Evaluating the Quality of Structured Environmental Management Decisions

ARTICLE *in* ENVIRONMENTAL SCIENCE AND TECHNOLOGY · SEPTEMBER 2006

Impact Factor: 5.33 · DOI: 10.1021/es051932b · Source: PubMed

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Evaluating the Quality of Structured Environmental Management Decisions

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Structured decision making (SDM) approaches have been advocated as a means of improving the quality of environmental and related risk management decisions based largely on the self-reported behavior of decision makers. The goal of the research presented here was to test this basis for decision quality by comparing the self-reported assessments of individual decision makers with their actual choice behavior across a set of three related environmental contexts. It was hypothesized that a modified structured decision approach would lead participants to make better informed decisions which accurately reflected their objectives, not based solely on self-reports, but also on internally consistent decision making behavior. Results from this study only partially support this hypothesis. While individuals' self-reports suggest that the structured approach outperformed results from an unstructured control condition, there was a lack of agreement between these self-reported evaluations and actual choice behavior. Beyond the obvious policy implications of decisions that are inconsistent with stated objectives, these findings point to the need for improved metrics when evaluating the quality of environmental decision processes.

1. Introduction

Significant attention has been devoted over the past two decades to improving the quality of environmental and related risk management decisions with much of this work culminating in the recent publication of a set of cohesive research priorities for environmental decision making (*1*). One of the recent thrusts of this multi-disciplinary effort has focused on developing and testing structured decision making (SDM) approaches (sometimes referred to as "decision aiding" approaches), which are designed to alleviate some of the complexity inherent to many environmental decisions. These approaches help decision makers to better evaluate technical information about a problem and to make choices that better reflect their prioritized objectives. This is achieved through a variety of means, including the translation of technical information into more user-friendly terms, improving the evaluability of options by providing side-by-side comparisons, and providing decision makers with decision aids alongside technical information to help enhance overall decision quality (*2*, *3*).

The theoretical foundation of these SDM approaches is based in large part on two related classes of findings from behavioral decision research: First, that individuals and groups are seldom able to define their full range of objectives (*4*, *5*) in the context of a given decision problem and, therefore, have difficulty making choices that address their prioritized concerns (*3*). The second class of findings that inform the development of SDM approaches relate to the constructive nature of preferences (*6*, *7*). Findings from this area of research (*7*−*9*) have demonstrated that for many novel or complex problems decision-makers seldom have well-formed preferences in advance of making judgments and instead "construct" them during the elicitation process. While clearly problematic given the ad hoc nature of many important choices, this constructionist view of preferences also has advantages. Chief among them is that it becomes possible to structure both information about a given problem (*10*) and the elicitation process (*11*) so as to encourage more thoughtful analysis.

Based on the largely positive responses of both expert and lay decision makers who have used these approaches and the endorsements of a variety of researchers and practitioners, the frequency with which SDM approaches are being used in the environmental arena is growing rapidly. A short list of SDM applications includes their use for helping to clean up contaminated sites (*12*), set guidelines for water use by hydroelectric utilities (*13*), create estuarine management plans (*14*), and devise strategies for the protection of endangered species (*15*). In each of these cases, it was suggested that the use of some type of SDM approach helped to enhance the quality of the resulting decisions.

Decision quality is an elusive concept, however. Given the multiattribute nature of most environmental decisions, it is difficult—if not impossible—to identify an ideal course of action before a decision needs to be made and then compare a decision maker's final choice against this benchmark (*1*). As a result, evaluations of the quality of structured decision approaches have been based on rather vague notions of what constitutes an effective decision-making process (e.g., having the "right" people use the "right" information), the observations of SDM facilitators and outside analysts (e.g., *16*), and in many cases, the self-reports of individual decision makers engaged in these processes. In a recent experiment, for example, Arvai et al. (*10*) linked decision quality to individual decision makers' self-reports of their comfort and satisfaction with their decisions, as well as the degree to which they felt their final choices addressed their prioritized concerns.

This relatively heavy reliance on self-reports ought not to imply that other measures of decision quality are not desired for evaluating SDM approaches. Many, including the authors of this paper, agree with von Winterfeldt and Edwards (*17*) that the quality of decisions depends on the quality of the processes by which they are made. Very much along these lines, McDaniels et al. (*13*) and Arvai et al. (*10*) proposed that evaluations of decision quality ought to be based largely on the ability of the participants to understand the information and effectively utilize the decision aids that comprise the SDM framework (a view that the National Research Council (*1*) also endorses). Ultimately, success in this context is manifest in the ability of the decision maker to make choices that address their prioritized objectives and concerns. Even these more comprehensive standards for decision quality, however, pose a potentially significant measurement chal-

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TABLE 1. Composite (Across Valence and Arousal) Affect Ratings Across Three Management Problems

	damaged trails		deer overpopulation		wildlife disease	
	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
mean affect rating	3.84	0.18	4.06	0.21	5.71	0.18

lenge for evaluations that look beyond decision makers' self-reports or relatively simple qualitative observations (*1*). It is this challenge that we wish to address here.

The goal of the research described in this article was to evaluate, experimentally, the quality of decisions resulting from a SDM approach intended to help nonexpert decision makers make more thoughtful choices in the context of a multiattribute environmental risk problem. The modified SDM approach tested here was similar to methods applied practically (*13*, *18*) and identical to ones that have been the focus of recent experiments (*10*, *19*).

Overcoming the measurement challenge noted above required that an experiment be designed where, for each individual decision maker, it would be possible to ascertain an optimal course of action based on their stated objectives. The final choices made by these individuals could then be compared with this standard. This requirement was addressed by manipulating the context of a hypothetical (but realistic) environmental decision problem such that decisions motivated by a careful consideration of objectives would, for most people, yield outcomes that were different from ones motivated primarily by simplifying heuristics, such as an over-reliance upon affect. In this context, affect is defined as a feeling-state that people experience in response to a stimulus which in turn influences judgments (*20*, *21*), sometimes working in parallel with cognitive processes and sometimes pre-empting them. In particular, use of an *affect heuristic* leads to judgments about objects, activities, and other stimuli shaped by the varying degrees of positive or negative feelings attached to them (*22*−*24*). By designing an experiment in this way, it is possible to compare subject's self-reports (e.g., characterized by statements such as *"I made a choice that strongly reflected my objectives and concerns"*) with their actual choice behavior (e.g., decisions that indeed reflected prioritized objectives vs those that ignore stated objectives in favor of shorthand decision rules).

2. Methods

2.1. Design. The context for this experiment was environmental management decisions in a state nature area located in Ohio. Specifically, subjects were asked to provide input about how state funds should be spent to address three emerging, and for the purposes of this experiment, independent problems. These problems ranged from being affect-poor to affect-rich and included, in ascending order, walking trails in disrepair, white-tailed deer overpopulation, and wildlife disease. A manipulation check confirmed the level of affect across two dimensions—valence and arousal—for each of the three problems (Table 1).

The experiment made use of an extensively pretested workbook prepared in two versions: an unstructured technical (UT) and a structured values (SV) condition, both consisting of 10 pages. The workbooks were completed individually under the supervision of two trained facilitators (the first author and a research assistant who provided general guidance and answered questions to ensure that the subjects understood both the information that was presented to them and the accompanying decision-making tasks) and, on average, took approximately 40 min to complete.

The experiment involved two components with one independent variable (the unstructured or structured condition) and several dependent variables. *Component 1* of the experiment was designed to allow for between-treatment comparisons of subjects' self-reports as the main measure of decision quality. As with previous research of this type, the specific dependent variables used for judging the quality included participant's self-ratings of (i) changes in their level of knowledge, (ii) the degree to which they were able to make choices that were consistent with their prioritized concerns, and (iii) their level of comfort and satisfaction with their ultimate choices. *Component 2* of the experiment was designed to allow for a within-treatment—in the SV condition only (since only subjects in this condition made use of the value focused information and took part in the decision structuring tasks)—consistency-based analysis of the relationship between subjects' actual prioritized objectives and their final choices as a second measure of decision quality.

Both the UT and SV conditions shared four common elements. These elements were (a) background information about the nature area and its three emerging environmental management problems, (b) more detailed information presented in text and in tabular format about the human and environmental health risks associated with them, (c) a series of pre- and post-test closed-ended self-rating questions, and (d) the final funding allocation (choice) task. As with previous research of this type (e.g., *3*, *10*, *12*), subjects in both the UT and SV conditions received the same basic information about the human and environmental health effects associated with the three management problems. However, there were variations between the UT and SV conditions in terms of (*1*) how this basic information was framed and (*2*) the addition, in the SV condition only, of value-focused content—a key characteristic of past SDM approaches (*5*, *11*).

Information in the UT condition, for example, was more detailed from a technical standpoint, addressing with greater depth the risks to human and environmental health associated with each of the three management problems. This information included predictions about the number of injuries and deaths that could be expected over the next year, as well as the level of wildlife and vegetative disruption that could be expected over the same time period on a per square mile basis (Table 2). The goal of such an approach is to improve the available knowledge base so that participants can make choices that are informed by detailed scientific data and is similar in intent to many of the science-based initiatives in decision making now being undertaken by the EPA (*25*).

In the SV condition, by contrast, information as it related to the three risks was linked to these same technical dimensions, but also explicitly to other objectives for environmental management (Table 3). This approach is modeled on several decision-aiding initiatives that emphasize value-focused thinking (*5*) and work to facilitate both improved comprehension of technical information and less demanding tradeoffs during decision making (*8*, *26*, *27*). To this end, human health risks were described in terms of the general severity of anticipated effects by category (i.e., using scales from 1 [low severity] to 10 [high severity]) and were not subdivided by the type of ailment, as was the case in the UT condition. Environmental risks were also presented using 10-point scales that addressed anticipated changes in the levels of wildlife and flora. Subjects also received information—again on 1 to 10 scales—across two values-oriented concerns: recreational opportunities and the overall aesthetic appearance of the park.

To help ensure the validity of the materials presented to subjects in both conditions, the information was based on current information describing environmental hazards in Ohio MetroParks. To ensure equivalency in content, the translation from the UT to the SV condition was undertaken

TABLE 2. Risk Information for Each of the Three Park Management Problems Presented Only in the UT Condition[a]

	damaged trails	deer over-population	wildlife disease
human health risks			
injuries[b]	135	35	20
sprains	75	0	0
fractures	20	5	0
cuts/abrasions	40	30	20
illness[b]	0	10	80
West Nile Virus	0	0	35
Lyme disease	0	10	45
chronic wasting disease	0	0	0
fatalities[b]	1	3	2
environmental health risks			
wildlife and vegetation disrupted[c]	6%	50%	10%
mammals	5%	60%	25%
birds	0%	20%	25%
aquatic organisms	15%	20%	10%
trees	5%	50%	0%
shrubs	10%	50%	0%
decorative plants	10%	90%	0%
vegetative dieback[d]	5%	35%	0%

[a] Figures in each column represent predictions about the risks that are expected in the park over the upcoming year. [b] Number per year in Ohio. [c] Percent of species disrupted per square mile. [d]Percent per square mile in Ohio.

TABLE 3. Risk Information for Each of the Three Park Management Problems Presented Only in the SV Condition[a]

	damaged trails	deer over-population	wildlife disease
human health[b]	4	4	5
injuries	7	5	1
illness	0	1	8
fatalities	1	2	1
environmental health[b]	3	6	4
wildlife	2	5	6
flora	4	7	1
recreational opportunities[b]	5	4	3
hiking and camping	2	2	1
wildlife viewing	6	4	5
hunting	5	5	2
aesthetics[b]	2	5	4

[a] Figures in each column represent predictions about the risks that are expected in the park over the upcoming year. [b] Risks presented on a 1—10 scale where 1 = low severity, 5 = moderate severity, and 10 = high severity.

by a local expert familiar with wildlife and park management issues in Ohio. This information was also reviewed for correspondence between the two tables and current conditions—as part of a research review process—by managers within Cleveland MetroParks.

Both the UT and SV conditions began by asking subjects to answer (using closed-ended, 7-point Likert scales) a series of initial self-rating questions. These questions addressed subjects' base level of knowledge about the three environmental problems and degree of comfort with the prospect of providing input during the decision-making process (where 1 = very low, 7 = very high). Subjects in both conditions were then presented with the information describing the three environmental problems. It was at this point that the designs of the SV and UT conditions diverged.

In the UT condition, subjects were simply asked to consider all of the information that had been presented, rank the two objectives based on their own opinions about importance, and then allocate funds (totaling $500,000) across the three management problems. In the SV condition, by contrast, subjects completed an additional decision structuring task: Subjects in this condition were first asked to rank the four objectives from most to least in need of addressing. Subjects were next asked to cross reference their ranked objectives with the information in Table 3 to identify funding priorities. The goal here was to help subjects translate their ranked objectives into management priorities based on the information provided. Finally, subjects were asked to weight their ranked priorities by allocating funds (totaling $500,000) such that their final choices would reflect their previously stated concerns and priorities.

Strict adherence to this process would imply a fully normative model that predicts subjects' use of information to arrive at weighted objectives and relative funding allocations. For example, assume that a subject ranked human health effects as their most important objective of concern followed by recreation impacts, environmental health, and aesthetics. To make choices that reflected these ranked objectives according to the normative model, this subject would be expected to assign the highest management priority and largest funding allocation to wildlife disease because it posed the greatest risk to human health based on the information presented in Table 3. This, in turn, would be followed by relatively smaller funding allocations for damaged trails and deer overpopulation (by linking impacts across their ranked objectives with the appropriate management problem).

Both the UT and SV conditions then ended as they began, with a series of closed-ended self-rating questions including the four asked at the start of the experiment as well as two others dealing with the degree to which subjects felt their allocation choices addressed their ranked objectives and their overall level of satisfaction with their decisions.

2.2. Subjects. Subjects in this study were paid adult visitors to metropolitan parks in the Cleveland, Ohio area. A total of 50 subjects were assigned at random to the SV condition and another 51 subjects were assigned to the UT condition. The workbook of one subject was excluded from the SV condition and six were excluded from the UT condition because all of the sections had not been completed.

2.3. Hypotheses. With respect to *Component 1* of the experiment, it was expected that self-reports from participants regarding the quality of the decision process would be similar to those found in past studies. To this end we expected that participants in the structured values condition (as opposed to those assigned to the unstructured technical condition) would feel more comfortable with the prospect of providing input to decision makers, more satisfied that their decisions addressed their issue-specific concerns, and more satisfied with their decisions overall. With respect to *Component 2*, we expected—based on past endorsements of structured decision approaches—that subjects in the SV condition would indeed make allocation choices that more closely reflected their stated objectives.

3. Results

3.1. *Component 1*: Self-Reported Measures of Decision Quality. A within-subject comparison of responses to the first four closed-ended self-rating questions in both conditions revealed a significant increase in level of knowledge regarding trails, deer overpopulation, and disease (paired t-test, $p < 0.01$; Table 4, Items 1—3). In terms of subjects' degree of comfort with respect to providing input during the decision process, subjects in the UT condition showed a significant decrease in comfort from when they started the experiment to when they finished (paired t-test, $p < 0.001$; Table 4, Item 4). In addition, a between-subject comparison revealed a higher level of comfort among subjects in the SV

TABLE 4. Summary of Within- And Between-Condition Comparisons of Subjects' Responses to Closed-Ended Self-Ratings in Both the UT and SV Conditions

self-rating item	unstructured technical (UT)					structured values (SV)				
	$\bar{x}_{Start}$	SE_{Start}	$\bar{x}_{End}$	SE_{End}	p	$\bar{x}_{Start}$	SE_{Start}	$\bar{x}_{End}$	SE_{End}	p
1. knowledge (trails)	3.1	0.25	4.1	0.22	<0.001[a]	3.7	0.21	4.4	0.23	<0.001[a]
2. knowledge (deer)	3.8	0.24	4.4	0.22	<0.001[a]	3.7	0.22	4.4	0.17	0.001[a]
3. knowledge (disease)	3.3	0.20	4.1	0.22	<0.001[a]	3.7	0.21	4.3	0.21	0.005[a]
4. comfort with providing input	5.2	0.22	4.5	0.25	<0.001[a]	5.4	0.22	5.1	0.23	>0.05[a] <0.05[b]
5. choices reflect what matters			4.9	0.21				5.5	0.17	<0.05[b]
6. overall satisfaction with choice			4.5	0.25				5.1	0.23	<0.05[b]

[a] p-value reflects a within-condition comparison in both the UT and SV conditions (paired sample t-test). [b] p-value reflects a between-condition comparison of post-test question ($\bar{x}_{End}$) in both the UT and SV conditions (2-sample t-test).

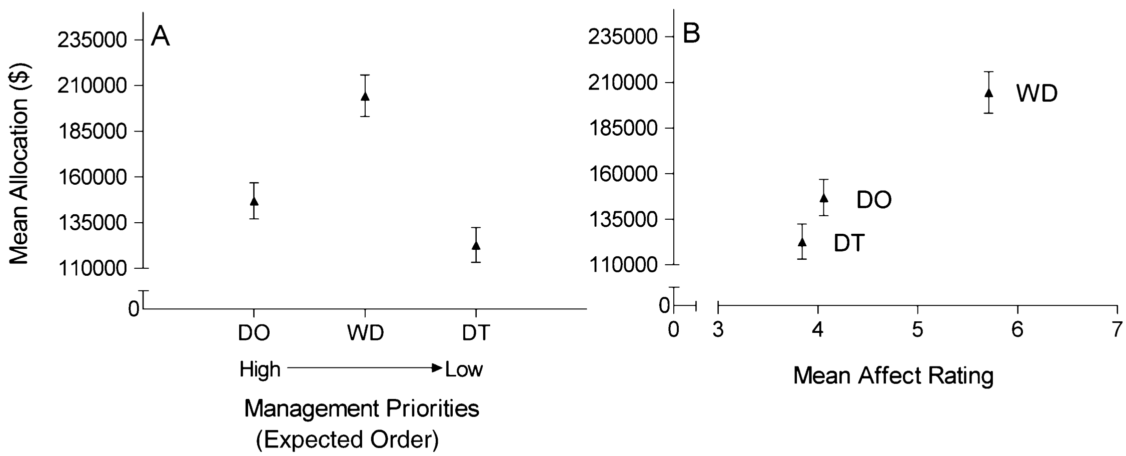

FIGURE 1. Mean funding allocations across three environmental management problems in a state nature area—damaged trails (DT), deer overpopulation (DO), and wildlife disease (WD)—as a function of (i) the expected order of management priorities based on subjects' ranked objectives (A), and (ii) mean affect ratings (B). Error bars reflect standard error.

condition at the completion of the process (2-sample t-test, $p < 0.05$; Table 4, Item 4).

For the final two self-ratings questions, a between-subject comparison also revealed statistically significant differences between responses from subjects in the UT and SV conditions. Specifically, subjects in the SV condition reported being better able to address the issues that mattered most to them when making decisions about managing risks in the state nature area that was the focus of this experiment (2-sample t-test, $p < 0.05$; Table 4, Item 5). Likewise, subjects in the SV condition also reported being more satisfied with their decisions overall (2-sample t-test, $p < 0.05$; Table 4, Item 6).

3.2. *Component 2*: Consistency-Based Measures of Decision Quality. *3.2.1 Ranked Objectives and Management Priorities.* On average, participants in the SV condition identified improving environmental health as their primary concern ($\bar{x} = 1.69$, SE = 0.11) followed by improving human health ($\bar{x} = 1.94$, SE = 0.15), improving recreational opportunities ($\bar{x} = 2.9$, SE = 0.11), and addressing aesthetic concerns ($\bar{x} = 3.24$, SE = 0.14). Subjects' management priorities in the SV condition, which were expected to correlate strongly with subjects' ranked objectives, were both averaged across subjects for comparison and correlated with the top two ranked objectives. On average, participants in the SV condition identified wildlife disease as their first priority ($\bar{x} = 1.51$, SE = 0.102), deer overpopulation as their second priority ($\bar{x} = 1.86$, SE = 0.105), and damaged trails as their third priority ($\bar{x} = 2.53$, SE = 0.093). This ranking does *not* correspond with the expected ranking—based on subjects' ordering of objectives and the risk information provided in Table 3—of deer overpopulation, wildlife disease, followed by damaged trails. Further testing in the form of a one-tailed bivariate correlation of objectives by priorities for both environmental health (Pearson correlation = −0.044, $p = 0.383$) and human health (Pearson correlation = 0.129, $p = 0.188$) revealed no significant correlations, supporting this finding that the management priorities did not correspond with the ranked objectives.

3.2.2. Funding Allocations. Mean funding allocations were compared across subjects' mean management priorities as well as included in a regression model to identify significant predictors. The largest mean funding allocation was assigned to the problem of wildlife disease ($\bar{x} = \$204{,}490$, SE = $11,406), with relatively lesser mean amounts assigned to deer overpopulation ($\bar{x} = \$146{,}939$, SE = $9907) and damaged trails ($\bar{x} = \$122{,}755$, SE = $9578) (see Figure 1A). Analysis of variance coupled with a Tukey's pairwise comparison of funding allocations revealed significant differences across these three allocations ($F = 16.53$; $p < 0.001$).

Visual inspection of the data (Figure 1B) suggests a high degree of correspondence between mean funding allocations and subjects' initial affect ratings of the three management problems; further analysis in the form of a stepwise multiple regression with *affect*, *objectives*, and *priorities* as predictors of funding allocations confirmed this result. This analysis revealed that *affect ratings* and *management priorities* were significant predictors ($F = 34.796$, $p < 0.0001$) while *ranked objectives* were excluded from the model as an insignificant predictor ($p = 0.520$). Taken together, these results fail to support the hypothesis that subjects in the SV condition would allocate funding in a manner that reflected their ranked objectives.

4. Discussion

To address our first hypothesis (that subjects in the SV condition—as opposed to those assigned to the UT condition—would feel more comfortable with the prospect of providing input to decision makers, more satisfied that their decisions addressed their issue-specific concerns, and more satisfied with their decisions overall), it was necessary to undertake a comparison of the self-reported evaluations made by subjects that took part in the UT and SV conditions. The results (Table 4) obtained from this element of the experiment provide support for this hypothesis; of particular interest, these findings are virtually identical to results from similar studies conducted previously (e.g., *10*).

Based on these findings, utilizing a SDM approach seems to provide some clear benefits to decision makers. Previous writing supports this idea, pointing to the benefits associated with the explicit values-focus of a SDM approach. Keeney (*5*), for example, argues that because stakeholders' values are at the core of all policy debates, making their consideration an explicit component during the decision-making process ought to help people make choices that better reflect their issue-specific concerns. Others have suggested that, as many of the stakeholders who take part in various policy-making processes are not technical experts (as was the case with the public sample drawn for this study), an added emphasis on nontechnical values and objectives during decision making likely provides much needed context and helps participants more easily evaluate tradeoffs when making complex and novel decisions (*2*, *3*). (The lack of these kinds of benefits in the UT condition may have contributed to the relatively high incompletion rate among subjects in this condition; see Section 2.2.)

Recent research conducted on the evaluability of objectives and options during decision making supports these assertions; for example, Hsee (*8*, *26*) and Slovic (*24*) have shown that in a decision context, displaying difficult-to-evaluate information such as unfamiliar technical data alongside easier-to-evaluate information (e.g., nontechnical information that lay decision makers are more accustomed to processing) helps to provide much needed context for a given choice. Applied to the context of the research reported here, it becomes easier to determine the relative importance of some level of improvement in environmental health—for example the effects of a given policy choice on the flora of a park—when this information is linked to attributes that decision makers are more accustomed to evaluating (e.g., the effects of the same policy on recreation-related choices).

An added benefit of incorporating values-based information in environmental decisions of the type studied here relates to easing the burden associated with tradeoff making. For example, subjects in the UT condition had little choice but to make a tradeoff between addressing risks to the environment or the risks associated with a variety of frightening illnesses or even death. These types of tradeoffs pose a challenge to even the most seasoned decision makers and may represent a form of constitutive incommensurability (*27*) where individuals feel as though they are being asked to make tradeoffs among attributes that *all* seem critically important. People end up feeling as though they are forced to subvert some morally significant values in favor of others and this, understandably, creates a conflict. Providing additional, less technical attributes across which tradeoffs may be made (as was the case with the recreational and aesthetic attributes in the SV condition of this experiment) may help to alleviate the dissonance associated with these types of choices.

These arguments, coupled with the self-reported evaluations of decision makers in this experiment, suggest that the quality of decisions stemming from a SDM approach ought indeed to be higher when compared with an unstructured control. The results from Component 2 of this experiment (limited to subjects in the SV condition), however, tell a different story (Figure 1). Despite subjects' positive self-reports about the degree to which their funding decisions reflected their objectives in the SV condition, an analysis of individual histograms depicting each subject's set of funding allocations compared with ranked objectives showed that only 6 of the 49 subjects made choices that were completely consistent with their ranked objectives, adhering to the normative model. The responses from an additional 8 subjects could be considered internally consistent when ties were accounted for (i.e., in the case where two or more management problems are ranked in ascending order but receive the same funding allocation). In addition, 3 more subjects seemed to follow a quasi-normative model; these individuals were information misers, demonstrating a tendency to satisfice (i.e., identify one dominant objective and accurately translate that objective into the appropriate priority and funding allocation) while expressing inconsistent behavior across the remaining objectives and problems. By contrast, 32 out of the 49 subjects allocated funds in a manner that did not correspond with their ranked objectives (i.e., demonstrating an inability to link any of the tasks and utilize the risk information in any consistent manner).

Looking at the treatment group as a whole, subjects in the SV condition ranked—on average—environmental health risks to be their primary concern, followed by human health risks, the loss of recreational opportunities, and then aesthetic declines. Based on this ranking of concerns cross-referenced with the information provided (i.e., a task that subjects were asked explicitly to undertake as part of the SDM approach), we expected subjects who adhered to this normative model to identify the management of environmental problems associated with deer overpopulation as their top priority followed by wildlife disease and then damaged trails (see Figure 1A); along these lines, we also expected the pattern of subjects' average funding allocations to follow suit. In the case of information misers (satisficers), we expected subjects to provide the problem of deer overpopulation the highest funding allocations with some lower amount—regardless of the relative order—allocated to the remaining problems. As shown in Figure 1A, however, neither model was identified. Despite their stated objectives, subjects in the SV condition identified wildlife disease as their top management priority and then provided the largest mean funding allocation to this problem.

These results point to a disconnect between subjects' ranking of management *objectives*—which the self-reported findings would suggest was driven by thoughtful analysis of the information provided—and the prioritizing of management *problems*, which appeared to be driven by some other mode of judgment, possibly the use of an affect-based heuristic. In fact, further analyses of the results reveals that participants' prioritization of management problems and their funding allocations corresponded directly with their initial affect ratings (as opposed to their ranked concerns; see Figure 1B). Specifically, mean funding allocations increased as the mean affect scores increased—a finding that is consistent with previous research in the context of both environmental (*28*) and financial (*20*) choices. Overall, these findings do not support our second hypothesis that a SDM approach would lead to higher quality decisions as indicated by concordance between subjects' stated objectives and their actual choice behavior.

What accounts for this discrepancy? As the research reported here was based on an experiment, one can point to many possibilities linked to experimental design. For example, incorporating real-time information illustrating the levels of improvement that might have been expected under different allocation scenarios likely would have yielded results that differ from those reported here. Similarly, the hypothetical nature of the experiment, coupled with the fact that the magnitude of the environmental problems was similar across the specified attributes, may have decreased the level of urgency felt by decision makers. Subjects may have recognized the relatively low magnitude associated with the most affect-rich problem (wildlife disease) but judged the marginal utility associated with this difference (as compared to the other environmental problems) to be negligible. As a result, subjects may have judged the choice task as not warranting a high level of accuracy and hence, less effort (*29*, *30*).

A second possible explanation for these findings is the large role that affective impressions play in judgment and decision making. While it is important to acknowledge the critical role played by affective impressions in many decisions (*24*, *31*, *32*), the affective characteristics of a problem may also work to override the gains achieved via decision structuring as suggested in Figure 1B. Of the 32 subjects who did not allocate funds in a manner that corresponded with their ranked objectives, 20 allocated funds in a manner that corresponded with their initial affect ratings (i.e., a higher affect rating yielded a higher funding allocation). Clearly, these instances of affective override (*28*) can have significant real-world policy implications (e.g., the recent questions surrounding the wisdom of heavy investments in fighting the affectively charged war on terror (*33*, *34*) while devoting significantly fewer resources to more mundane but equally urgent environmental problems such as upgrading infrastructure for flood protection and natural disaster preparedness).

Because they were derived experimentally, these results ought not to be overstated. The experiment presented here was a first attempt at addressing the NRC's stated priority for additional research aimed at evaluating decision quality (*1*). For example, future research can—*and should*—investigate the role of other SDM tools (such as computer-based decision aids that would illustrate the levels of improvement that a decision maker might expect with different resource allocations, as well as making allowances for group deliberation and feedback) as a means of improving the consistency of choices. Thus, findings from this single experiment should not be viewed as a condemnation of SDM approaches. Environmental decisions are often too complex, and the consequences of management actions too important, to ignore the objectives and concerns of stakeholders that underlie decisions. SDM approaches are still among the few techniques that are designed to explicitly help decision makers address this complexity while providing much-needed facilitation, in a systematic and defensible fashion (*2*). Similarly, the implications of SDM approaches for stakeholder involvement efforts should not be understated. Stakeholders' willingness to take part in environmental management efforts along with their levels of comfort and satisfaction while active in the process are factors that should be taken into account when considering alternative stakeholder involvement approaches (*10*).

In the end, however, the overall quality of environmental decisions should also be judged by both process (i.e., the steps in a structured, decision aiding approach) *and* outcome-oriented (i.e., decision makers' ability to utilize these steps effectively) attributes (*35*). We believe, therefore, that the disagreement observed in this study between decision makers' self-reported evaluations and their actual choice behavior, as well as the implications of this finding for the design of future environmental decision making efforts should not be ignored. Future efforts—both experimental and practical—that utilize SDM approaches should include some measure of outcome quality when evaluating the overall quality of the approach. Purely basing an evaluation of decision quality on self-reports of success may lead to confidence in a decision that does not accurately reflect the objectives of the individual or group, and therefore, may not be effective over the long-term—despite the best intentions of the process and those facilitating the effort.

Acknowledgments

We thank Ann Froschauer and Caryn Klaff for their assistance with this research. Also, this manuscript benefited significantly from the comments of three anonymous reviewers. This research was supported by the National Science Foundation under award number SES 0350777 to The Ohio State University and Decision Research. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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Received for review September 29, 2005. Revised manuscript received May 24, 2006. Accepted June 1, 2006.