expected from a third party increases monotonically with its expected utility.

4. Wisdom is also sometimes viewed as "the wisdom of the ages." This Burkian view places wisdom in the context of tradition and culture. That perspective is less closely linked to the sense of the "wise man" in which I use the concept. For the purposes of this discussion, the two meanings of wisdom differ in that the "wisdom of the ages" implies a characteristic that is transmissible. It remains true, however, that such wisdom, unlike science, is not dependent on empirically corroborated or testable propositions.

5. As noted earlier, these definitions regarding decisions to escalate a dispute assume that a threat exists. The probability of peace in this context is, therefore, the probability that a threatening situation will be resolved without resort to force.

6. For instance, the proposition that allies are more likely to fight than enemies is testable directly from knowledge of who is allied with whom and how frequently various alignment combinations fight with one another. The test does not require direct measurement of utilities or probabilities.