

Can We Generalize from Student Experiments to the Real World in Political Science, Military Affairs, and International Relations?

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The authors conducted an experiment with a group of military officers and replicated it with a group of students at a public university in the United States. The experimental scenario dealt with a decision problem in the area of counterterrorism. The authors found that while more than one-third of students recommended doing nothing, the overwhelming majority of military officers (more than 90 percent) recommended doing something. Also, military officers exhibited less maximizing and more satisficing decision making than students. The results show that relying on experiments with students “playing” the role of real-world national security policy makers may bias the results. The two groups are, in fact, very different. Based on student samples, it is possible to accept propositions that would not be found with samples of elite decision makers and reject propositions that may be right. However, it is possible that students can be assigned to experiments where they represent the “public” and not elites.

Keywords: *national security; decision making; counterterrorism; student experiments; uncertainty*

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Numerous studies in political science, military affairs, and international relations use experiments (for reviews, see McDermott 2002a, 2002b). Virtually all of these studies use students as the subject pool.¹ Questions about the validity of results using students in experiments are often raised (see, e.g., Stoll 2004 and Sears's [1986] famous study on the "sophomore effect"), but no empirical test has been conducted to assess whether students accurately represent elites' choices and strategies. This article compares results of an experiment conducted with military commanders with a replication using students. It uses a computerized, process-tracing experiment using the Decision Board 4.0 simulator (Mintz et al. 1997; Mintz 2004a) in comparing the choices students and officers make, their respective decision processes, and the effect of exogenous variables such as framing and certainty on choices and decision processes.

The article attempts to answer the following questions:

1. Do students make the same choices as elite decision makers?
2. Do students use the same decision strategies as actual decision makers?
3. Are information acquisition patterns of students and officers similar in international relations scenarios?
4. Do factors such as framing and uncertainty affect the choices and strategies of students and military leaders in the same way?

Accordingly, we compared students' and officers' choices and decision strategies along the following dimensions: (1) actual choices, (2) the amount of information students and officers used, (3) the decision strategy they employed, (4) the effect of framing on choice and process, and (5) the effect of certainty on choice and process.

THE EXPERIMENT

In this experiment, a national security scenario dealing with a combating terrorism decision was used to introduce alternatives and dimensions into the Decision Board software.² The scenario stated that the military was faced with a decision about which counterterrorism technologies to pursue in fighting the war on terror. The scenario is highly representative, of course, of elite decision making in the war on terrorism, where the boundaries between military and civilian decision making are often blurred. Subjects were presented with four real-world alternatives and were asked to select among the following:

- Border-Crossing Sensors
- Environmental Monitors
- Local Emergency Responders
- Do Nothing

1. Green and Gerber (2002) and Tetlock (1983) provide a useful review of strengths and weaknesses associated with experimental research (see also Kinder and Palfrey 1993; McDermott 2002a, 2002b).

2. The experimental task and the decision scenario are described in detail in Appendix A.

The dimensions employed in the scenario represent decision criteria that were found to be relevant in other studies in international relations (see James and Oneal 1991; Mintz and Geva 1997; Mintz et al. 1997; Morgan and Bickers 1992; Ostrom and Job 1986). Hence, the dimensions included in the Decision Board were as follows:

- Military
- Economic
- Political

The Decision Board software recorded the “moves” of subjects on the board. We then compared students’ and officers’ decision strategies and choices using process-tracing techniques.

PROCESS TRACING

Process tracing is a methodology designed to help identify and classify decision-making processes. Process tracing identifies what information is being accessed to form a judgment and the order in which the information is accessed (Ford et al. 1989). This knowledge can then be used to make inferences about which decision strategies were employed en route to a choice. As Mintz et al. (1997, 556) state, “[Process tracing’s] main strength is its ability to identify specific strategies used by decision makers and to test theoretically derived implications of situational and personal variables on the decision process and its outcome.”

Larson (1985) and Khong (1992) used process-tracing techniques in studies of the origins of the containment doctrine and on decision making during the Vietnam War, respectively (see also George and Bennett 2005 for a more general discussion of process-tracing methods in case study research). Experimental process-tracing methods have thus far been most often used in studies of voter choice (see, e.g., Johnson and Riggle 1994; Lau 1995; Riggle and Johnson 1996; Taber and Steenbergen 1995). Astorino-Courtois (2000), Mintz and Geva (1997), Mintz et al. (1997), and Redd (2000, 2002) have used process-tracing techniques in studies of foreign policy decision making. In this article, we report results of an experiment conducted with students and military officers using the Decision Board 4.0 software.

THE DECISION BOARD PLATFORM

The core structure of the Decision Board platform, which is depicted in Figure 1, is a matrix of alternatives and dimensions on which the alternatives are evaluated (see Mintz et al. 1997). The computerized board records key features of

Decision Board	Border Crossing Sensors	Environmental Monitors	Local Emergency Responders	Do Nothing	Weight
Military Dimension	Select	Select	Select	Select	Add
Economic Dimension	Select	Select	Select	Select	Add
Political Dimension	Select	Select	Select	Select	Add
Final Choice:					

Final Decision

Figure 1: Decision Board Platform

the decision-making process. These features are subsequently used to identify the decision strategies of policy makers.³ A major category of these features relates to the sequence in which the decision maker accesses the information.

A decision problem typically consists of the selection of an alternative from a set of available alternatives. The choice set is evaluated along a single dimension or, more typically, multiple dimensions. The “values” in the matrix represent the evaluation of a given alternative on a given dimension. These information bins can be opened to reveal their contents by the click of a mouse, whereas decisions are made by clicking on the choice box of a desired alternative (Mintz et al. 1997). The computerized Decision Board records (1) the sequence in which decision makers acquire the information, (2) the number of items that respondents view for every alternative along every dimension, and (3) the amount of time that elapses from the time respondents begin the task until they make their choice. Version 4.0 of the Decision Board also automatically displays the “decision portraits” of decision makers and calculates holistic versus nonholistic search patterns and maximizing versus satisficing decision rules. Using process-tracing techniques, one can identify the strategy selection and decision model of decision makers.

3. The Decision Board Simulator 4.0 has been used for research, teaching, and training. It has been used in research to test theories of decision making (expected utility, prospect theory, cybernetic theory, poliheuristic theory), for modeling voting games and electoral campaigns, for process tracing of political and economic trends and events, and for understanding consumer behavior and choice. It has been used in teaching courses in international relations, public policy and public administration, and management. The Board has been used at twelve universities, including the University of California–Davis; University of Canterbury, New Zealand; China Foreign Affairs University in Beijing, China; School of Management at Tel Aviv University, Israel; the University of Wisconsin–Milwaukee; U.S. Air Force Academy; Yale University; and the Program in Foreign Policy Decision Making and the George Bush School of Government and Public Service at Texas A&M University.

Following the definition of the four alternatives and three dimensions, the values were inserted in the decision matrix. These values consisted of a descriptive statement and a summarizing numeric value (on a scale from -10 to +10) (see Appendix B).

METHOD

SUBJECTS

Fifty military officers and forty-six undergraduate students at the University of Wisconsin-Milwaukee (UWM) participated in the experiment. As in many experimental studies in political science, military affairs, and international relations, the undergraduate student subjects were recruited from several political science courses. The military commanders were recruited from a leadership course taught at the National Defense University (NDU). The military officers who participated in this study included a brigadier general, thirteen colonels, thirty-one lieutenant colonels, and five captains. These officers represented all four branches of the U.S. armed forces and several branches of the Reserve and National Guard. The study used the Decision Board 4.0 platform as a "decision process tracer." The subjects were randomly assigned to one of four experimental conditions.

DESIGN

A 2×2 between-groups factorial design was employed. The two factors were as follows: (1) certainty effects (certain vs. uncertain that the antiterrorism technology would function) and (2) framing of the likelihood of funding the antiterrorism technologies (positive vs. negative).

THE INDEPENDENT AND DEPENDENT VARIABLES

The independent variables in this study consisted of (1) the framing of the likelihood of funding from Congress for the new antiterrorism technologies and (2) the degree of certainty that the proposed antiterrorism technologies would work as designed. The dependent variables in this study consisted of (1) information acquisition patterns and (2) the choices subjects made.

The Decision Board recorded the amount of information used by the officers and students. We also used measures of alternative versus dimension-based processing. Alternative-based strategies imply a process whereby a decision maker sequentially reviews items of information within a given alternative across dimensions and then proceeds in this manner for subsequent alternatives. Dimension-based strategies simply signify that decision makers process information within a dimension across alternatives (Payne 1976). These strategies were calculated using Billings and Scherer's (1988) search index (SI). The index ranges from -1 (purely dimensional processing) to +1 (purely alternative-based processing). The scoring of subjects'

moves was determined by the SI scores (see also Mintz et al. 1997; Mintz 2004a; Redd 2000, 2002). The index tallies the number of dimensional moves (d), alternative moves (a), and shifts (s) and uses the equation $SI = (a - d)/(a + d)$ to define the search index. Positive numbers indicate alternative-based moves, while negative numbers imply dimensional moves. As in Billings and Scherer, shifts were disregarded from this index.

THE RESEARCH INSTRUMENT

The Decision Board in this experiment consisted of a 4×3 (Alternatives $\times$ Dimensions) matrix, representing twelve information bins, which contained information pertaining to the evaluation of a given alternative along a given dimension. The Decision Board has several advantages: a user-friendly interface, multimedia capacity, and the ability to record the cognitive "moves" of decision makers. It also produces a distribution of subject choices, a decision portrait of each subject, holistic versus nonholistic scores, and satisficing versus maximizing scores. As in previous studies (Mintz et al. 1997; Redd 2002), the information was presented as an evaluative statement followed by a corresponding numerical evaluation. For example, "Using local emergency responders allows the military to coordinate antiterrorism activities with local communities. This provides for a more 'comprehensive' antiterrorism shield for the United States. I would rate this alternative as 7."

Subjects indicated their choice by clicking on the choice button underneath the corresponding alternative. Subjects could also open any information bin by clicking on it. Each subject dealt with only one of the four conditions: (1) positive framing—certain technology, (2) positive framing—uncertain technology, (3) negative framing—certain technology, and (4) negative framing—uncertain technology.

RESEARCH MATERIAL

In addition to comparing the choices that students and military officers made and their decision strategies, we have assessed the effect of framing and certainty on decision processes and choice. Consequently, two factors were manipulated: framing and certainty (see Appendix A).

Manipulation of Framing

Framing refers to the manner in which an issue is presented (see, e.g., Frisch 1993; Tversky and Kahneman 1981). Subjects in the positive framing condition were told, "At the present time, because of the war on terrorism, there is approximately a 90% chance that Congress will fund at least one of these options. Congress has committed . . . to do whatever it takes to protect the American public from terrorism." In contrast, those in the negative framing condition were told, "At the present time, because of the recent war in Iraq, there is approximately a 10% chance

that Congress will not fund any of these options. Congress may be constrained in its spending because of a weak domestic economy and the ongoing war in Iraq and the cost of the war approaching \$100 billion."

Manipulation of Certainty

Subjects in the certain condition were told, "At this stage there is a high level of certainty that these future technologies will be successful and will work as conceived of and designed. Many in the scientific community are encouraged by the progress made so far and are hopeful that these options and the technology associated with them will actually work." In contrast, those in the uncertain condition were told, "At this stage there is a high level of uncertainty about whether these future technologies will be successful and will work as conceived of and designed. Many in the scientific community are skeptical about the progress made so far and doubt that these options and the technology associated with them will actually work."

To increase the "mundane reality" of the experiment (Aronson and Carlsmith 1968), and since many national security and foreign policy decisions are made under time and informational constraints, all of the subjects were subjected to time pressure manipulation, which consisted of instructions indicating that there was a time constraint. However, the subjects in both subject pools were not actually restricted in the amount of time available.

PROCEDURE

The experiment was administered with military officers at the National Defense University and replicated with students at the University of Wisconsin–Milwaukee. The instructions and decision scenarios were displayed on the computer screen. Subjects were informed that they would be presented with a specific scenario concerning various technologies being developed to combat terrorism and with a decision matrix containing alternatives and the evaluations of those alternatives along three different dimensions: military, economic, and political. The subjects were instructed to make the best choice among the available options. Following the national security decision, a postdecision questionnaire was administered, followed by a detailed debriefing.

RESULTS

MANIPULATION CHECKS

It is important to note that the manipulations for framing and certainty worked in both subject populations. For the student subjects, the framing manipulation was significant, $F(1, 41) = 7.43$, $p < .009$, positive frame ($M = 8.00$) and negative frame

($M = 6.27$). The certainty manipulation for the student subjects was also significant, $F(1, 41) = 10.19, p < .003$, certain ($M = 5.86$) and uncertain ($M = 3.57$).

For the military officers, the framing manipulation was likewise significant, $F(1, 45) = 7.42, p < .009$, positive frame ($M = 8.12$) and negative frame ($M = 6.50$). The certainty manipulation for the military officers was also significant, $F(1, 45) = 7.63, p < .008$, certain ($M = 6.56$) and uncertain ($M = 4.75$). As will be explained below, there were significant differences in the choices, processes, and information acquisition patterns of students and officers.

STUDENTS–MILITARY COMMANDERS COMPARISON

We compared students' choices, information search patterns, and decision strategies with the military officers' choices, information search patterns, and decision strategies and generated the following results. First we compared student subjects' decision to choose the Do Nothing response versus choosing one of the other Do Something options with the officers' decisions to do the same. We found that 35 percent of the student subjects chose the Do Nothing option, while 65 percent chose one of the other three alternatives, compared with only 8 percent of the military officers choosing the Do Nothing option and 92 percent choosing one of the other (Do Something) options (see Table 1). Using a difference of proportions test for the two different subject pools (z -test), we found a significant difference between the two subject pools ($z = 3.13, p < .001$).

Furthermore, we compared the choices of the two groups for the four specific options. Using a chi-square test, we found significant differences between the two groups ($\chi^2 = 12.11, p < .01$). Specifically, we found that military officers were likely to select the Border-Crossing Sensors alternative while student subjects were more likely to choose the Do Nothing option (see Table 2).

We then analyzed differences between the two groups in the amount of information they accessed. The data reveal that the two groups differed in the overall number of cells viewed, $F(1, 94) = 14.55, p < .0002$. Specifically, students accessed significantly more cells ($M = 11.30$) than their military counterparts ($M = 9.04$) (see Table 3). This is probably the result of students being less familiar with the policy alternatives and their implications.

We also found significant differences in the amount of information accessed as a function of condition (see Tables 4 and 5). Under the condition of positive framing, the difference was significant, $F(1, 47) = 6.82, p < .01$, with the students again accessing more information ($M = 11.33$) compared to the military commanders ($M = 9.24$). Under negative framing, $F(1, 45) = 7.39, p < .009$, students also opened more information bins ($M = 11.27$) than military subjects ($M = 8.84$). Significant differences were also obtained for the certainty condition, $F(1, 47) = 9.88, p < .003$, students ($M = 11.57$) and military officers ($M = 9.12$); they were also obtained for the uncertainty condition, $F(1, 45) = 5.20, p < .03$, students ($M = 11.04$) and military subjects ($M = 8.96$). Students viewed more information than military officers across all conditions.

TABLE 1
Differences between Students and Military Commanders in Choosing
"Do Nothing" versus "Do Something" (in Percentages)

Subject Group	Choice	
	Do Nothing	Do Something
Students	35	65
Military	8	92

TABLE 2
Differences between Students and Military Commanders
in Choosing among All Options

Subject Group	Choice			
	Border-Crossing Sensors	Environmental Monitors	Local Emergency Responders	Do Nothing
	<i>n</i> (Percentage)	<i>n</i> (Percentage)	<i>n</i> (Percentage)	<i>n</i> (Percentage)
Students	15 (33)	3 (7)	12 (26)	16 (35)
Military	30 (60)	3 (6)	13 (26)	4 (8)

TABLE 3
Number of Cells Accessed

Cells Accessed (Mean)	
Students	Military
11.30	9.04

WHO IS MORE RATIONAL? MILITARY OFFICERS OR STUDENTS?

We also compared officers' and students' differences in choices of decision strategies. We found a significant result in officers' and students' maximizing and satisficing decision strategies ($z = 2.39$, $p < .01$).⁴ Specifically, 40 percent of the student subjects chose a maximizing strategy while 60 percent chose a satisficing strategy, whereas 82 percent of the officers chose a satisficing strategy and only 18 percent chose a maximizing strategy (see Table 6). The strong findings showing satisficing decision rules employed by most subjects correspond to Herbert Simon's (1955) notion of bounded rationality and Mintz's (2004b) poliheuristic theory.

TABLE 4
Number of Cells Accessed (Mean) as a Function of Framing

<i>Subject Group</i>	<i>Framing</i>	
	<i>Positive</i>	<i>Negative</i>
Students	11.33	11.27
Military	9.24	8.84

TABLE 5
Number of Cells Accessed (Mean) as a Function of Certainty

<i>Subject Group</i>	<i>Certainty</i>	
	<i>Certain</i>	<i>Uncertain</i>
Students	11.57	11.04
Military	9.12	8.96

TABLE 6
Differences between Students and Military Commanders in Choosing
Maximizing versus Satisficing Decision Strategies (in Percentages)

<i>Subject Group</i>	<i>Decision Strategy</i>	
	<i>Maximizing</i>	<i>Satisficing</i>
Students	40	60
Military	18	82

Interesting, there was a marked difference between the groups, with the officers exhibiting less maximizing and more satisficing decision making than students. Although the Do Nothing alternative was the highest rated overall, this alternative was a nonstarter for the majority of the military officers due to its negative score on the military dimension.

We then compared the weights that officers and students assigned to the dimensions on the Decision Board.⁵ The data show that military officers' weights for different dimensions were significantly lower than those of students. Specifically,

4. Satisficing implies that a decision maker's chosen alternative need not be an optimal one, merely one that satisfies some a priori minimum threshold; that is, the choice is "good enough" (Simon 1955, 1957).

5. *Weights* refers to the importance levels decision makers attach to different dimensions.

TABLE 7
Overall Weighting of Dimensions

<i>Weight Assigned to Dimensions (Mean)</i>	
<i>Students</i>	<i>Military</i>
6.62	5.99

TABLE 8
Differences between Students and Military Commanders
on Evaluating the Importance of the Economic Dimension

<i>Weighting of Economic Dimension (Mean)</i>	
<i>Students</i>	<i>Military</i>
6.80	5.45

TABLE 9
Differences between Students and Military Commanders on
Rating the Do Nothing Alternative

<i>Alternative (Mean)</i>	
<i>Subject Group</i>	<i>Do Nothing</i>
Students	4.82
Military	1.61

there was a difference between the two subject pools in weighting the dimensions overall, $F(1, 283) = 5.70, p < .02$, wherein student subjects weighted the dimensions higher ($M = 6.62$) compared to military commanders ($M = 5.99$) (see Table 7). We also found a specific difference between students and officers evaluating the importance of the economic dimension, $F(1, 93) = 10.46, p < .002$, students ($M = 6.80$) and officers ($M = 5.45$) (see Table 8). This finding indicates that in recommending Do Something, military officers were less concerned with the financial costs associated with the different alternatives. It is interesting to note that the students rated all three dimensions between 6.4 and 6.8, whereas the military officers rated the political and military dimensions in the 6-point range but rated the economic dimension lower, at 5.45.

TABLE 10
Alternative versus Dimension-Based Information Processing
and Choice in the Context of the Certainty Manipulation

Subject Group	Certainty	
	Certain	Uncertain
Students	0.415	-0.010
Military	-0.165	0.418

NOTE: Positive numbers denote alternative-based processing, whereas negative numbers denote dimension-based processing. The scale ranges from -1 to 1.

We also found a significant difference between the two groups in their overall rating of the alternatives—specifically, the Border-Crossing Sensors and Do Nothing alternatives. Military officers liked the Border-Crossing Sensors alternative, $F(1, 91) = 3.97, p < .05$, students ($M = 5.55$) and officers ($M = 6.63$), much better than the Do Nothing alternative, $F(1, 91) = 31.60, p < .0001$, UWM ($M = 4.82$) and NDU ($M = 1.61$)—a huge difference (see Table 9).

THE EFFECT OF FRAMING AND UNCERTAINTY ON PROCESS AND CHOICE

We then examined the effect of framing and uncertainty on information processing and choice. Using ANOVA methods and the Billings and Scherer (1988) SI, we found a close to conventionally significant result for the student population, $F(1, 42) = 3.44, p < .07$, for the certainty manipulation. Specifically, when presented with certainty, students used more alternative-based procedures ($M = .415$) than when presented with uncertainty ($M = -.010$). In the uncertainty condition, student subjects operated in a more dimension-based fashion. This finding suggests that when the student subjects were faced with a more cognitively demanding uncertain condition, they tended to resort to dimension-based strategies, strategies that have been shown to help alleviate cognitive strain (Russo and Doshier 1983).

We found a significant result for the military subjects, $F(1, 46) = 6.56, p < .01$, for the certainty manipulation; however, the results were in the opposite direction compared to the student subjects. Specifically, when presented with certainty, the military officers used more dimension-based procedures ($M = -.165$) than when presented with uncertainty ($M = .418$). Under conditions of uncertainty, they operated in a more alternative-based manner (see Table 10 for a summary of this finding). It seems that when facing uncertainty with respect to the operation of the antiterrorism technologies, the military commanders decided to gather more information about these technologies by processing information about each alternative in an alternative-based fashion. When told the technologies were certain to succeed, the military officers tended to evaluate them across the political, economic, and military dimensions.

WHEN CAN WE GENERALIZE FROM STUDENT EXPERIMENTS IN POLITICAL SCIENCE AND INTERNATIONAL RELATIONS?

Experiments using students to test propositions about military elite decision making ignore the fact that students are typically novices while officers are more often experts in national security and counterterrorism aspects of decision making. Moreover, officers ought to be more accountable or responsible for failed decisions compared to students. Military officers are also typically older than students, and the military profession tends to be more male dominated; therefore, students may not accurately represent officers' expertise and the military experience and environment. Because of these limitations, student samples are often inappropriate, as empirically they can lead to divergence in subject population results. Specifically, using student samples, we may accept propositions that would not be found in samples using elite decision makers, or we may accept propositions that could be wrong. Ultimately, the problem is one of incorrect inference, and caution is warranted in evaluating theoretical and empirical claims based on experiments with student samples.⁶

The experiment reported in this article demonstrated the difficulty of generalizing from experiments with students to the behavior of real-world national security decision makers. The external validity of such experiments is questionable. Whereas the *general tendency* of officers' and students' results was largely similar, statistically significant differences were found on most indicators of information processing and choice. It is unrealistic to expect that undergraduate students will be able to perform successfully the role of military elites. However, not all experiments in political science and international relations focus on elite decision making. We therefore would like to set the boundary conditions of our findings.

Numerous experimental studies of political decision making involve the public: voter participation experiments (Palfrey and Rosenthal 1985), political marketing and advertising experiments (Astorino-Courtois 1996; Iyengar 2000), public attitudes toward affirmative action (Kuklinski et al. 1997), gender differences effects on conflict and aggression (McDermott and Cowden 2001), the evaluation of public figures (Lau, Sears, and Centers 1979), and an experimental analysis of a political stock market (Forsythe et al. 1992). When the real-world "equivalent" of a student sample is the "public" rather than the leader or the elite, then, with an appropriate research design, student experiments may actually tell us a great deal about the behavior of the public. For example, experimental research on framing takes the position that students are an educated segment of society. Therefore, if framing "works" on students, it should also work on other, less educated, less sophisticated groups (Mintz and Geva 1998). With a representative sample, for example, from

6. Experimental studies in political science are typically conducted with student subjects. Such a subject pool is younger and more mixed than that of elite decision makers. Specifically, the sample of military officers in our study consisted of subjects with an average age of forty-three, while the average age of the student subjects was twenty-two. For the military officers, 84 percent were male and 16 percent female, compared to 57 percent male and 43 percent female for the subjects from the University of Wisconsin-Milwaukee.

geographically and demographically diverse schools, one may be able to infer about the behavior of the public on a variety of issues. As a general rule, while we do not have evidence to support the external validity of experiments with students representing the public, we believe that experiments can be conducted when students represent this segment of society, whereas results of experiments where students play the role of elite decision makers in the area of national security should be taken cautiously.

Finally, other types of research questions—such as those dealing with personal economic and financial decisions, social dilemma issues, market research, consumer behavior, and so on—may be amenable to students-as-subjects experiments.

CONCLUSION

In this article, we compared the choices student subjects made to those of military officers. We used a decision scenario that mimics real-life problems of officials in the area of counterterrorism. We also compared the information search and decision-making processes of both groups. We then analyzed how uncertainty and the framing of options affect decision makers' responses and choices with respect to policy options dealing with counterterrorism. We have done so in an experimental setting using the Web version of the Decision Board Platform 4.0 with two different subject populations: students and military commanders.

Our results reveal *significant* statistical differences between students and actual decision makers in (1) the choice, (2) the amount of information used by the two groups, (3) the decision strategy employed by each group, and (4) the effect of exogenous conditions on decision strategy and choice in international relations.

Specifically, student subjects tended to acquire significantly more information than military officers en route to their choices. Officers also assigned lower weights to dimensions than students, and the groups varied in their decision strategies: military officers used more satisficing strategies than students (Simon 1957). Also, while uncertainty affected decision makers' selection of decision strategies, it affected the two subject pools in opposite ways: student subjects responded to uncertainty with more dimension-based processing while the military commanders employed alternative-based procedures when faced with greater uncertainty.

There were also marked differences between the military officers and students in their choices. Military commanders were very reluctant to choose the Do Nothing option (8 percent), while student subjects were much more likely to do so (35 percent). The military commanders were rather homogeneous in their choices, while the student subjects were more evenly split between the Do Nothing option and other alternatives.

"Experiments testing the same model should be conducted on multiple populations . . . in order to determine the external validity of any given experimental paradigm" (McDermott 2002b, 40). Future work should compare students' and actual decision makers' choices and strategies in experiments where decision dilemmas

concern public decision making (e.g., on the effect of framing). Research should also cross-validate our results using *multiple* scenarios on multiple issues. It is unrealistic to expect students to play the role of elites in political science and international relations experiments—at least not in the area of national security decision making—as the groups are very different in their sociodemographic characteristics, expertise, level of professional responsibility, and other significant factors. While some general tendencies were similar, when we compared specific results statistically between students and officers, significant differences were found on most indicators.

APPENDIX A

The Scenario

COMBATING TERRORISM

During the past several weeks the media have focused heavily on the administration's upcoming decision regarding its choice whether to pursue various advanced technologies aimed at combating terrorism in the future. Since the events of September 11, 2001, the administration has been undertaking steps to detect and combat terrorists and terrorist acts committed here in the United States. The administration, in cooperation with various research centers and laboratories, has been looking to develop several new futuristic advanced technologies designed to detect weapons of mass destruction (WMD).

However, not all of the technologies can be implemented in the future. A choice must be made. As a chief administration official, you must decide what to do. The decision has military, economic, and political implications. The military dimension deals with how the proposed technologies would aid the armed services in dealing with potential uses of WMD on American soil. The economic dimension addresses the total costs of each technology in terms of research and development as well as implementation. The political dimension deals with how your choice of the new technology will be received by Congress and the American public.

At the present time, because of the war on terrorism, there is approximately a 90 percent chance that Congress will fund at least one of these options. Congress has committed verbally and in writing to do whatever it takes to protect the American public from terrorism.⁷

The following alternatives have been identified:

- **Border-Crossing Sensors:** Introduce sensors that can be used at border crossings in order to detect whether terrorists are attempting to smuggle chemical or biological weapons into the country.
- **Environmental Monitors:** Introduce environmental monitors that can trace whether chemical or biological weapons have been set off. Using EPA monitoring stations, these monitors sample the air for traces of chemical and biological toxins.

7. Negative frame reads as follows: "At the present time, because of the recent war in Iraq, there is approximately a 10% chance that Congress will not fund any of these options. Congress may be constrained in its spending because of a weak domestic economy and the ongoing war in Iraq and the cost of the war approaching \$100 billion."

- Local Emergency Responders: Provide local emergency responders with radiological detection equipment.
- Do Nothing: Decide not to proceed with implementing any particular system at this time.

At this stage there is a high level of certainty that these future technologies will be successful and will work as conceived of and designed. Many in the scientific community are encouraged by the progress made so far and are hopeful that these options and the technology associated with them will actually work.⁸

The Decision Board will indicate how each of these options is evaluated along various relevant dimensions. These written evaluations are also summarized as a rating on a 21-point scale (–10 implies that an option is evaluated very unfavorably, 0 implies a neutral position, and 10 implies a very favorable evaluation of the option).

A decision has to be made! Please begin the computer simulation to explore the evaluations of the alternatives along the various dimensions and then determine your choice.

As with all “real-life” decisions, there is a trade-off between the amount of information you consider and the time it takes you to make a decision based on that information.

Taking too much time to review the evaluations may be costly. Remember that you can only access a particular “box” of information once.

Press CONTINUE to start the decision process.

8. Uncertainty manipulation reads as follows: “At this stage there is a high level of uncertainty about whether these future technologies will be successful and will work as conceived of and designed. Many in the scientific community are skeptical about the progress made so far and doubt that these options and the technology associated with them will actually work.”

APPENDIX B

DECISION MATRIX FOR COMBATING TERRORISM

Dimension	Border Crossing Sensors	Environmental Monitors	Local Emergency Responders	Do Nothing
Military	“Deploying sensors at border crossings is a positive step in the prevention of terrorism in the United States. This also provides the military with a concrete location in which to concentrate its antiterrorism activities.” I would rate this alternative as 4	“Deploying environmental monitors could help in the detection of terrorist activity; however, simply ‘monitoring’ the release of chemical/biological toxins may be too little, too late. The military tends to favor ‘preventing’ terrorist activities, rather than simply detecting them.” I would rate this alternative as 1	“Using local emergency responders allows the military to correlate antiterrorism activities with local communities. This provides for a more ‘comprehensive’ antiterrorism shield for the United States.” I would rate this alternative as 7	“Doing nothing in this case is unwise. The military must prepare now to address the possible threat of terrorist action here in the United States. If we fail to act now we will be subjecting the United States to a grave security threat.” I would rate this alternative as -8
Economic	“This option would most likely be cost prohibitive. The U.S. has long borders with both Mexico and Canada and trying to cover the thousands of miles with each is more than we can afford.” I would rate this alternative as -4	“Deploying environmental monitors throughout the United States in most major cities would be entirely too expensive, running into the billions and billions of dollars.” I would rate this alternative as -8	“This option is more cost effective since local communities and actors could help bear the cost of fighting the war on terrorism.” I would rate this alternative as 3	“From an economic standpoint this is the best option. Economic resources would be better spent in targeting terrorists in their overseas locations.” I would rate this alternative as 10

(Continued)

APPENDIX B (continued)

Dimension	Border Crossing Sensors	Environmental Monitors	Local Emergency Responders	Do Nothing
Political	“Protecting our borders is a very visual sign of the war on terror and will make U.S. citizens feel safer.”	“This will show that the U.S. is seriously committed to the war on terrorism. Environmental monitors show the public that we will do whatever it takes to protect our people.”	“This option will not be looked upon favorably by local governments since they will have to contribute resources to the war on terror. Likewise, this may put undue burdens on the public within their local communities.”	“A case can also be made to the public for doing nothing at this time. The other three technology options are unproven and untried on a nation-wide scale at this point in time and the public may prefer to take the wait-and-see approach.”
	I would rate this alternative as	I would rate this alternative as	I would rate this alternative as	I would rate this alternative as
	5	9	-5	8

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