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Rationality Wars and the War on Terror: Explaining Terrorism and Social Unrest

ABSTRACT Terrorism is problematic at multiple levels. Social scientists debate its cause; policymakers debate what to do about it; many debate the meaning and political use of the term; and many live in fear of it. Current explanations of terrorism hinge on competing models of decision making. Anthropologists are increasingly influential in decision theory as issues of rationality, culture, and evolutionary psychology are invoked to explain patterns in human decision making. In this article, I review and critique current explanations of terrorism, I relate these explanations to larger debates in decision theory and anthropology, and I present an example of how current schisms may be transcended. [Keywords: terrorism, decision sciences, rationality, bounded rationality, sigmoid-utility theory]

TERRORISM AND THE SUBSEQUENT War on Terror have affected societies around the globe and attracted the attention of researchers from disciplines as varied as political science, psychology, economics, physics, and anthropology (Barabasi 2003; Caplan 2006; Post 1990; Sageman 2004; Simons 2006; Smelser et al. 2002). Researchers debate causes such as poverty, failed states, humiliation, religion, and culture clashes using theories based on different assumptions about human cognition and decision making (Habeck 2006; Huntington 1993; Pape 2005; Sageman 2004; Stern 2003). Researchers are particularly challenged to explain why relatively well-off individuals are attracted to terrorism (Atran 2003; Maleckova 2005). My goals in this article include reviewing key current explanations of terrorism, demonstrating their dependence on decision-theory models, suggesting an approach that can help resolve decision theory debates, and providing a sounder understanding of terrorism in its varied forms. I provide two examples of how this new approach can explain the development of political radicalism and terrorist violence, and the paradox of wealthy and middle-class involvement with terrorism. Even though the examples refer to Islamic groups, most nonstate actors engaged in asymmetric conflict are within the purview of this article.

A central theme in this article is the extent to which people, including terrorists, exhibit the tenets of rationality, which include a full awareness of one's preferences and resources, self-interested motives, and the conduct of cost–benefit analyses to maximize one's satisfaction. Bounded rationality theorists challenge this view by noting that lim-

its to cognition exist, often suggesting that people use very simple heuristics when making decisions. They posit that some limits, like norms, are culturally derived, and others are socially constrained. Recent research in neuroscience indicates the ways that emotions and the recognition of inequity influence decision making. I use these different developments to formulate an approach that focuses on culturally derived measures of social status, embeds value in social context, and provides measures of risk taking that correlate with envy and humiliation, as well as greed. This approach's features allow researchers to model the cultural and emotive factors that current terrorism theorists think are relevant for understanding the phenomenon of global terrorism. I begin this article with a definition of *terrorism* and a discussion of the term's problematics.

TERRORISM

The term *terrorism* dates from the French Revolution and has a long history of varied definitions and political connotations (Chomsky 2002; see Hoffman 1998:15–28 for a history of the term). Nonetheless, James Lutz and Brenda Lutz (2004, 2005:7) point out that published *terrorism* definitions have the following commonalities. Terrorism is best regarded as a tactic utilized by groups of individuals who oppose stronger political or military organizations and by asymmetrically weak groups to target noncombatants for death and injury (and property for destruction) to intimidate and put political pressure on dominant organizations (see also Combs 2003; Hoffman 1998; Smelser et al.

2002:14–15). Those most commonly labeled "terrorists" are typically nonstate actors. This in no way denies that states use terror; analysts routinely classify state-run violence as state terror (Combs 2003; Hoffman 1998; Lutz and Lutz 2004; McCauley 2006). The distinction between terrorism and state terror simply draws an analytical distinction in the scale, motivation, and means by which fear-inducing violence is employed. Also, the notion that "one man's terrorist is another man's freedom fighter" is obviated if one adopts and consistently applies the Lutz and Lutz definition: It applies to organizations such as al-Qaeda, and to the Sons of Liberty who tarred and feathered officials during the American Revolution (see global review in Lutz and Lutz 2004 and 2005:167 and comparisons in Schneider and Schneider 2002). Terms like *terrorism* can be used consistently and scientifically, even if governments use them arbitrarily. An alternative is to use a less controversial term, but in the absence of an accepted term, I work with the term at hand.

EXPLAINING TERRORISM

Many theories of terrorism focus on the role of poverty or political–economic chaos in weak states (Combs 2003; Lutz and Lutz 2005:13–18; Shahrani 2002). However, recent research has uncovered a paradox: Both impoverished and wealthy individuals become terrorists (Krueger and Maleckova 2003), and some of the most chaotic states do not produce terrorists (von Hippel 2002). This leads researchers to reject the role of these factors in motivating terrorism and to assume that religious ideology, thwarted political realization, social alienation, or humiliation are root causes (see reviews in Combs 2003; Lutz and Lutz 2005; Rapoport 1990; Simons 2006; Stern 2003). I review two of these explanations to demonstrate their dependence on current developments in decision theory.

Education and Poverty

Examining data from the Middle East, Alan Krueger and Jitka Maleckova (2002, 2003) aim to refute theorists and policymakers that blame poverty and a lack of education for terrorism, and by extension to refute the rational-choice paradigm on which these theories are based. In contrast to the argument that uneducated people rationally rebel because they lack opportunity, they find that support for terrorism increases with education (Krueger and Maleckova 2003:127, 132, 135, 140). Similarly, anthropologists note that Indonesian jihadists often recruit university students (Hefner 2002), and studies of terrorists in other regions note the same (Habeck 2006; McDermott 2005; Sageman 2004). In contrast to rational-choice theories that explain rebellion as a rational attempt to win wealth and leave poverty, Krueger and Maleckova's findings demonstrate that terrorists are not necessarily poverty stricken. For instance, support for terrorism among Palestinians increases along an economic continuum (Krueger and Maleckova 2003:126). A review of Lebanese Hezbollah, Palestinian *shahids* (martyrs), and the Israeli Jewish Underground likewise demonstrates

that members of these organizations suffer lower rates of poverty on average than their parent populations (Krueger and Maleckova 2003:131, 135). Krueger and Maleckova (2002: 32) specifically argue that these data refute economic theories of terrorism, implying that education increases political motives to engage in terrorism.

The Evolutionary Psychology of Terrorism

Scott Atran (2003) and Atran and Jessica Stern (2005) favor a small-group dynamics and an evolutionary-psychology approach, and stress the influence of charismatic leaders who invoke fictive kin relations and nepotism to influence socially alienated individuals. They note that "80% of [European] Jihadis live in diaspora communities, marginalized from the host society, and in hard-to-penetrate social networks" (Atran and Stern 2005:620). Ayla Schbley and Clark McCauley (2005) recently reported the same pattern, and Marc Sageman (2004:127) describes how jihadists exploit the disorientation of migrants for recruitment. Charismatic leaders integrate recruits in tight-knit, family-like groups where nepotistic emotional attachments can grow (Atran 2003:1534; see also Schbley and McCauley 2005 for empirical evidence). Similarly, Anna Simons (2006) stresses bonding among young males as another mechanism. Decision making in this situation is bounded by "conditions of group pressure and charismatic leadership" (Atran 2003:1535). The reliance on fictive kin conventions indicates a role for cultural norms, consistent with suggestions by bounded rationality theorists. Atran and Stern conclude that "such reasoning is not very sensitive to standard cost-benefit calculations" (2005:620).

The work of both Krueger and Maleckova and Atran and Stern provides important refutations to simplistic notions that fixing poverty or changing education and state propaganda alone will eliminate terrorism. Their work is intellectually valuable because it demonstrates how theories of terrorism hinge on models of decision making. Current skepticism about economic models of decision making, in favor of more normative models, informs these areas of inquiry.

DECISION-MAKING PARADIGMS AND THEORIES

A fundamental issue debated in the formalist–substantivist debates of the 1960s was whether people rationally pursue selfish goals (see formalists Cook 1966; Schneider 1989) or meet their needs by following the culturally prescribed dictates of their cultures (see Dalton 1961 for the substantivist position). Another debated position was whether people rationally pursue material goals (Harris 1979). These debates continue with some anthropologists arguing in favor of some form of rational or selfish model of human decision making (Betzig 1986; Winterhalder and Smith 2000) and others arguing for group-oriented and normatively driven decision models (Richerson and Boyd 2005). These models of human decision making are both implicitly and explicitly at the core of current theories of terrorism, and so a

review of these paradigms helps to evaluate the basis for terrorism explanations.

Rational-Choice Theory

Some explanations of terrorism invoke rational choices made by terrorists (Crenshaw 1990; Pape 2005), mostly for personal gain or as a cost-effective strategy for achieving political aims. Rational-choice theory has been the canon of neoclassical microeconomics for at least a century. Its core concepts include the assumptions that:

1. Collective economic phenomena (prices, national accounts, production efficiency) are the result of the individual decisions of autonomous decision makers;
2. individuals have full knowledge of their preferences;
3. individuals have full knowledge of the resources they have to satisfy their desires;
4. individuals maximize their satisfaction, or utility, by allocating their scarce resources to alternative ends optimally;
5. individuals possess all the capabilities for calculating how to allocate their resources optimally; and
6. individuals are concerned only with maximizing their own utility; they are unconcerned with how poorly or well others are doing (Cowell 1986:ch. 4).

The omniscience implied in assumptions 2–5 is an overstatement of human capabilities (Gigerenzer and Selten 2001; Klein 2001). Individuals never have complete knowledge of everything they need to know to behave truly optimally, and few decision makers have the computational ability required to maximize complicated objective functions. The assumption of strict self-interest (assumption 6) has also been strongly criticized and demonstrated to be limited in its applicability. In many experiments, researchers have found that individuals will approximate rationally self-interested behavior when confronted by a computer or an impersonal market (Fehr and Schmidt 1999; Sanfey et al. 2003). However, when individuals know they are dealing with other individuals, they become "other regarding" and consider their partner's intent and the fairness of the transaction (Camerer and Thaler 1995; Fehr and Schmidt 1999; Kahneman 2000). Anthropologists have reproduced these other-regarding results in nearly 20 different societies (Henrich et al. 2004; Paciotti and Hadley 2003; Tracer 2003). Based on these analyses, bounded rationality theorists argue that rational-actor theory no longer appears tenable.

Bounded Rationality

Skepticism about economic rational choice for understanding terrorism is evident in Atran and Stern's work and implicit in Kreuger and Maleckova's, as noted above. The primary alternative to rational choice in anthropology is bounded rationality. Prospect theory (Kahneman and Tversky 2000) is another paradigm that is important in the decision theory literature. Its core elements include the real-ization that people distort probabilities, that people feel the disutility of loss more than the utility of gain, and that decisions can be strongly influenced by the manner in which a problem is framed. I have recently applied prospect theory concepts both to general decision making and to terrorism, and I have found that its basic precepts can be synthesized with the concepts focused on in this article (Kuznar 2006; Kuznar and Kobelja 2006b; Kuznar and Lutz 2007). However, prospect theory has received virtually no attention in anthropology or in the terrorism literature, and a full treatment is beyond the scope of this article. Therefore, I will focus on those decision theories germane to current anthropological and terrorism theory debates.

Imitative Heuristics. Bounded rationality theorists have stressed that decision making relies on simple imitative heuristics. Imitative heuristics are commonly used in computer simulations of social unrest, social fragmentation, and terrorism (Carley et al. 2003; Epstein 2002; MacKerrow 2003). Robert Boyd and Peter Richerson (1985:213 ff., 241 ff.) originally modeled how simple heuristics, such as imitation of common behaviors (conformist transmission) and imitation of prestigious individuals (prestige bias), potentially account for a wide variety of both adaptive and maladaptive behaviors (see also Henrich 2002; Henrich and Boyd 1998; Richerson and Boyd 2005) and the evolution of social differentiation and conflict (McElreath et al. 2003). Joseph Henrich (2002:992) further stresses that imitation obviates the relevance of payoffs in decision making.

Although imitative learning occurs, key questions remain unanswered and need to be further researched before simple imitation can be concluded. If people imitate peers (conformist transmission), then what social sample is relevant: one's family, neighbors, the human race? If prestige bias is operant, then which prestigious individuals are imitated: the head of a family, the village headman, an imam, a pope? Without further guidance as to when different social scales are germane, the paradigm fails as a testable guide for research.

Inequity Aversion, Payoff Relevance, and Emotion. A more promising avenue of research concerns the broader and more systematic ways that inequality and perceptions of unfairness influence decision making. Researchers of terrorism increasingly pay attention to humiliation as a key motivational element (Habeck 2006:92; Pape 2005; Rapoport 1990; Smelser et al. 2002:26; Stern 2003). For humiliation to create outrage, individuals need the capacity both to evaluate relative payoffs (not just blindly imitate) and evoke emotional reactions to inequality.

Anthropologists have long appreciated the important role reciprocity plays in exchange. Cross-cultural research establishes that individuals expect gifts to be reciprocated and that people punish nonreciprocators in personally costly ways (Camerer and Thaler 1995; Fehr and Schmidt 1999; Henrich et al. 2004:19; Paciotti and Hadley 2003; Tracer 2003). Because reciprocity involves apparently

voluntary giving in the absence of compulsion (through law or threat of violence), it is sometimes offered as evidence of altruism (Sethi and Somanathan 2001). However, in a real world of potentially repeated interactions, the "tit-for-tat" nature of reciprocation is not necessarily altruistic if in the long run reciprocation rewards friends that help and punishes enemies that harm the reciprocator (Axelrod 1997).

Neuroscientists have noted that reciprocal behavior elicits activity in emotion (bilateral anterior insula) as well as maximization goal-maintenance (dorsolateral prefrontal cortex) and reward-processing areas of the brain (Rilling et al. 2002:397; Sanfey et al. 2003:1756–1757); economic decisions are not payoff irrelevant. Furthermore, the fact that individuals feel conflict between cooperation and temptation to defect on a partner is manifest in activity in a cognitive conflict–processing region, the anterior cingulate cortex, or ACC (Rilling et al. 2002:398; Sanfey et al. 2003:1757). This conflict would not exist if people blindly imitate or are instinctively altruistic. The fact that regions of the brain involved with the consideration of preferences, goals, and payoffs and regions influenced by emotion activate during decision making illustrates that humans are cognitively complex (Adolphs 2006) as well as emotively influenced (Damasio 1994).

Inequity aversion refers to a dislike of inequality and a concern with fairness; it is widely observed in human experiments (Andreoni et al. 2002; Irlenbusch and Sliwka 2005) and among nonhuman primates (Brosnan and de Waal 2003). The existence of inequity aversion requires a concern with reputation and the accounting of social capital. Experimental results reinforce the notion that decisions in interpersonal, reciprocal exchange are influenced by concerns over one's reputation (Nowak et al. 2000; Sigmund et al. 2002). Neuroscientists have identified regions of the brain (especially the ACC) whose activity is associated with social humiliation, potentially revealing a measurable mechanism by which reputation and social status affect decision making (Lieberman and Eisenberger 2006). Inequity aversion and social accounting are rational in an environment with repeated interactions; no one can materially afford to be a sucker.

The intellectual landscape of decision theory is complicated and its various paradigms contested. Nonetheless, decision paradigms influence the foreign policies of governments and the programs of NGOs, taking on the character of axiomatic truisms that are accepted as received wisdom (see politician's statements quoted in Krueger and Maleckova 2002: 27). However, the research reviewed above has identified several decision and social processes that are likely to have an influence on rebellion and terrorist recruitment. Sigmoid-utility theory is an example of how some of these insights can be synthesized into a theory that transcends old paradigmatic boundaries.

Sigmoid-Utility Theory

The sigmoid-utility concept originated in rational-choice theory, in which researchers proposed that social classes cre-
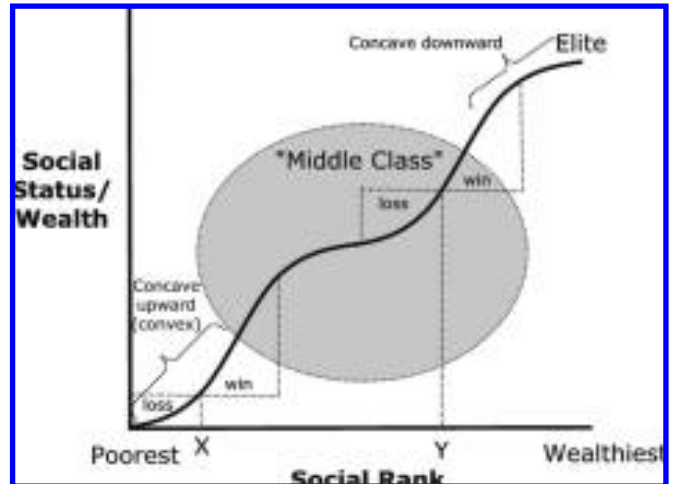
FIGURE 1. Location in a convex section of a social-status curve (positions X and Y) predicts risk-taking behavior. Location in a concave-downward section predicts risk-averse behavior.

ate convex regions in utility curves that would lead to risk taking (Friedman and Savage 1948). Sigmoid-utility theory posits that where qualitative jumps in social status occur, the increase in status possible by taking a risk outweighs the loss in status by losing. For instance, if one takes a chance to enter a higher social class and loses, that person still remains a member of his or her class; there is much to gain and little to lose. People prone to take risks therefore are located in convex sections of a status curve, as depicted in Figure 1. The term *status* here refers to a measure of the value placed on an individual in his or her social system, not to a particular role a person has in society as traditionally conceived by anthropologists (Linton 1936).

The underlying assumption of the original utility theory is that an individual achieves marginal gains in utility with gains in wealth, although Milton Friedman and Leonard Savage's discussion of class indicated that the theory could be more broadly applicable to marginal gains in more culturally valued "goods" such as social status. The development of sigmoid-utility theory I present here embeds value in social structure, restructures value to be a nonlinear function of social rank, and broadens the source of value to include psychological and neurological phenomena such as social status and envy, as well as a desire for material gain.

Value, or utility, functions are not necessarily private valuations over a good but, rather, are fundamentally conditioned in relation to the social environment, such as the distribution of wealth in a community. This represents a shift from purely private and subjective individual utility functions to an understanding of utility that emerges from social organization. For instance, an individual's value of a good, such as a sports car, can theoretically be entirely private, but a person's social status is necessarily relative to the distribution of status among others. In other words, if no one else cared to own a sports car, it could not serve as a status symbol and therefore would not carry much value (see Schwartz 2004 for an exposition on the social distribution

of goods and envy). Therefore, the *x*-axis in Figure 1 is not a quantity of a good but, rather, of social rank, and the *y*-axis is not utility per se but, rather, a measure of social status based on that rank. Consequently, sigmoid-utility theory describes how people would act when striving to increase their marginal social status. Because status presumably confers value to an individual, I continue to use the term *utility*, although the differences with traditional rational-choice utility theory should be noted. The full approach I demonstrate in this article is perhaps best considered a synthesis of sigmoid-utility theory with broad notions of bounded rationality and quasi-rational paradigms.

On the basis of the neuropsychological studies cited above (see, esp., Fessler 2001; Lieberman and Eisenberger 2006), researchers understand that perceptions of inequality evoke feelings of humiliation and loss of honor and associated brain activity. Therefore, sigmoid-utility theory has the potential to operationalize insights on how reputation, feelings of humiliation, and relative deprivation may lead to risk-taking behaviors such as terrorism; the social status curve becomes in this case a means of measuring of the strengths of peoples' emotional states, whether they be greed, envy, or humiliation. The theory's reliance on socially constrained and relative values, such as social status, makes it consistent with some bounded rationality (Fessler 2001; McCabe and Smith 2001) and social-network approaches (Oliver and Myers 2003; Watts 2003) to decision making.

Anthropological Applications and Relevance to Terrorism. Sigmoid utility was first successfully employed in anthropology by F. Cancian (1972) to explain economic risk taking by Mayan peasants. Bruce Winterhalder and colleagues (1999) provide a review of applications in anthropology and biology. I have developed sigmoid-utility theory by creating methods by which status and the potential to take risk can be measured. I have also tested this approach on a variety of cases, including risk attitudes of Andean pastoralists (Kuznar 2001), relative hunting efforts of foragers and competition among macaques (Kuznar 2002a), a reinterpretation of experimental results among Mapuche Indians and Sangu herders (Kuznar 2002b), the rebellious behavior of Mayan nobles and American colonists (Kuznar and Frederick 2003), and political behavior in the Palestinian Authority (Kuznar et al. 2006). In all cases, the approach has succeeded in predicting observed patterns of group behavior, the typical metric for validating theories of rebellion and terrorism. Recent research aimed at making finer-grained predictions of actual individuals' political behavior in Kapauku society (Irian Jaya) has also met with a similar degree of success (Kuznar and Kobelja 2006a; see below for another example).

The relevance of this approach to understanding terrorism is underscored by the recognition that the global expansion of Western economic institutions creates new class structures and animosities in many Third World societies (Smelser et al. 2002:21). The frequent recognition of a sense of humiliation at Western prosperity by radical Muslims (Habeck 2006; Simons 2006; Smelser et al. 2002; Stern 2003) also indicates the need for a model of social accounting and resentment. Also, Krueger and Maleckova (2002: 29, 31) and Atran and Stern (2005:620) refer to relative differences in social status that evoke negative emotional responses, and sigmoid-utility theory provides an explanation of how and why this may occur. Whether individuals are attracted to nonstate rebellious organizations for material gain or out of a sense of moral outrage at inequity, the same wealth or status distributions can predict their risk proneness.

One might inquire as to why rebellions and terrorism are not present in all complex societies, because inequality is so widespread. First, not all societies have the same degree of convexity in their status distributions, and some societies like the United States have relatively few concave-upward sections (Kuznar and Frederick 2003). Second, Sageman (2004) argues that feelings of relative deprivation are an important necessary but not sufficient condition for terrorism. Convex status distributions may be a necessary condition for risk taking, but the form of risk taking could be nonviolent (protest, risky investments), depending on the opportunities available to the aggrieved. Those motivated to rebel need also to possess the means to rebel, and resource-mobilization theorists in political science have demonstrated that a requisite amount of capital and social networking is also necessary to enable rebellion (Collier 2000; Gurr and Moore 1997; Weede and Muller 1998). Sigmoid-utility theory provides an analysis of some of the necessary conditions for rebellion and terror, but these other factors are required for a full analysis of the phenomenon.

Methods. The typical pattern of wealth–status distribution in complex societies (chiefdoms, states, global economies, etc.) is a generally exponential increase from poorest to wealthiest (or lowest to highest status), but with sigmoid variation along this trend line, consequently predicting risk takers at different levels of wealth in a society (Kuznar and Frederick 2003; Kuznar and Kobelja 2006a). The ability to identify risk takers in various wealth sectors in a society gives sigmoid-utility theory the potential to resolve the paradox of the wealthy terrorist and explain the zero correlation between rebellious activity and socioeconomic background noted by Krueger and Maleckova. It is not the case that just anyone is likely to join a rebellion; instead, it is the case that certain people at different status levels are likely to rebel.

Operationalizing sigmoid utility involves defining a measure of status (wealth of varying forms, social status measures from social network analysis), ranking individuals in a society from lowest to highest status, and determining a social-status function, $S(x)$, as depicted in Figure 1, in which x is rank in a social hierarchy. I have developed a method for estimating a status function that uses an exposigmoid status function whose parameters are socially meaningful (Kuznar 2002a; Kuznar et al. 2006). The function has the form:

$$S(x) = e^{k + ax + \sum c \sin (bx)} \tag{0}$$

where *x* is social rank, $k + ax$ is a linear function, *a* is a measure of the cultural importance of rank, *c* and *b* in combination measure the waviness (amount of class distinction) in a society, and the summation is a trigonometric polynomial defined over the number of frequencies required to model the amount of class distinction (Lomb 1976).

The method of estimating this curve involves first removing any exponential effect by taking the natural log of the status measures, then extracting linear trends in social status by fitting a linear regression to the remaining data. If there are sigmoid fluctuations, then the residuals from the OLS will be periodic. A discrete Laplace transform method known as the periodogram is then applied to define the number of periods and the statistically significant frequencies of the trigonometric polynomial required to fit the residuals (Van Dongen et al. 1999). Once the linear and the trigonometric components have been estimated, those that are statistically significant form the argument to an exponent, resulting in the continuous, differentiable, exposigmoid status function, $S(x)$.

The Arrow-Pratt measure of risk aversion measures risk sensitivity (Pratt 1964). The Arrow-Pratt, $r(x)$, is the negative of the second derivative of a utility function (here a status function), divided by the function's first derivative:

$$r(x) = -S''(x)/S'(x) \qquad (1)$$

Applied to the social status function, the second derivative measures how quickly changes in one's social fortunes are changing. The first derivative normalizes this increase, correcting for the overall increase in the function at any one point (Pratt 1964). Negative values of the Arrow-Pratt correspond to convex status curves and predict the strength of risk-prone (risk-taking) attitudes. In this way, the Arrow-Pratt metric measures one's likelihood of taking or avoiding a risk depending on how much status is likely to be gained (or envied) for a given rate of increase on the social status curve, $S(x)$.

My goal is to provide a theory and method that can be operationalized on real data to model terrorism and other forms of risk taking. Sigmoid-utility methods and the Arrow-Pratt measure provide metrics of the extent to which measurable social inequality evokes emotion-based risk-taking behaviors. As a method, sigmoid-utility theory has the advantage of producing predictions about behavior from objectively measurable phenomena (wealth and status distributions). This measure can be conditioned to a particular setting by evaluating what reference sets individuals have for comparison. Are people aware of status only in their village, society-wide, or globally? What measures of status are appropriate in a particular setting: size of yam stores, herd size, or monetary wealth? Answers to these questions are accessible through ethnographic research. For instance, researchers can identify measurable dimensions relevant to status in a particular social setting. Status curves and corresponding risk measures can be estimated for each dimension of status. Those dimensions that

produce the most extreme risk measures should have the most influence on decision making. People's focus on issues will shift along with shifts in the status distribution of different dimensions. In this way, the vacillating resentments seen among Islamic fundamentalists directed sometimes to local regimes and at other times to the West (Fuller and Szayna 2000; Sageman 2004) can be explained by people's keying on different dimensions of value.

Material Matters

The anthropological debate concerning material versus ideological causation of human behavior has a long history (Harris 1979; Kuznar and Sanderson 2006; Sahlins 1976). With regard to understanding terrorism, material inequalities and senses of fairness do seem to matter, but whether or not preferences are guided by norms of fairness or greed for material wealth is potentially irrelevant: Material wealth differences provide a natural frame that signals differences in status that in turn lead to risk-taking behavior and rebellion. For instance, the September 11, 2001 (9/11), hijackers typically experienced intense feelings of material inequity. Examples include economic discrimination in Kuwait as migrant workers and discrimination as students in Germany and the United States (McDermott 2005:23, 64, 113). Furthermore, because evaluation of unequal payoffs is necessary to the brain functioning involved with social humiliation and inequity aversion, material inequalities can very well induce risk-prone behavior in the absence of selfish, wealth-maximizing greed; objectively measured wealth differentials provide an empirical insight into emotions of humiliation, resentment, and lost honor. Material wealth may not be the only consideration, but it is likely to be relevant in many instances.

The following excerpts from the Hamas Charter, Sinn Fein official history, Osama bin Laden's *Declaration of War,* Abu Bakr Naji's recently translated al-Qaeda strategic manual, and a medieval European rebel's speech illustrate the pernicious and humiliating effect material differences have:

> They [Jews] attack people where their breadwinning is concerned, extorting their money and threatening their honour. . . . With their money they were able to control imperialistic countries and instigate them to colonize many countries in order to enable them to exploit their resources. [Hamas 1988: art. 20, 22]

> The British government fostered political division between Irish Catholics and Irish Protestants through a system of political, social and economic privilege. [Sinn Fein 2006]

> The crusader forces became the main cause of our disastrous condition, particularly in the economical aspect. [From Osama bin Laden's *Declaration of War against the Americans,* in Alexander and Swetnam 2001: app. 1A, 3]

> If not for theft and robbery, our people would be the richest people. [*Management of Savagery*, Naji 2006:110]

> They are clothed in velvet . . . and we be vestured with poor cloth: they have their wines, spices and good bread, and we have the drawing out of the chaff and drink

water: they dwell in fair houses, and we have the pain and travail. [John Ball, C.E. 1377, Froissart 1910:62]

Contemporary wealth differences between Palestinians and Isrealis (Roy 1994), between Northern Ireland's Catholics and Protestants (Lutz and Lutz 2004:176), and between people of the Islamic world and Western countries in general (Smelser et al. 2002:22) fuel feelings of resentment and humiliation (Simons 2006). Not only do individuals feel this resentment, but because their frame of reference is the group to which they belong, their humiliation strengthens bonds to their groups in an effort to redress the inequity (Smelser et al. 2002:26).

Altruistic instincts need not be invoked to explain feelings of resentment that one's group members are oppressed. Given that humans depend on long-term reciprocal relationships with kin, coethnics, coreligionists, and so forth for material support, it is immanently reasonable that a threat to those one trusts may be seen as a threat to one's self (i.e., it could be me next!). This sentiment is clear in the *Declaration of War* and the *Management of Savagery* wherein bin Laden and Abu Naji both decry materialism but clearly resent Western wealth and its perceived ability to work against their version of Islam. In this way, relative poverty is related to terrorism as a social phenomenon: If one thinks one's fortunes are affected by the well-being of one's group, and if one's group is disadvantaged relative to another, feelings of humiliation and frustration are likely, and even relatively well-off individuals in the disadvantaged group will become risk prone.

Examples

Two case examples illustrate how sigmoid-utility theory combines methods and insights from current decision theories to predict vulnerability to recruitment, the evolution of radicalism and risk-taking preferences, and the effects of small-group social dynamics. The first example uses differences in material wealth to construct a status curve and simulate the formation of political groups in a large society, and the second uses nonmaterial prestige measures derived from social network analysis to measure status and risk-taking within a highly insular and tightly bonded group.

The Evolution of Radicalism within Political Organizations in Palestine. This example is based on a simulation study of the history of Palestinian political coalitions (Kuznar et al. 2006), using Palestinian Authority data on incomes and occupations (Palestinian National Authority 2003). The Palestinian data have the classic exposigmoid distribution of a complex society (see Figure 2). A curve was fit to these data to produce Arrow-Pratt risk sensitivity measures for each agent (simulated individual). These inequalities and sensitivities are most relevant to cleavages within Palestinian society, but they also fuel resentment toward their generally wealthier neighbors (Rubenberg 2003). Agents interact through a coordination game (Alvard and Nolin 2002), as depicted in Table 1.
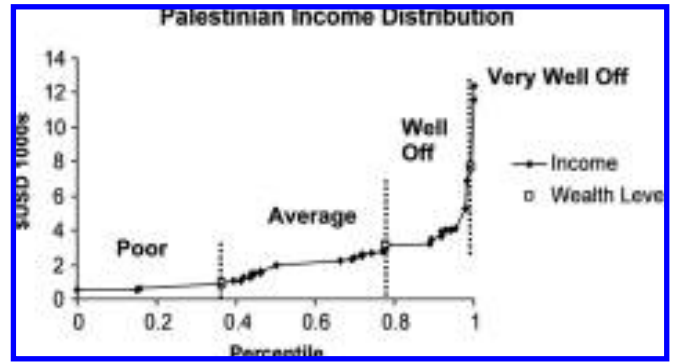
FIGURE 2. Palestinian wealth distribution by population percentile. (Data from Palestinian National Authority 2003)

The coordination game represents the potential outcomes when two individuals consider joining a coalition. If both join, they realize high payoffs (these payoffs could be material or conceptual), but they also have the option of rejecting each other and continuing with a status quo that yields lower payoffs. Joining is risky because if one joins and the other defects, the joiner receives a very low or negative payoff (the sucker's payoff). In contrast to widely used Prisoner's Dilemma games, these games have multiple Nash equilibriums and reflect the multiple feasible options commonly present in coordination and cooperation (Alvard and Nolin 2002). This game is useful for modeling the payoffs associated with joining a rebellious coalition. Recruitment often involves personal interactions between individuals, based on building trust and camaraderie (McDermott 2005; Sageman 2004), and so a 2 × 2 game models the interaction between recruiter and recruit. The relative payoffs reflect the fact that many people never join rebellions, simply continuing on with their lives and earning the payoffs (P) they normally expect from life (see Table 1). However, if rebels were to succeed, they would perceive their payoffs to be much higher (R > P). This game has a Nash optimal mixed strategy in which agents join and defect probabilistically. Applying sigmoid utility to individual decisions, each agent's Nash optimal probability of cooperating is altered in proportion to its degree of individual risk proneness; the most

TABLE 1. Coordination Game

Payoffs where $R > T = P > S$ reflect the relative benefits and costs of joining and defecting a rebellious coalition

		Column Player	
		Join	Defect
Row Player	Join	(R, R)	(S, T)
	Defect	(T, S)	(P, P)

Note. Payoffs to mutual cooperators (R) are larger than payoffs to status quo (P) and temptation (T), which are higher than the suckers payoff (S).

TABLE 2. Deviation in Average Wealth between Palestinian Population and Simulated Coalitions, and Percent Representation of Wealth Levels in Palestinian Population, Hamas–PIJ, Risk-Prone Simulated Coalitions, and Coalition 20

Wealth Level	Palestinian Population	Hamas/PIJ	Simulated Risk Prone Coalitions	Coalition 20
	Average Wealth p value of difference from Palestinian Population			
			.061	.251
	Percent Representation in Social Organization			
Poor	31	16	18	17
Average	48	41	54	47
Well-Off	20	33	24	29
Very Well-Off	1	10	5	5

risk-prone agent always joins, the most risk-averse agent never joins, and other agents join based on their risk sensitivity in proportion to these extremes (see details in Kuznar et al. 2006).

When two agents join with each other, they join a coalition. Coalitions are defined as groups of individuals linked directly and indirectly through joins. To model the effects of small-group psychology and altruistic behavior toward group members, the average risk sensitivities for coalitions of joined agents are calculated. Then, agents' probabilities of joining with nonmembers are altered from their Nash optimum in the reverse fashion from individual-agent probabilities; agents in a highly risk-prone coalition are unlikely to join with nonmembers and vice versa. This captures the notion that as groups become more radicalized (risk prone with respect to mainstream society), they become more insular and pressures to conform with in-group members increase (Atran 2003; Atran and Stern 2005; Post 1990; Simons 2006; Stahelski 2004).

In summary, the simulation iterates the following steps: (1) Produce a status distribution, (2) fit a curve, (3) calculate risk sensitivities of individuals, (4) alter individual-join probabilities, (5) calculate risk sensitivities of individuals according to coalition risk sensitivity, (6) alter individual-join probabilities, (7) randomly pair-off agents to play coordination game with revised join probabilities, (8) record coalition membership, and (9) repeat. This relatively simple simulation captures the essential features of how inequalities in social status and group membership can influence individuals' political behavior and lead to the development of variably risk-prone groups. As coalitions form, not only their size but also their composition and overall risk sensitivity can be calculated, creating virtual histories of the growth and decline of organizations and measures of their relative risk proneness (radicalism) through time.

The simulation outputs provide an explanation for the mixed results of empirical studies (Krueger and Maleckova 2003). Enough history and coalition development occurred by iteration 75 to allow comparisons to actual Palestinian political groups. Overall, the mean wealth of the risk-prone coalitions was only weakly statistically higher than the general population (t-test, $p = .061$), and the largest risk-prone group (Coalition 20) was not statistically significantly different from the general population, in agreement with Krueger and Maleckova's (2002: 28) findings of near-zero correlations between wealth and support for terrorist groups (see Table 2). It is also important to note that many coalitions were risk averse (nine of 21), reflecting the fact that many Palestinians, like people everywhere, neither join terrorist groups nor become embroiled in the tumultuous politics of their societies.

Claude Berrebi (2003) compiled biographical information on 335 members of Hamas and Palestinian Islamic Jihad (PIJ) and compared the wealth status of individuals in his sample to the general Palestinian population. His percentile estimate of the actual Palestinian wealth distribution corresponds closely to the convex regions of the Palestinian wealth curve that would define income-based classes (see Table 2 and Figure 2). His Hamas–PIJ sample differed from the general Palestinian population, having 15 percent and seven percent fewer poor and average wealth individuals, respectively, and 13 percent and nine percent more well-off and very well-off members, respectively (see Table 3). A robust test of the simulation model is whether or not the most risk-prone simulated groups reproduce the differences with the general Palestinian population seen in the Hamas–PIJ sample.

The improvement in characterizing terrorist groups with the sigmoid-utility simulation is measured by a λ statistic that indicates the percent reduction in error (PRE) in predicting the percentage-wealth-level representation by using the model (Bohrnstedt and Knoke 1982:286). The reduction in error is calculated by seeing how much closer the model predictions are to the actual Hamas–PIJ percentages and calculating the percent reduction of error as follows:

$$\lambda = \frac{\sum |Hamas/PIJ\% - Palestinian\%| - \sum |Hamas/PIJ\% - SimulatedCoalition\%|}{\sum |Hamas/PIJ\% - Palestinian\%|} \quad (2)$$

The summation is over Berrebi's four wealth levels (poor, average, well off, very well off). A chi-square statistic was calculated between observed model agreement with Hamas–PIJ and the expected agreement without the model (difference between Hamas–PIJ and general Palestinian population). Use of the simulation model provided dramatic and highly statistically significant reductions in error. Notably, coalition 20 (the largest risk-prone coalition) very closely matched the wealth profiles of both Hamas and

TABLE 3. Percent Difference in Wealth Level Representation between Terrorist Groups and Palestinian Society or Simulated Risk-Prone Coalition 20 and PRE Statistic

Wealth Level	Hamas & PIJ- Palestinians	Hamas- Coalition 20 Percentages	PIJ- Coalition 20 Percentages
Poor	-15	-1	-3
Average	-7	-7	-3
Well-Off	13	2	7
Very Well-Off	9	8	0
	lambda	.591	.705
	chi-square	318	277
	p value	4×10^{-71}	3×10^{-62}

Note. PRE = percent reduction in error; PIJ = Palestinian Islamic Jihad.

PIJ, quantitatively reinforcing the qualitative comparisons made above (see Table 3).

Risk Taking and In-Group Status among the 9/11 Coconspirators. In highly insular groups that perceive extreme ingroup–outgroup inequity, such as terrorist cells, small-group dynamics can become so intense because of social isolation that one's status within the group becomes the dominant motivator (Post 1990; Stahelski 2004). Focus on one's status within a group is a good example of a restriction on rationality: One may rationally calculate what risks to take to impress group members while ignoring one's social status in a larger society. Biographies of the 9/11 hijackers emphasize the insularity of the various cells and the total dependence of their members on one another (McDermott 2005). For instance, Canadian police that monitored the Toronto cell dubbed them BOG (Bunch of Guys) for their insularity and total absorption in "guy talk" about the evils of Zionist plots, and Ziad Jarrah (the hijacker who flew United Airlines Flight 93) became estranged from his wife because of his attachment to the Hamburg cell.

Social-network statistics can be used to measure relative status within a group and the potential for risk proneness. Valdis Krebs (2002) provides social network data on the known 9/11 coconspirators. His data on degree centrality (links to others), betweenness (control over others' links), and closeness (social distance to others) each measure an aspect of prestige in a network (see Knoke and Kuklinski 1982:51–55 and Wasserman and Faust 1994:177–192 for descriptions of these measures). Following similar methods in an analysis of the centrality of Enron executive coconspirators (Frantz and Carley 2006), I combine Kreb's centrality metrics to measure the relative importance and prestige of individuals in the 9/11 network.

Ranking the 9/11 coconspirators according to prestige produces a social status distribution to which one can fit a curve following the methods outlined previously and derive
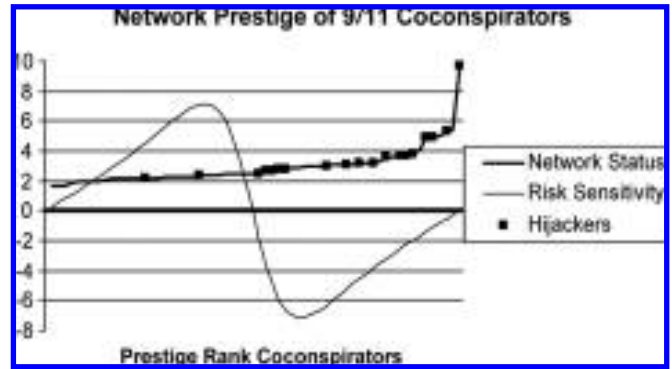
FIGURE 3. Network Prestige Measures and Risk Sensitivity of 9/11 Coconspirators. Normed prestige measures and Arrow-Pratt measure of risk aversion conveniently have the same scale. Most 9/11 hijackers are in the most convex sections of the status curve and have negative (risk-prone) risk sensitivities. (Network prestige data from Krebs 2002)

Arrow-Pratt measures of risk sensitivity (see Figure 3). According to sigmoid-utility theory, individuals who are risk prone (have negative Arrow-Pratt values) should be more likely to volunteer for missions to achieve status with peers. This method predicts 17 of the 19 hijackers; these were men who stood to gain much in the eyes of their peers by taking the risk of hijacking a plane (see Simons 2006 for a similar suggestion). On inspection, most hijackers were located on the convex sections of the social network status curve (Figure 3). The mean difference in Arrow-Pratt measures (hijackers = −2.2, nonhijackers = 1.0) was highly statistically significant with a student's t-test ($t = 3.12$, $p = .0015$). Therefore, once small-group dynamics can be established and relevant measures of social status obtained, sigmoid-utility theory can account more directly for influences of group pressure and charismatic leadership as suggested by Atran and, furthermore, can even predict actual individual behavior. Contextual information on individual skills, functional roles performed in the cells, and opportunities to volunteer would increase the accuracy of these predictions.

CONCLUSION

Current explanations of terrorism are implicitly and explicitly based on theories of decision making. Decision theories are hotly contested and derived from different assumptions about human cognition. Producing an improved understanding of phenomena like terrorism therefore requires researchers to bridge impasses between selfishness and altruism theories and between theories of cognitive complexity and simplicity. Should these conflicts not be resolved, no progressive understanding of terrorism or any other decision-based behavior will be possible, only a pastiche of contradictory interpretations after the fact. And "after the fact" will not be good enough for those who wish to avoid social strife like terrorism.

I propose sigmoid utility as an example of how different theoretical elements could be synthesized into more realistic, less dogmatic, and more effective theory of decision

making. It has the advantage of grounding value in objectively observable but socially generated phenomena (social ranks, centrality, prestige, wealth, access to resources, UN health and well-being measures, access to mates, etc.). It takes advantage of advances in our understanding of how reputation, social status, and reciprocity influence individual decisions and generate higher-order cultural phenomena such as terrorist organizations. The method is also open to alternative and culturally contextual measures of status, reputation, and humiliation and resentment. The approach is consistent with recent research on inequity aversion. Its underlying mathematical model provides a heuristic, but measurable, device for representing how individuals feel about a change in status.

The merits of sigmoid utility will be decided ultimately by people's behavior. Whatever theories prevail will have to synthesize logically consistent and empirically valid findings across disciplines and paradigmatic divides. These models will need to be tested cross-culturally and evolutionarily. Given anthropologists' methodological plurality and cross-cultural perspectives, they are uniquely situated to effect such a synthesis.

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NOTE

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