Constraints, Compromises, and Decision Making

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Noncompensatory decision making forms a core part of poliheuristic theory. At the same time, decision making under constraints is a common view among expected utility theorists. It is argued that poliheuristic theory permits one to endogenize constraints. Views about the rules of war are used to contrast the exogenous versus endogenous perspectives, and the noncompensatory perspective is formalized in terms of a class of utility functions. Finally, these poliheuristic, noncompensatory utility functions are contrasted with those typically used in the literature on spatial modeling.

Keywords: *Noncompensatory decision making; poliheuristic theory; behavioral decision theory; utility functions; spatial modeling; international norms; rules of war*

> The genius of Republican liberty, seems to demand on one side, not only that all power should be derived from the people; but, that those entrusted with it should be kept in dependence on the people, by a short duration of their appointments. . . . Stability, on the contrary, requires, that the hands, in which power is lodged, should continue for a length of time, the same.
>
> —James Madison

The metaphor of "decision making under constraints" has extremely wide currency in the economics, political science, and international relations literatures. It is tied very closely to and widely used by expected utility theorists who see actors as maximizing their utilities under constraints.

Typically, the constraints are exogenous in various ways. Key is that constraint rarely appears as a term in the model in ways that are open to theoretical and empirical analysis. I will argue that one needs to endogenize these constraints. This endogenization involves conceptualizing the constraints as goals of the decision maker. We can always reformulate a constraint as a goal of the actor.

In expected-utility decision making under constraints, one satisfies the constraint first and then proceeds to maximize among the surviving options. In poliheuristic theory, the first stage of the decision-making process involves elimination—in a noncompensatory manner—of alternatives that are unacceptable on key dimensions. In

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the second stage, decision makers often use more optimizing strategies. Both maximizing under constraints and poliheuristic choice thus have a first, noncompensatory stage, followed by a more maximizing second one.

The advantage of poliheuristic theory over expected utility maximization under constraints is that it incorporates—endogenizes—the constraint as a key value dimension of the decision maker. A standard example is the importance of public opinion on foreign policy. The standard realist—and often expected utility—approach talks about a leader maximizing her or his foreign policy utilities under the constraints of public opinion.[1] One can just as easily flip this around so that the leader is maximizing her or his chances of staying in power subject to foreign policy constraints. Following the lead of poliheuristic theory, this study argues that the decision maker has two key goals—to please the public and address foreign policy aims.

A distinctive characteristic of poliheuristic theory is its emphasis on the fact that decision makers have multiple goals. A core part of the theory is how leaders evaluate different alternatives in light of their multiple and often conflicting aims. This emphasis poses a sharp contrast with standard expected utility models that most often make assumptions about the form of the one-dimensional utility function. By using only one-dimensional utility functions, the researcher assumes that all the key goal conflicts that are at the center of poliheuristic theory have already (and somewhat magically) been resolved.

One of the strongest and most consistent findings in the literature on organizational decision making and behavioral decision theory is that losses are treated differently from gains. Core to poliheuristic theory is the noncompensatory principle; major losses on a key dimension (political, domestic, foreign, or whatever) cannot be compensated for by gains on other dimensions:

> The political dimension is important in foreign policy decisions not so much because politicians are driven by public support but because they are averse to loss and would therefore reject alternatives that may hurt them politically. (Mintz and Geva 1997, 84)

In short, noncompensatory decision making and loss avoidance are two sides of the same coin. I argue that loss avoidance and the noncompensatory principle are intimately related: Noncompensatory decision making is one possible expression of loss avoidance. By the definition of noncompensatory decision making, losses on one key goal cannot be substituted for or compensated by high values on other goals. This link between poliheuristic theory and loss avoidance is a common thread in various poliheuristic analyses (e.g., Mintz and Mishal 2003; Sathasivam 2002). I propose to work out some of the formal implications of this basic idea, particularly in the context of utility functions.

The flip side of the noncompensatory principle is the positive value of compromise alternatives. By definition, noncompensatory decision making avoids alternatives that have radically different values in key goals because, to compensate for a low value, one

1. "[A] nation's utility function reflects the constraints that the populace places on its government's actions" (Morrow 1986, 1140).

needs a high one on other dimensions. But this is worth expressing as a core aspect of decision making: Actors try to find compromises that score high and relatively equally on key goal dimensions.

Poliheuristic theory argues that we need to model multiple fundamental goals and constraints. Once we have endogenized the constraint, the problem can be restated in terms of utility functions. In short, decision making under constraints is closely related to the question of what is the appropriate utility function for a decision maker with multiple goals. Once we have included multiple goals, we need to model how goals interact according to the noncompensatory principle. For example, Astorino-Courtois and Trusty (2000) analyzed how Syria had three core dimensions that it used to evaluate policy options in its relationship with Israel: (1) political honor/credibility, (2) containment of Israeli influence, and (3) security. According to poliheuristic theory, three of the nine possible alternatives were eliminated in the first stage of the process (including the outcome predicted by expected utility analysis) and eliminated by the noncompensatory impact of the political honor/credibility dimension.

To introduce these basic ideas, I use the example of the rules of war. This is a good example because it is very common for expected utility thinkers to conceptualize institutions and norms as constraints on individual decision making. I will suggest that it makes more sense to think of this in terms of multiple goals. I use the survey data of Brunk, Secrest, and Tamashiro (1996) to show how most people fit better the multiple-goal model than the maximizing-under-constraints one. The data of Brunk, Secrest, and Tamashiro indicate that most people have both security and institutional values as goals and are fundamentally concerned with making compromises between them.

I then define a class of models that consists of core noncompensatory dimensions: This results in models that are quasi-noncompensatory. Instead of thinking of noncompensatory models in dichotomous terms, we should think of them in continuous terms: As an alternative gets worse and worse on a core dimension, it is harder and harder to compensate for it. When the alternative reaches zero on a key goal, then it is eliminated because it is impossible to compensate for it.

I conclude the study by showing how the insights of poliheuristic choice have important implications for spatial modeling and the choice of utility function. The standard utility functions used in the literature almost uniformly violate the core notions of poliheuristic theory. If we take noncompensatory decision making, loss avoidance, and the positive value of compromise seriously, one would choose other utility functions.

INSTITUTIONS, NORMS, AND DECISION MAKING UNDER CONSTRAINTS

The key question in this section revolves around how individuals relate to institutions. I am not concerned with how or why individuals create institutions but rather how individuals decide in normative contexts. I propose that the idea of decision making under constraints is a common view of the interaction between a decision maker and her or his normative environment.

> In general, I will have little to say about compliance with norms, because, in this theory, compliance or noncompliance is merely the result of the application of the principle of maximizing utility under different constraints. (Coleman 1990, 286)

> Institutions . . . are the humanly devised constraints that shape human interaction. (North 1990, 3)

The behavioral decision-making literature on fairness and economic behavior illustrates the problem involved in exogenizing institutions/norms as constraints. Kahneman, Knetsch, and Thaler (1986, 729) provide an example to which I can relate from previous experience as a Toronto resident:

> Question 1. A hardware store has been selling snow shovels for $15. The morning after a large snowstorm, the store raises the price to $20. Please rate this action as: completely fair, acceptable, unfair, very unfair.

Of those surveyed, 82% said that this was unfair.

Of course, standard economic theory says that increases in demand are accompanied by increases in price, so that the market clears. When living in Toronto, I have walked to the local hardware store after snowstorms and ice storms (being of myopic rationality) to buy tools. The store did not raise its price to take advantage of my misfortune.

Economists normally explain the behavior of my Toronto hardware store as instrumental behavior in the maximization of long-run profits. My hardware store knows that I might become very unhappy if I am gouged by the market-clearing price of snow shovels right after a storm and might begin to take my business elsewhere.

This is exactly the maximization of profit under constraints. Since the hardware store owners are not fools, they have some ideas about how their clientele react to what they consider unfair behavior. Hence, the ethical norms of people in the neighborhood are exogenous factors for the hardware store owners.

This move saves the standard economic assumptions of the firm at the price of challenging economic assumptions about the consumer. What is exogenous to the firm must then be endogenous to the consumer. Why does my hardware store (which was, after all, only 2 blocks from my home) have to worry? If I were made unhappy, I might take the additional effort to go a mile to another hardware store. Customers are willing to sanction (i.e., pay costs) in defense of their norms of fairness. Kahneman, Knetsch, and Thaler (1986, 736) asked exactly this question:

> A willingness to punish unfairness was also expressed in the telephone surveys. For example, 68 percent of respondents said they would switch their patronage to a drugstore five minutes further away if the one closer to them raised its prices when a competitor was temporarily forced to close.

The standard economic response to this would then be that one needs to incorporate fairness concerns into the utility function. That is exactly what this study proposes. The experimental decision-making literature is full of examples of how individuals balance fairness and moneymaking concerns (e.g., Guth et al. 1982; Hoffman and Spitzer 1985; Roth et al. 1981). In almost all cases individuals do not exclusively maximize the money payoffs; these are reduced by fairness concerns of various sorts. I will argue that people, organizations, and governments, in general, make compromises between important goals.

ENDOGENIZING CONSTRAINTS

> In the decision-making situations of real life, a course of action, to be acceptable, must satisfy a whole set of requirements, or constraints. Sometimes one of these requirements, or constraints, is singled out and referred to as the goal of the action. But the choice of one constraint from many is to a large extent arbitrary. For many purposes it is more meaningful to refer to the whole set of requirements as the (complex) goal of the action. This conclusion applies both to individual and organizational decision-making.
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> —Herbert Simon (1996)

Simon (1996) expresses a fundamental argument of this study: The distinction between goals and constraints reveals itself, in the final analysis, to be an arbitrary one. Poliheuristic theory is distinctive in its focus on how decision makers consider multiple goals and constraints. Depending on the situation, these goals can be domestic, international, political, organizational, and the like. What is notable is how poliheuristic theory brings these considerations directly into the decision-making model.

It could well be that one person's exogenous constraint is another person's endogenous goal. For example, poliheuristic analyses often take domestic politics and public opinion as one kind of constraint on foreign policy choice in democracies (e.g., Mintz 1993). In other contexts, some have argued that the one goal of politicians is reelection (Mayhew 1991). If we were to take that position, then foreign policy would be a constraint on the goal of reelection. In the case of politicians—like everyone else—I think that the most realistic view is that they have both policy and election goals (Lindsay 1994).

If put this way, I have reformulated decision making under constraints as a question about multiple goals and utility functions. In any given situation, a problem will arise for a decision maker about how the issue and various options relate to her or his goals—say, policy and reelection. By doing this, we have really endogenized the constraints. We can now address and be aware that not only can constraints be reformulated as goals, but some people also really do have the constraints as goals.

MORAL NORMS AND WAR WINNING

> Should tradeoff reasoning be treated as a defining property of rationality, good judgment, and maturity? For realists, institutions, and economic liberals, who argue that decision makers are utilitarians, the answer is yes. Leaders think in terms of how much of *x* they are willing to give up for *y*. For Kantian liberals and constructivists, it is possible to identify large classes of important issues for which decision makers find compensatory

> tradeoff reasoning illegitimate. . . . For example, regarding weapons systems, constructivists might expect leaders to believe that it is preferable to kill more people with conventional arms than to break a taboo by dropping one small atomic bomb.
>
> —J. Goldgeier and P. Tetlock (2001)

The topic of war and the rules of war provides a good example of the issues that relate constraints to multiple goals. Here we can see how one person's constraint is another person's goal. We shall also see that few people fall into the one-goal box. Few place exclusive emphasis on the rules of war to the exclusion of the other policy goals implicit in a war choice; in the same way, few focus exclusively on the goals to be gained by war at the complete expense of the rules of war. Most people consider both in making their choice.

Brunk, Secrest, and Tamashiro (1996) surveyed a wide range of U.S. elites regarding their attitudes about when war is appropriate and how it should be waged. They looked at various elite groups, such as retired military officers, retired members of Congress, priests, diplomats, and journalists. The survey contained items designed to test for various positions that the authors had found in the literature on morality and war, for example, pacifism, just war theory, and so forth. I want to focus on two belief systems—one they called "better safe than sorry," which contains, loosely, a conservative, risk-averse, realist position; the second one holds the basic principles of a just-war theory.[2]

The "better safe than sorry" position I shall call realism since, in its pure form, it attaches little weight to moral principles or to international rules about the conduct of war. In its extreme form, national security always overrides moral norms. In contrast, the just war position represents a decision-making structure in which moral principles preempt concerns for war engaging or war winning.

In terms of the Brunk, Secrest, and Tamashiro (1996) survey, we can ask to what extent we find pure one-goal types among U.S. elites, either in the realist direction or in the just-war one. Table 1 reproduces their results. I use the term "strict" to designate those who were clear-cut realists or clear-cut just-war proponents. The data show that few elites are either pure realists or pure just-war advocates. The vast majority, 73%, fall into what Brunk, Secrest, and Tamashiro call the "ambivalent" category, the moderate-moderate cell of the table.

Of course, for me it is not that 73% of the respondents were ambivalent but rather that they have multiple values. In any given scenario, they try to balance competing concerns. The scholarly literature tends to focus on the polar cases, whereas most elites appear to fall somewhere in between. This is how I interpret Welch's (1993) claim about the importance of the justice motive in war decisions; it was an important input into the decision but not the only one.

Table 2 shows how the sampled elites responded to hypothetical scenarios that brought into play security and the rules-of-war dimensions. Clearly, the mixed type—which is 73% of the sample—weights the moral goals higher than the realists but not as high as the just-war types. They are trying to balance the competing concerns of

2. The results of their survey showed little support for other positions, such as moral crusading (i.e., use of war to change others beliefs), pacifism, and so on.

TABLE 1
Mixed Goals (in percentages)

	Just War	
	Moderate	*Strict*
Realism		
Moderate	73	13
Strict	14	1

SOURCE: Compiled from Brunk, Secrest, and Tamashiro (1996, 146).

security and international norms about war. Not surprisingly, they lie between the realists and the just-war advocates. This is the sort of compromising I think is typical of most decision making.

The study by Brunk, Secrest, and Tamashiro (1996), which was conducted really for other purposes, illustrates most of the claims made in this analysis: (1) most people have multiple goals, (2) different people weight those goals differently, and (3) constraints for some are goals for others.

NEGATIVE IS MORE IMPORTANT THAN POSITIVE

One thing that stands out in the study of actual individual and organizational choice is that losses are treated differently from gains. The distinction between the positive and the negative lies at the core of prospect theory. The S-shaped utility function is concave in the realm of the losses and convex in the region of the gains. This contrasts with the straight line that, according to expected utility theory as usually practiced, should run through the positive and negative regions.[3] Also, those who have studied organizations and policy have found that they are much more sensitive to failure than to the prospects for gain.

The decision making under constraints idea reflects a different way to avoid negative values on an important dimension. Recall that a constraint must be satisfied before maximization can proceed. This means that the decision maker avoids options that are negative (as defined by the constraint) before making an optimal choice. Once we have endogenized the constraint, this then becomes a general principle to avoid options that score low on one goal, even if the score is high on other dimensions. Gains in other dimensions do not compensate for the low value on the constraint/goal.

As with prospect theory, this makes sense of a lot of what we see in practice. For example, the U.S. political establishment was in agreement that returning the Panama Canal to Panama was the best decision. The treaty was negotiated under Henry Kissinger and Gerald Ford and supported by the Carter administration. However, pub-

3. Of course, one can get convex and concave utility functions by other means—notably, attitudes toward risk (see Morrow 1994).

TABLE 2
Goal Trade-Offs:
Support for a Hypothetical War With Nicaragua, by Belief System
(in percentages)

Survey Item	*Realism*	*Mixed*	*Just War*
If Nicaragua sets up a communist government	13	4	5
If Nicaragua starts a military buildup that overshadows its neighboring states	21	7	5
If Nicaragua sends aid (arms, advisers, etc.) to communist revolutionary movements in neighboring countries	32	14	11
If Nicaragua invites Soviet military bases to be set up within its borders	65	33	27
If Nicaragua invades a neighboring country	66	52	36
If there is clear evidence that Nicaragua is going to join an attack on the United States	95	77	67

SOURCE: Compiled from Brunk, Secrest, and Tamashiro (1996, 148).

lic opinion polls showed little support for this move. As a result, there was much hesitation in the Senate regarding ratification. On a more intimate level, parents who have more than one child will often refuse options whereby one child who is not well off is balanced by the other children who are doing extremely well.

Hence, I propose that a basic decision-making principle is:

> Avoid Major Loss Principle. Any option that scores low on a key goal receives a low overall rating.

When Mintz (1993, 1995) introduced noncompensatory decision making as part of poliheuristic theory, he was expressing the same idea. One immediately eliminates alternatives that imply major losses on key value dimensions, typically the political dimension. For example, during the Cuban missile crisis, the Kennedy administration had two goals: (1) get the missiles out and (2) avoid war with the USSR. Or, if you prefer, the constraint version: get the missiles out under the constraint of avoiding war. Options that scored low on either goal were never very seriously pursued. Diplomatic protest was unlikely to get the missiles out; military invasion was likely to cause war. According to accounts of the decision-making process, neither of these options was followed up in a serious way.

Loss aversion is a well-established principle. It is a core part of poliheuristic theory, not to mention prospect theory and behavioral decision theory in general. Loss aversion is related to the relative importance of pain versus gain as a behavioral incentive. Individuals and organizations respond much more to loss and failure than to the prospects for gain. For example, Lau (1985; see also 1982) found that among Democrats, 77% of disapprovers of Johnson voted in 1966, whereas only 64% of the approvers did; for Republicans, it was 78% and 64%, respectively.

The principle I propose matches perfectly what the poliheuristic decision-making procedure describes. In his analysis of decision making before the Gulf War, Mintz (1993) shows that an option was first tested on the domestic politics side. If it did not score well there, it was eliminated from further consideration, even though it might have been a good solution to the Iraq problem. In his survey of the experimental evidence about poliheuristic theory, Redd (2002) found consistent support for the noncompensatory nature of decision making. Here I argue that this is, in fact, a general principle of decision making when there are several important goals. It is because they are key goals that people hesitate to compensate for them.

FORMAL QUASI-COMPENSATORY MODELS

In looking at decision making with multiple goals, I depart from standard practice. If one examines utility functions as they appear in the political science literature, typically the function contains only one variable ("utiles"). All considerations of tradeoffs and competing goals do not appear. The classic von Neumann-Morgenstern procedure (see Morrow 1994 for a textbook treatment) involves a process of making gambles between various desirable things. This results in a continuous utility function with desirable properties. Although nice in theory, it is useless in practice.

More common are assumptions about the shape of the utility function. Sometimes, it is simply a linear function (e.g., Pahre 1997), with utility declining linearly with distance (see below for more on this). Convex shapes are popular because they represent well the idea of decreasing marginal utility.

If there is more than one variable in the utility function, then the question arises about how they interact (or not). As Mintz et al. (1994) discuss, additive relations between variables are standard in most (expected utility) decision frameworks and represent compensatory models. If Z_1 has a low value, it can be compensated for by a high value on Z_2. These kinds of models thus lack the core poliheuristic principle given above; low values on core goal Z_1 cannot be compensated for by high values on Z_2: In other words, a low value on Z_1 does not eliminate it from consideration.[4]

We need to define utility functions with noncompensatory factors, factors that are necessary for Y to attain a high value. Constraints and noncompensatory factors impose necessary conditions; they must be satisfied. We need utility functions where a low value on any key goal prevents the overall utility from achieving significant levels.

A simple way to think of this is by way of dichotomous variables; either the option satisfies the key goal or not. If the option does not satisfy the goal, then the option is

4. Noncompensatory factors are intimately related to the more general phenomenon of nonfungibility. This can most clearly be seen in the behavioral decision literature in economics. According to standard economic theory, money is fungible across accounts. However, there are numerous examples in which people do not follow the fungibility rule. Thaler (1991) has proposed that people have different accounts for money and that money is not fungible across accounts. Gifts, pension funds, and windfall gains are all treated differently than regular income. People will often pay higher interest rates as part of this behavior. For example, a consumer can often borrow more cheaply from her or his (pension) savings to finance purchases, such as cars, yet she or he often prefers to pay the higher dealer rates.

TABLE 3
A Simple Noncompensatory Function

Z_1	Z_2	Y
1	1	1
1	0	0
0	1	0
0	0	0

eliminated. This would give us a situation illustrated in Table 3. Clearly, when either dimension, Z_1 or Z_2, is absent, then the option is not considered (i.e., $Y = 0$).

More generally, we can extend this idea to continuous variables in which 0 and 1 are the two extremes. Then we want utility functions with the following properties:

$$Y = f(Z_1, Z_2, \ldots)\ \ Z_i \in [0, 1], \tag{1}$$

where

$$Y = 0 \text{ when any } Z_i = 0,$$

and where

$$Y = 1 \text{ when all } Z_i = 1.$$

The "ideal point" would be something that scores the maximum (i.e., 1) on all dimensions, giving us the maximum value of *Y*, 1.

The obvious example of such a model, but not the only choice, uses a multiplicative form. Such a model satisfies the fundamental requirement for a multivariate non-compensatory utility function—that a poor score on one dimension makes the overall utility for the option low. Hence, a basic model is

$$Y = Z_1 * Z_2 * Z_3. \tag{2}$$

This emphasizes that multiplication often characterizes the utility functions that interest me. If we take Z_i as dichotomous variables, we get Table 3.

Equation (2) implicitly weights each dimension equally. This is of course not usually the case. Some goals are more important than others. Reelection may be more important than policy goals; winning the war may be more important than the rules of war. Some goals are just more important than others. However, one can easily give differential weights to each dimension by adding parameters as exponents, giving us

$$Y = Z_1^{\beta_1} * Z_2^{\beta_2} * Z_3^{\beta_3}. \tag{3}$$

Equation (3) expresses this through different values of β_i. Since all the Z_i lie in the interval [0,1] if $\beta_i > 1$, then this goal is more important since it reduces the overall evaluation more than dimensions with βs less than 1—for example, $.25 = (.5)^2 < (.5)^1$. If Z_i is a less important factor, then its β is less than 1—for example, $.71 = (.5)^{.5} > (.5)^1$. In this case, the impact of Z_i is mitigated; even though Z_i has low importance itself, its impact on the whole is not so severe. If all the $\beta_i = 1$, then we have equal weights for all parameters, and equation (3) reduces to equation (2).

The limiting case of $\beta_i = 0$ provides a test of the importance of a given dimension since $\beta_i = 0$ implies that $Z_i^{\beta i} = Z_i^0 = 1$, $Z_i \neq 0$. This means that Z_i has no impact on the overall evaluation; regardless of the actual value of Z_i (except 0 when it is undefined), its contribution to the overall value is always the maximum, 1.

The noncompensatory model presented in equation (3) does not decompose into simple bivariate effects, as would be the case in additive utility functions. The only clear-cut bivariate effect occurs when Z_i equals 0.

Equation (3) is quite familiar to economists; it is the classic Cobb-Douglas production function. The Cobb-Douglas production function has a venerable history, going back to 1928 (Cobb and Douglas 1928). As its name indicates, it tries to model the production of (industrial) goods as a mixture of capital and labor inputs:

$$Q = a * K^{\beta} L^{1-\beta}, \qquad \beta \geq 0 \qquad \alpha > 0. \tag{4}$$

It is clear that this[5] is exactly the model I described above. However, one must be careful since not all production functions have the characteristic I have required for noncompensatory models.

In contrast to additive utility functions, these noncompensatory models have two key characteristics. The first is that they are nonlinear. Both the multiplicative form and the parameters in the exponents make the model very nonlinear. Second, the model is interactive in nature. A change in one variable (say, from near 1 to near 0) can have a dramatic impact on the whole.

I suggest that the noncompensatory effect for a dimension be defined in terms of the limiting or barrier-setting characteristic of the factor.[6] This emphasizes the key characteristic of a noncompensatory factor: Its absence (or low value) reduces the overall score to 0 (or very low levels), whereas the presence of a noncompensatory factor says only that the overall evaluation *may* be greater than 0.

I propose that the noncompensatory effect be defined as:

> The noncompensatory effect of Z_i is the maximum utility attainable given that all the other variables are at their maximum (i.e., 1.00).

$$Z_i^{n.e} = \max f(\mathbf{Z}) \qquad \text{where } Z_{i \neq j} = 1. \tag{5}$$

This defines the barrier beyond which one cannot increase utility without increasing Z_i itself, stressing the constraining role of the noncompensatory variables in the model (see below for a graphical interpretation of this point).

5. In the special case of $(\beta_1 + \beta_2 + \beta_3) = 1$, the function is said to be linearly homogeneous. This is actually the most common expression of the Cobb-Douglas production function in economics. Used in such a form, Cobb-Douglas statistical models are tested with restricted least squares (Greene 1993, 211-16).

6. In other work (Goertz 2003), I have called this the "necessity effect." Recall that noncompensatory factors are necessary conditions.

My use of the Cobb-Douglas function as a core example of noncompensatory utility functions goes against the spirit of economic analyses of these functions. In either their utility or production function version, the emphasis is on the maximum output (for an international relations example, see Morgan and Palmer 2000). Here I have focused on how low values on key goals keep overall evaluations low. The stress lies on the limiting effects of low values on key decision dimensions.

The decision-making under constraints model makes the noncompensatory constraints absolute. Once the constraints have been endogenized, it is more useful—and realistic—for the noncompensatory factors to have a continuously increasing effect as their value on the noncompensatory factors declines. In other words, as an option scores lower on a key goal, it should have a greater, negative effect on the overall utility. The extreme case is when the noncompensatory dimension has value 0, which results in 0 utility. In equation (1), this was the requirement that $Z_i = 0$ make the overall utility function, $f(Z_1, Z_2, \ldots) = 0$. The continuous version says that when Z_i is near 0, then so should $f(Z_1, Z_2, \ldots)$.

When Z_i equals 0, we have a "strict" noncompensatory utility function. No matter what the values of the other $Z_{i \neq j}$, the overall utility is 0. "Quasi"-noncompensatory decision making enters in when $Z_i > 0$. In this case, Z_i does not fix—it now constrains—the overall utility function, which now depends on the values of Z_j. So a low value on Z_i can be compensated for, at least partially, by high values on Z_j.

But how much can Z_j compensate for Z_i? This is determined by the noncompensatory effect defined above. Hence, the utility functions defined here really have a quasi-noncompensatory character. For all values of $Z_i > 0$, some limited compensatory effects can occur. One can partially compensate for a low Z_i by a high Z_j.

Figure 1 illustrates graphically some quasi-noncompensatory utility functions and many of the points I have been making. Notice that all of the surfaces are attached to the Z-axes. This is the requirement that $Y = 0$ if Z_1 or Z_2 equals 0, the strict noncompensatory idea. When either Z_1 or Z_2 is 0, then Y is 0, no matter what the value of the other variable. The noncompensatory effects appear if you fix either Z_1 or Z_2 at some value greater than 0. If you fix Z_1 at some point greater than 0, then the noncompensatory effect is the value of Y that one can attain when $Z_2 = 1$—this is the maximum utility one can get for that fixed value of Z_1. Notice that when Z_1 is small, the noncompensatory effect can be dramatic. In contrast, if Z_1 is large (i.e., near 1), a lot depends then on the value of Z_2.

These various examples show that the idea of quasi-noncompensatory models makes good intuitive sense. Key are low values on central goals because they have a large impact on the overall utility function. This makes sense of the idea that because they are key goals, we should—and are—hesitant to permit big compensatory effects. We want, if possible, something that scores relatively high on all our key ends. These quasi-compensatory functions put into mathematical form some deeply held intuitions.

Swiss decision making about their nuclear bomb shelters provides a nice illustration of how quasi-noncompensatory decision making works in practice (Schärlig 1985). Defense officials evaluate civilian shelters on a variety of criteria. They code

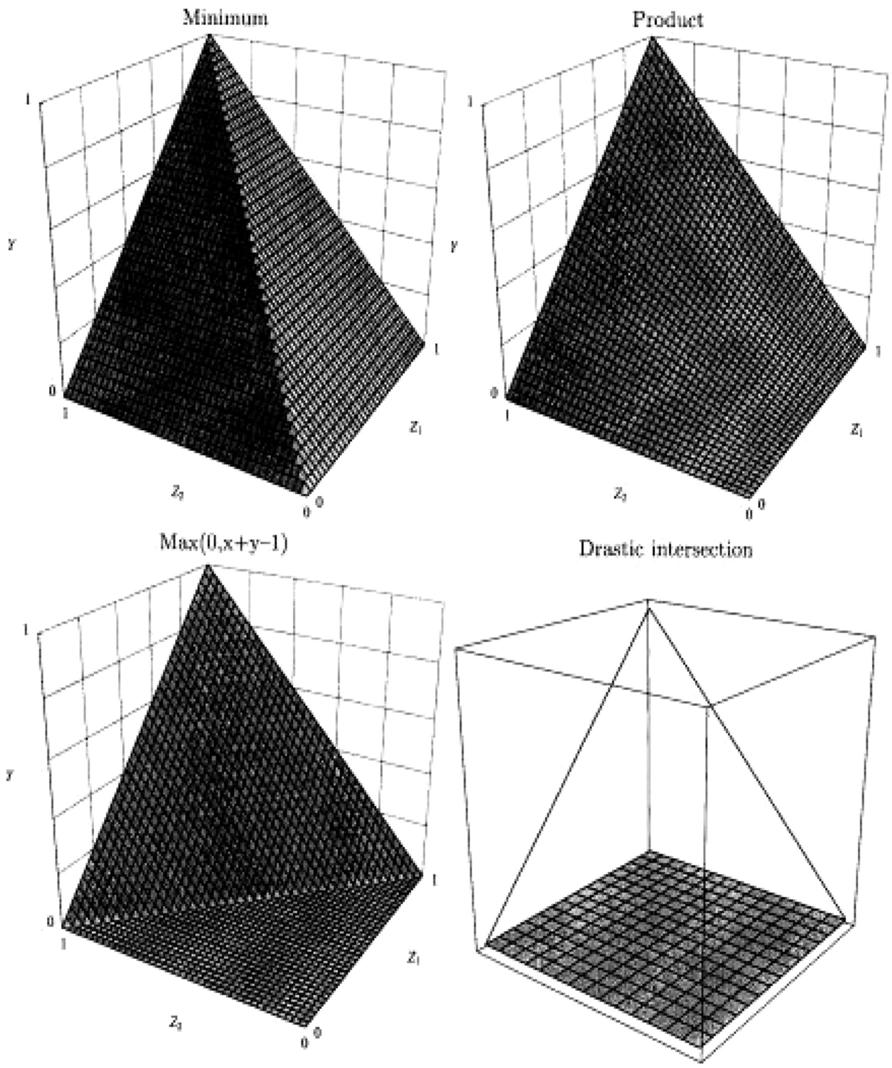

Figure 1: Quasi-Noncompensatory Utility Functions

each dimension as follows: *very good* = 1, *good* = 2, *usable* = 5, and *bad* = 40. The decision rule is that if the total score is greater than 50, then the shelter is unusable. Thus, if any dimension receives a 40 (i.e., bad), it is extremely unlikely that the shelter will pass inspection. It is quasi-noncompensatory because a "bad" does not definitively exclude the shelter, but it does make it very hard for the shelter to qualify.

The quasi-noncompensatory models presented here capture very well one aspect of poliheuristic theory:

> But while these studies capture the salience of domestic politics to foreign policy decisions, they fall short of recognizing the *noncompensatory* nature of the decision process. In fact, no study views "satisficing" the domestic politics criterion as a prerequisite for the use of force in a noncompensatory decision-making environment. Domestic politics becomes the sine qua non, and subsequently military outcomes need not be assessed alongside a multiple of trade-offs . . . a low score in the political dimension cannot be compensated for by a high score on some other dimension, politicians are not likely to adopt unpopular policies. (Mintz and Geva 1997, 84)

I have extended this basic idea to the general idea of decision making under constraints. Quasi-noncompensatory utility functions then give some specific, mathematical form to one core aspect of poliheuristic theory.

WEIGHTING GOALS

In the above analysis (e.g., Figure 1), I have considered both goals equally important. But the standard case is one in which we attach different weights to key goals. This was very clear in the Brunk, Secrest, and Tamashiro (1996) survey; some people weighted the goals of just-war theory much higher (or lower) than others. If we use equation (3), we can examine the different goal orientations of different types of actors.

As an example, we can look at what one might call a "prudential realist," a classic realist of the Morganthau school. Clearly, for such a leader, security concerns are very important, whereas moral rules of war are somewhat important. A realist leader in a democracy might be somewhat concerned with the rules of war because of negative public opinion fallout. Here these concerns reflect the constraints of public opinion—domestic and international—and how they induce a goal. For example, Tannenwald (1999) shows that realists, such as Eisenhower, Nixon, and Kissinger, considered using nuclear weapons in war but were constrained by public opinion.

We can weight the two goals in equation (3) using some ideas from fuzzy logic. In fuzzy logic, there exists a class of operations called "hedges." These are adjectives and adverbs that modify the strength of basic concepts (see Cox 1999 for an introduction). The standard fuzzy logic interpretation of the hedge *very* is to square the basic value. This acts to concentrate the high values at the upper end of [0,1] since $z^2 < z$. The standard fuzzy logic hedge for *extremely* thus becomes z^3. The general rule, then, is that the more important the goal, the larger the exponent.

The *somewhat* hedge gets operational definition in terms of the square root. In contrast to the square, this dilutes the values since $z^{.5} > z$. At the extreme, something that has no importance at all has the exponent 0. At zero $z^0 = 1$, this factor has no impact at all on the overall evaluation.

Figure 2 illustrates the value function of a typical prudential realist. Notice that the surface is skewed toward the security end (i.e., Z_2) of things. This means that for the realist to get a high utility, she or he needs to move along the Z_2 security dimension, not the Z_1 rules-of-war dimension. The overall evaluation increases much more rapidly as one moves along the security dimension than along the moral rules dimension. For example, the rules-of-war dimension can be quite low (e.g., .05), and if the security

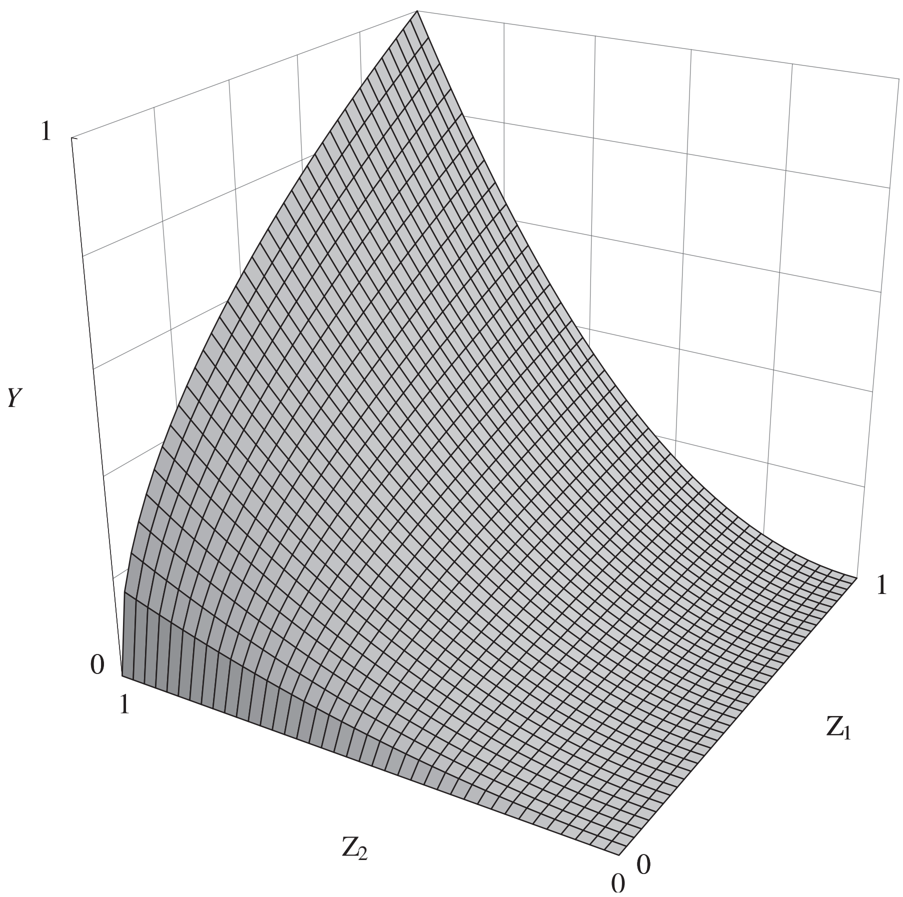

Figure 2: Prudential Realism Utilities

dimension is at its maximum of 1, then the overall evaluation is almost .25. If one inverts the two, the results are quite different: If security is low (e.g., .05), moving the rules of war to its maximum has virtually no effect in terms of increasing the overall evaluation, a quasi-noncompensatory effect.

BACK TO CONSTRAINTS

I argued above that what one needed was not exogenous constraints but endogenous goals. One of the problems with constraints in the typical maximization under constraints (using Lagrange multipliers, for example) is that the constraints are absolute. Hence, the model is likely to be very unstable when values are near the constraint. However, with quasi-noncompensatory utility functions, we can model the constraints in a much more flexible and integrated fashion.

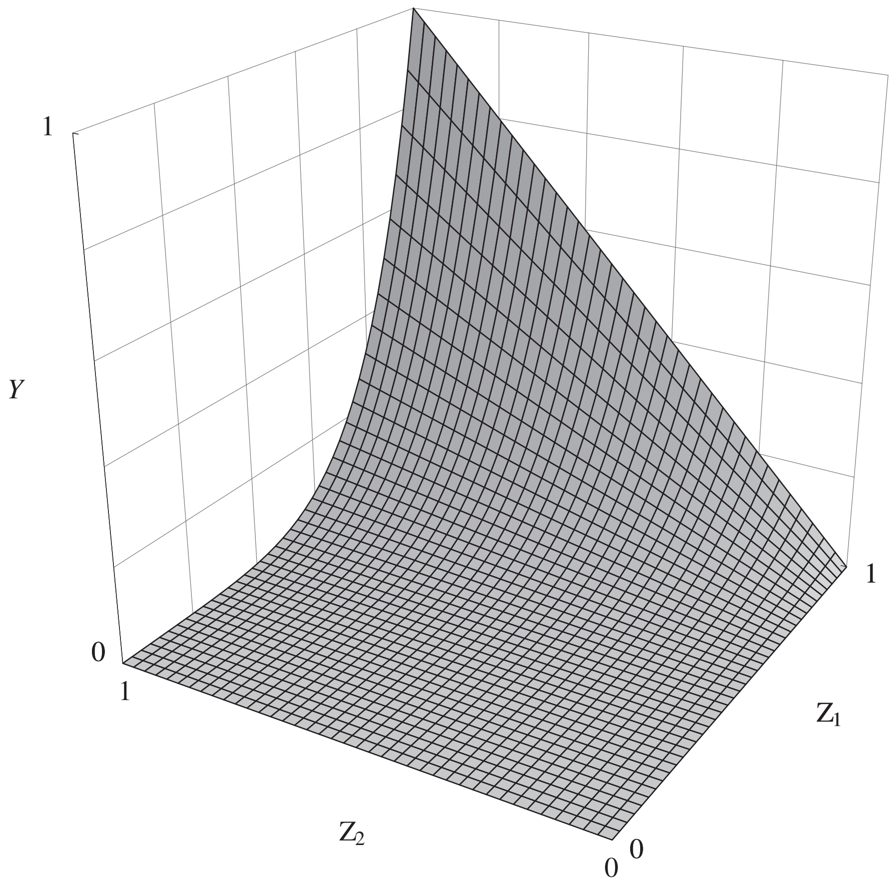

Figure 3: International Norms as Constraints

Recall that in the pure case, a constraint must be satisfied before any maximization can take place on other dimensions. We can reformulate this in terms of the importance of a given dimension. We can thus model a real constraint by giving that dimension a very high importance level.

Suppose, as illustrated above, that institutions—like the moral rules of war—are constraints under which expected utility decision makers maximize. We would then have a situation illustrated by Figure 3. The rules of war (i.e., Z_1) are really a constraint (they are *very extremely* important, i.e., with an exponent of 5). When the rules-of-war dimension is low, then the overall evaluation is near 0 until the constraint is close to being satisfied (i.e., near 1.00). Instead of an absolute constraint, Figure 3 shows that something near 1 satisfies the constraint *sort of*. If the constraint is absolutely satisfied (e.g., moral rules are exactly 1.0), then the overall value increases with the value of the Z_2 security dimension.

One might be surprised that most of the surface is flat until one gets to higher values of Z_1. But remember that is what the constraint idea says: A low value on the constraint dimension—moral rules of war—means the overall evaluation must be about zero.

In short, by endogenizing constraints as goals, we are, in fact, better able to model them as constraints. One classic constraint in economics is the budget constraint: One's spending must be within income. But here too, even more clearly, the constraint is a loose one. As data on consumer debt in the United States indicate, one can partially violate the income constraint. It makes much more sense to say that spending within one's income is an important goal, to be balanced against other important goals.

COMPROMISE

> An alternative "satisfices" . . . if it meets aspirations along all dimensions (attributes). If no such alternative is found, a search is undertaken for new alternatives. Meanwhile, aspirations along one or more dimensions drift down gradually until a satisfactory new alternative is found or some existing alternative satisfices.
>
> —Herbert Simon (1996)

In the previous sections, I focused on the importance of the domain of the losses on the overall utility function. This was the negative, noncompensatory effect that low scores on one dimension can have on the whole (the avoid major loss principle). The basic principle was that low values on key dimensions result in low overall values. This section deals with two core, related issues in making decisions: how to make the best choice and how to make compromises between core goals.

Making trade-offs and optimal choices is exactly what concerns decision theorists and economists. When they examine, say, the Cobb-Douglas production/utility function, they analyze it in terms of making the optimal choice. For example, Cobb-Douglas usually contains labor and capital as the two variables; the goal is to maximize production by determining the optimal mix of the two. This involves simple tools of differential calculus. Given the prices of labor and capital and a budget constraint, one can find the optimal mix of labor and capital (e.g., Chambers 1988); this is exactly what Morgan and Palmer (2000) do in an international relations context.

The standard economic analysis assumes that all possible mixes of labor and capital are available, and so there are no hard choices to be made. If we move to real-life (political) decisions, our possible options are usually limited. Going back to Figure 1, we would like an option that scores 1 (the maximum) on all core goals: We would like to have our cake and eat it too. Unfortunately, the world rarely provides us with such choice sets. We have to make hard choices that involve trade-offs between important goals. For example, the literature on moral philosophy is full of examples where one has to choose between competing (moral) principles. In terms of Figure 1, we have choice options that are high on Z_1 and low on Z_2 or vice versa, but we have none that score high on both.

I suggest that most people implicitly match the payoff on the two goals (subject to the avoid major loss principle). They look for a compromise between the two competing goals. If possible, they trade off high values on one goal to bring up values on the lower scoring goal.

In economic terms, they "substitute" one goal for another. A central part of the economic analysis of production/utility functions is the substitutability of labor for capital (and vice versa). The exponents of equation (3) indicate how substitutable they are (the price of one in terms of the other, if you will).

In my context, the exponents indicate the relative importance of each goal in the utility function. If goal Z_1 is significantly more important than Z_2, then it will take relatively little of Z_1 to raise the level of Z_2. If Z_2 happens to be very low, it will often be worthwhile, overall, to sacrifice a little of Z_2 to increase the level of Z_1.

As general rule, then, we prefer options that are balanced on key goals. This can be seen in the various graphs of Figure 1. *Y* is higher when both *Z*s have the same value. For example, if option *1 is* $Z_1 = .2$ and $Z_2 = .8$, whereas option 2 is $Z_1 = .5$ and $Z_2 = .5$, in almost all the graphs, we are better off (or at least as good off) choosing option 2.

I call this the *compromise principle*. People try to make compromises that will bring up low scores on core dimensions. This is exactly what Simon (1996) says in the epigraph to this subsection: We begin to relax our requirements on some dimensions to bring up the value (to satisfice) on lower scoring goals.[7]

UTILITY: LINEARITY AND ADDITIVITY

The approach I have just presented relates directly to the issue of utility functions. One can think of the justification of equations, such as Cobb-Douglas, as an argument for a certain class of utility functions. It is thus worthwhile to contrast standard practices in political science with the perspective proposed here. We shall see that a concern for conflicts between dimensions and the importance given to loss lead to utility functions quite different from what one finds, almost without exception, in the political science and international relations literature.

Most applied work using utility functions contains a one-dimensional, overall utility function. Hence, the issues that occupy me here do not arise; they are usually dealt with by assumptions about the form (e.g., convex, concave) of the utility function. However, the literature on spatial modeling explicitly includes two or more dimensions—issues—so one can compare how this approach differs from one derived from poliheuristic theory.

The spatial modeling framework portrays a person's position, as in Figure 4. To use my language, a particular alternative or outcome can score high or low on issue 1 (e.g., domestic public opinion) and high or low on issue 2 (e.g., foreign policy goals, such as the cold war).

7. Elsewhere, I have argued (Goertz 2003) that one strength of fuzzy logic as an approach to decision making is that at its core, fuzzy logic averages conflicting advice (in the form of different norms, rules) to arrive at a final choice. It is fundamentally a balancing, compromising decision-making technique.

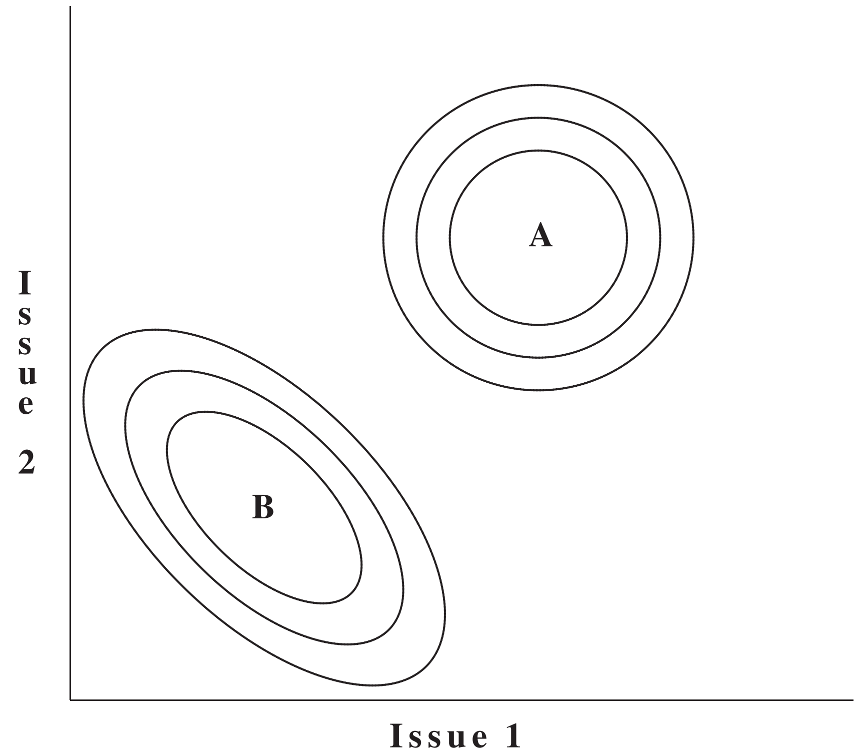

Figure 4: Spatial Models: Indifference Curves

Points A and B are called the “ideal points” for persons A and B. Possible alternatives are thus evaluated in terms of the distance between the alternative and the ideal point (or the distance between two alternatives). This means that distance from the ideal represents the utility of a given alternative to A or B. The closer the alternative to the ideal point, the higher the utility. The circles around A and the ellipses around B are indifference curves. They signify indifference because the utility associated with all points on the curve is the same—hence, the actor is indifferent between them all. In terms of utility, they are all the same distance from the ideal point.

The circular indifference curves around A mean that issues 1 and 2 are independent of each other. The elliptical curves around B illustrate a case in which there is dependence between issues 1 and 2 (the main axis of the ellipse corresponds to the correlation coefficient in statistics). What about the assumption of independence? Morgan finds that it is quite acceptable for the area of international conflict:

> Preferences are nonseparable [i.e., correlated] when, for some reason, the actor’s preference ordering on one issue depends on the outcome on another. It seems that preferences over issues involved in international crises are separable. . . . It is possible, however, to

> conceive of situations in which preferences are not separable. This generally occurs when some *constraint* exists (apart from actions of the opponent) that prohibits an actor from achieving its most preferred outcome on all issues. (1994, 35-36; emphasis added)[8]

Basically, independence corresponds to the additive view. The overall evaluation is the sum of the two (independent) dimensions. Utility is like adding two independent random variables. In contrast, the poliheuristic utility models I have outlined above are strongly dependent. This can be seen most forcefully when one dimension equals zero; no matter what the value or movement on the other dimension, the overall evaluation remains zero.

Morgan (1994) does recognize that there are some cases in which correlated utility models work better. The example he gives fits nicely in the context of this study: He says that issues are likely to be correlated if there are constraints! In a footnote to the above quote, he gives an example using budget constraints. Even more, he says that the correlated case fits when one is unlikely to achieve one's ideal point. It seems to me that these two provisos—constraints exist, and the ideal point is unrealistic—cover nearly all decisions and certainly all interesting ones.

This section concerns utility, so it is important to see that the measure of distance between points in Figure 4 is what determines utility. Hence, a key question is the actual measure of distance used in the spatial modeling literature. The obvious and almost universal choice is Euclidean distance. This is the length of the straight line between two points. Basically, utility is a linear function of distance. Graphically, if you keep issue 1 constant and move up or down on issue 2 by distance k, then utility change is proportional to k. This is not the case in my framework outlined above. Changes in dimension 1 or 2 lead to nonlinear changes in utility.

The standard measure of distance in the spatial modeling literature is Euclidean distance: $[(x_1 - y_1)^2 + (x_2 - y_2)^2]^{1/2}$. (This can be weighted, but that does not affect my argument here.) All the functions of this class lie above those in Figure 1. Conceptually, they do not incorporate the avoid major loss principle—or, to use poliheuristic terms, they are compensatory. Hence, the standard utility functions used in the spatial modeling literature lie above the ones illustrated in Figure 1. Here we see in mathematical terms that the poliheuristic class of utility functions is radically different from the standard, linear one.

It is useful to visualize the spatial modeling setup in Figure 4 from my three-dimensional perspective, which illustrates the mathematical points just made. The indifference curves around A and B all represent the same utility; that is, they all have the same Z value in the third dimension. The indifference circles in Figure 4 become a utility sphere, as illustrated in Figure 5 (which shows only part of the sphere). The ellipses around B would generate similar ellipsoid figures. Various horizontal slices through the sphere give the indifference curves of Figure 4, and the far corner point

8. For another example: "We assume that issues are separable and that utility functions are single-peaked. We do not believe these assumptions are unduly restrictive" (Lepgold, Bueno de Mesquita, and Morrow 1996, 46).

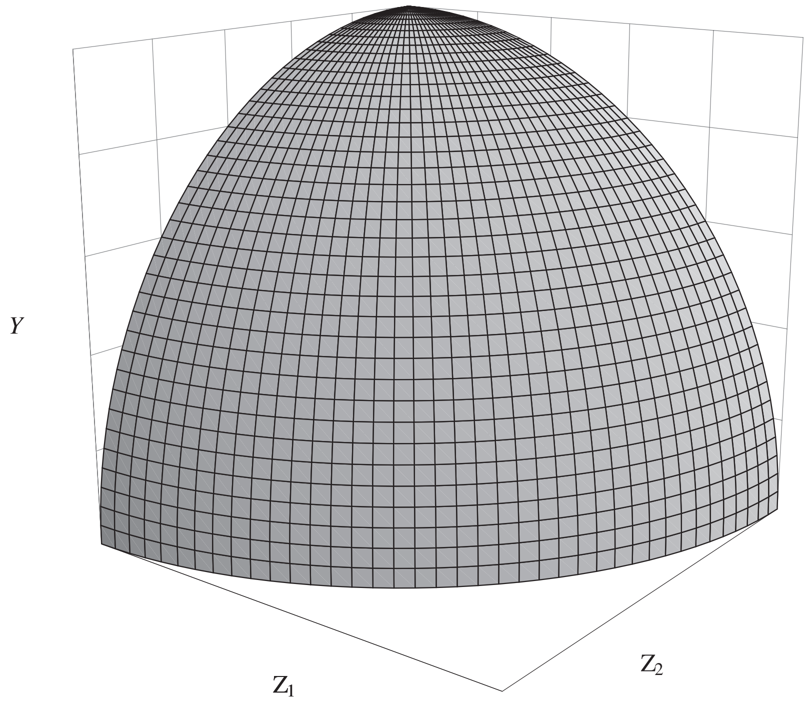

Figure 5: Spherical Utilities

(1,1,1) would be the ideal point. Comparing Figure 5 with Figure 1 shows the graphic difference between the spatial modeling view of actors and their decision making and mine. If you do the horizontal slicing in Figure 1, you get nothing like the circles or ellipses of Figure 4.

Scholars have found that, when trying to fit different utility functions for individuals, concave functions often work better than convex ones. For example, Krzysztofowicz and Koch (1989) found the following results for different forms of the utility function: 20% linear, 35% concave, 19% convex, and 26% mixed concave/convex. In his survey, Luce (2000, 80) found that the best-fitting functions that tie money to utility are power or exponential functions—hence, utility functions such as Cobb-Douglas.

The key point in contrasting Figure 5 and Figure 1 is that one needs to understand how key values interact and understand the dependencies between them. Poliheuristic theory implies strong dependencies between value dimensions, whereas typical spatial models assume little dependency. Astorino-Courtois and Trusty (2000) conclude their poliheuristic analysis of Syrian decision making with similar considerations:

> On both a practical and theoretical level, application of the model to Syria's decisions regarding the peace process demonstrates the importance of analyzing the value

> structures that underlie actor's preferences. Improved understanding of the relationships between critical value dimensions involved in foreign policy decisions—especially as they are impacted by seemingly modest changes in a bargaining setting—should help illuminate an important dynamic in the evolution of relations between states. (p. 375)

CONCLUSION

> All decision is a matter of compromise.
>
> —Herbert Simon (1996)

The concerns of the writers of the U.S. Constitution illustrate very well the avoid major loss and compromise principles. The designers of the Constitution faced problems similar to those I have discussed here. Looking specifically at foreign policy (although many of same issues arose in domestic policy), they had two key goals. One, they knew that energy was needed for an effective foreign policy. Foreign policy was often better conducted under a unified executive (e.g., king). Diplomacy, speed, secrecy, and so forth were often crucial to a good foreign policy and were best obtained under a unified command. Yet, at the same time, they wanted a republican democracy. They were very afraid of the concentration of power in one set of hands (the famous separation of power). Much of the debate at the constitutional convention revolved around how best to obtain these two goals.

Although most of the individuals wanted to achieve both goals, they weighted their relative importance differently. Some, such as Hamilton, wanted a stronger executive; others, such as the anti-Federalists, were more concerned about the concentration of power in the federal government. In terms of equation (3), they had different values for the exponents.

The final result in foreign policy (and the Constitution as a whole) was a compromise between the two goals of an strong executive and democracy as embodied in the Congress. Major policy decisions (e.g., treaties and war) required the input of Congress, achieving in that way a more democratic foreign policy. However, the conduct of war and diplomacy was left to the executive, showing a concern for efficiency and effectiveness.

In making these design decisions, the framers of the Constitution were forced to make compromises. There was no design option that scored 1.0 on all the key dimensions. What they avoided was a constitution that scored low on key goals. They were not willing to give up democracy to have the most efficient foreign policy. They substituted the ability to initiate a surprise war for more democracy in the decision to make war. I believe that the gain in democracy largely compensated for the loss of options in war initiation.

The writers of the Constitution had just been through two experiences that emphasized the shortcomings of one-sided solutions. The American Revolution expressed the view that the concentration of power in the hands of a king was not desirable. The Articles of Confederation showed that a weak and decentralized federal government did not produce good policy. The experience of 200 years has perhaps shown that the compromises embodied in the U.S. Constitution were not too bad.[9]

REFERENCES

Astorino-Courtois, A., and B. Trusty. 2000. Degrees of difficulty: The effect of Israeli policy shifts on Syrian peace decisions. *Journal of Conflict Resolution* 44:359-77.

Brunk, G., D. Secrest, and H. Tamashiro. 1996. *Understanding attitudes about war: Modeling moral judgments*. Pittsburgh: University of Pittsburgh Press.

Chambers, R. 1988. *Applied production analysis: A dual approach*. Cambridge, UK: Cambridge University Press.

Cobb, C., and P. Douglas. 1928. A theory of production. *American Economic Review* 18:139-65.

Coleman, J. 1990. *Foundations of social theory.* Cambridge, MA: Harvard University Press.

Cox, E. 1999. *The fuzzy systems handbook*. 2d ed. New York: Academic Press.

Epstein, D. 1984. *The political theory of the* Federalist. Chicago: University of Chicago Press.

Goertz, G. 2003. *International norms and decision making: A punctuated equilibrium model*. New York: Rowman & Littlefield.

Goldgeier, J., and P. Tetlock. 2001. Psychology and international relations theory. *Annual Review of Political Science* 2001:67-92.

Greene, W. 1993. *Econometric analysis*. 2d ed. London: Macmillan.

Guth, W., R. Schmittberger, and B. Schwarze. 1982. An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization* 3:367-88.

Hoffman, E., and M. Spitzer. 1985. Entitlements, rights, and fairness: An experimental examination of subject's concepts of distributive justice. *Journal of Legal Studies* 14:259-97.

Kahneman, D., J. L. Knetsch, and R. Thaler. 1986. Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review* 76:728-41.

Krzysztofowicz, R., and J. Koch. 1989. Estimation of cardinal utility based on a nonlinear theory. *Annals of Operation Research* 19:181-204.

Lau, R. 1982. Negativity in political perception. *Political Behavior* 4:353-78.

———. 1985. Two explanations for negativity effects in political behavior. *American Journal of Political Science* 29:119-38.

Lepgold, J., B. Bueno de Mesquita, and J. Morrow. 1996. The struggle for mastery in Europe, 1985-1993. *International Interactions* 22:41-66.

Lindsay, J. 1994. *Congress and the politics of U.S. foreign policy.* Baltimore: Johns Hopkins University Press.

Luce, R. 2000. *The utility of gains and losses.* Hillsdale, NJ: Lawrence Erlbaum.

Mayhew, D. 1991. *Divided we govern*. New Haven, CT: Yale University Press.

Mintz, A. 1993. The decision to attack Iraq: A noncompensatory theory of decision-making. *Journal of Conflict Resolution* 37:595-618.

———. 1995. The noncompensatory principle of coalition formation. *Journal of Theoretical Politics* 7:335-49.

Mintz, A., and N. Geva. 1997. The poliheuristic theory of foreign policy decision-making. In *Decision-making on war and peace: The cognitive-rational debate*, edited by N. Geva and A. Mintz. Boulder, CO: Lynne Rienner.

9. It is quite interesting to see the position of James Madison on the one compromise, regarding slavery, that eventually led to the Civil War. Madison thought slavery was the "most oppressive dominion ever exercised by man over man" (cited in Epstein 1984, 105), yet he knew that southern states would refuse any constitution that outlawed slavery. His compromise was a scheme whereby the federal government would slowly buy out the slaves in the South by the sale of western lands. This compromise would, in addition, recognize the rights and interests of slave owners in their "property." Obviously, this scheme was never carried out, but it shows how Madison struggled to find a compromise when confronted with very hard choices.

Mintz, A., and S. Mishal. 2003. Decision matrixes and outcomes: Arafat and Sharon's policy alternatives and considerations in the intifada. Discussion paper, Curiel Center for International Studies, Tel Aviv University.

Mintz, A., N. Geva, and K. DeRouen. 1994. Mathematical models of foreign policy decision-making: Compensatory vs. noncompensatory. *Synthese* 100:441-60.

Morgan, T. 1994. *Untying the knot of war: A bargaining theory of international crises*. Ann Arbor: University of Michigan Press.

Morgan, T., and G. Palmer. 2000. A model of foreign policy substitutability: Selecting the right tools for the job(s). *Journal of Conflict Resolution* 44:11-32.

Morrow, J. 1986. A spatial model of international conflict. *American Political Science Review* 80:1131-50.

———. 1994. *Game theory for political scientists.* Princeton, NJ: Princeton University Press.

North, D. 1990. *Institutions, institutional change and economic performance*. Cambridge, UK: Cambridge University Press.

Pahre, R. 1997. Endogenous domestic institutions in two-level games and parliamentary oversight of the European Union. *Journal of Conflict Resolution* 41:147-74.

Redd, S. 2002. The poliheuristic theory of foreign policy decision making: Experimental evidence. In *Integrating cognitive and rational theories of foreign policy decision making*, edited by A. Mintz. New York: Palgrave Macmillan.

Roth, A., M. Malouf, and J. Murninghan. 1981. Sociological versus strategic factors in bargaining. *Journal of Economic Behavior and Organization* 2:153-77.

Sathasivam, K. 2002. "No other choice": Pakistan's decision to test the bomb. In *Integrating cognitive and rational theories of foreign policy decision making*, edited by A. Mintz. New York: Palgrave Macmillan.

Schärlig, A. 1985. *Décider sur plusieurs critères*. Lausanne: Presses Polytechniques Romandes.

Simon, H. 1996. *The sciences of the artificial*. 3d ed. Cambridge, MA: MIT Press.

Tannenwald, N. 1999. The nuclear taboo: The United States and the normative basis of nuclear non-use. *International Organization* 53:433-68.

Thaler, R. 1991. *Quasi-rational economics*. New York: Russell Sage Foundation.

Welch, D. 1993. *Justice and the genesis of war.* Cambridge, UK: Cambridge University Press.