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Acceptable Input: Using Decision Analysis to Guide Public Policy Deliberations

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Multiparty deliberative processes have become a popular way to increase public participation in public policy choices. Their legitimacy depends on participants' ability, first, to understand the issues facing them and, then, to form and express their own positions on them. These tasks pose significant cognitive and emotional challenges. This paper argues that decision analysis, informed by behavioral decision research, offers procedures and standards for creating responsible deliberative processes. These involve (a) formal analysis of decisions, identifying the kernel of most relevant information, (b) communication procedures, recognizing the strengths and weaknesses of lay understanding, and (c) interactive elicitation methods, helping individuals to articulate the implications of their values for specific settings. A construct validity criterion assesses the extent to which the resulting valuations are properly sensitive to decision features. Feasible extensions of traditional decision analysis create opportunities to formalize the aspirations of participants and ensure that the intellectual content of deliberative processes is worthy of the political hopes vested in them.

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1. Introduction

1.1. The Deliberative Challenge

There has been increasing recognition of the desirability of responsible public input to controversial public policy choices (National Research Council 1996, Chess and Purcell 1999). Many researchers, including economists, political scientists, psychologists, policy analysts, decision scientists, and sociologists, have developed methods to elicit this input. Examples include opinion and attitude surveys, simulated referenda, willingness-to-pay measures in real and contingent markets, structured interviews and elicitation, and a variety of deliberative strategies to use with advisory, citizen, and technical committees.

Such methods have been used fairly widely, especially in setting environmental and health policies. Applications published in the peer-reviewed literatures and government agency reports may number in the low thousands; academic publications number thousands more. However, many of the stakeholders involved in such deliberations fail to share the faith of the analysts or facilitators leading the process. Community members often feel uneasy about how fully they have been consulted and what influence their input has had. Technical experts often worry that involving lay stakeholders will result in the neglect of critical scientific evidence. Policymakers often treat such processes as an obligatory ritual, lacking clear connection to their actions. Without binding constraints, decision makers may do what they want, thereby violating the social contract that drew community members and technical experts to the process.

In the short run, such dissatisfaction wastes the money, time, energy, and good will invested in public deliberative processes. Over the longer run, repeated failures can undermine faith in deliberation as an

input to policy analysis. If participatory processes fail, then society will lose an opportunity for the orderly sharing of information and views. It will face conflicts arising from potentially avoidable misunderstandings. It will feel greater need for political struggles, legal proceedings, economic boycotts, and other confrontations. It may lose faith in how well democracy can address conflicts with multiple interests and complex technical content.

Successful deliberations require three elements: (a) ground rules for bringing participants to the table, (b) content for creating effective understanding, and (c) a context for integration and valuation. We focus here on the latter two elements, accepting the general guidance on ground rules issued by many official, quasi-official, and professional bodies (e.g., Performance and Innovation Unit 2002, Canadian Standards Association 1997, National Research Council 1996, Presidential-Congressional Commission on Risk 1997). These principles include involving citizens early enough to shape the problem definition, continuously enough for the process to appear transparent, and candidly enough to evoke corrective feedback. Their success is reviewed by Beierle (2002), Fischhoff (1995), Gregory et al. (2001), Rossi (1997), and others.

Managing the content of such processes has both an analytical and a behavioral component. The former involves identifying the technical information and value issues essential to distinguishing among feasible options. The latter involves ensuring that participants understand the issues and then express their viewpoints in a way that decision makers understand. Both components must reflect the associated uncertainty so that stakeholders understand the quality of the underlying science and the complexity of the trade-offs required. Policymakers need such a comprehensive view in order to decide how much to rely on the conclusions of deliberative processes.

1.2. The Decision-Analytical Model

Practitioners of many analytical methodologies have developed standards for auditing their efforts. Standards for acceptable processes are less available. Without them, policymakers risk procedural malpractice, denying participants a fair chance to understand the issues, integrate that knowledge, and express their views. We propose such guidelines, based on the principles of decision analysis, long used to aid individual decision making.

Decision analysis structures choices in terms that flow from the formalisms of decision theory and multiattribute utility analysis (Clemen 1996, Keeney and Raiffa 1993). Its success, like that of participatory processes, requires effective two-way communication between analysts and decision makers. On one hand, decision makers must understand their circumstances well enough to identify the issues that matter most to them. On the other hand, they must describe their beliefs and values well enough to allow creation of a faithful decision model. To achieve these ends, decision analysis integrates decision theory with behavioral decision research, which studies how decisions are made in terms that allow process improvement (von Winterfeldt and Edwards 1986).

Realizing decision analysis's potential for designing and evaluating deliberative processes requires strengthening the link between decision analysis and behavioral decision research. In the early years of both fields, understanding cognitive and psychological processes was seen as essential to designing procedures that exploit their strengths, circumvent their weaknesses, and assess the adequacy of the result. Conversely, serving those ends set the agenda for behavioral research (Edwards 1954, Slovic et al. 1977). Over time, though, analytical procedures have lost some of their cognitive connection, while behavioral research has lost much of its prescriptive element. One result is that the descriptive findings of behavioral decision research have been invoked to support sweeping claims about limits to the public's decision-making competence (Breyer 1993, Sunstein 2002). Even when the research is cited accurately, these commentators take the public as it is, not as it could be after exposure to decision-aiding techniques and with properly designed participatory processes.[1]

We hope that this paper facilitates this reintegration. Citizens' opinions should be well informed and clearly expressed; such efforts require sound value

[1] An interesting contrast is the struggle between the law-and-economics movement (Posner 1981), making strong claims of rationality grounded in economics, and the behavioral-law-and-economics response (Hanson and Keysar 1999), making the opposite arguments grounded in behavioral research.

and technical judgments. The concepts and practice of decision analysis can help to formalize these aspirations. Thinking of deliberative processes in these terms encourages the adaptation of structured decision-aiding techniques to the tasks of enhancing and evaluating public input to controversial policy choices (McDaniels et al. 1999).

Because decision analysis typically has been applied to individual choices, such as investment or career decisions (Hammond et al. 1999), its extension to public policy requires an acceptable procedure for aggregating across individuals. That procedure can be external to the analysis, pooling the results of individual decision models. Or, the procedure can be internal to the analysis, pooling inputs before computing a shared model. Further, the aggregation could be formal, relying on explicit rules, or it could be informal, relying on participants to identify widely supported alternatives, and on decision makers to resolve conflicting recommendations. Such procedures are inevitably political because they determine the weight afforded to different perspectives. Because they involve judgments, such procedures also require a behaviorally realistic approach to applying analytical tools.

The next section of this paper structures the decision-analytic foundation for public participation in policy decisions. Sections 3 and 4 discuss the two central challenges to applying this perspective. Brief case-study examples are provided. Although we focus on environmental policies, analogous issues recur in other domains with technical content, such as health decisions or social choices affecting community quality of life.[2]

2. Decision Analysis as a Foundation for Deliberations

Decision analysis and behavioral decision research emerged as fields of study concurrently with interest in deliberative processes. Both pursuits addressed two needs. One was understanding the implications of potentially diverse preferences, including ones not addressed by conventional economic tools (Fischhoff and Cox 1985). The second was understanding the implications of potentially deep uncertainties about the consequences of decisions (Morgan and Henrion 1990).

Decision analysis addresses both concerns by relying on human judgment (Fischhoff 1980). It asks the people potentially affected by a decision (or those representing them) to express their values in structured ways, reflecting the concerns that matter to them and might be affected by the choice (e.g., economic, environmental, social, health, and safety). It asks technical experts to summarize their beliefs in terms that incorporate both statistical evidence and other beliefs (e.g., regarding uncertainty or bias in the science; National Research Council 1994). It requires decision makers to articulate clear distinctions between issues of fact and issues of value, seeking agreement regarding the former (e.g., the identity and distribution of emissions from a proposed factory) but not necessarily the latter—in the sense that reasonable people may disagree about the importance placed on different problem outcomes (e.g., the environmental and human health effects of these emissions). It should reveal where value issues are embedded in seemingly technical concerns (e.g., definitions of "risk" or "benefit").

Decision analysis disaggregates complex problems into components, subject to separate examination (i.e., individual objectives, probability distributions). These components are then combined, using computational methods following subjective expected utility theory (Keeney and Raiffa 1993), and trade-offs are elicited to create defensible policy recommendations. Reaching a preferred outcome (e.g., agreement on a policy option) thus typically requires a process that iterates between analyzing facts and analyzing values. These iterations reflect learning that serves to focus the analysis. For example, outcomes initially thought to be relevant may vary so little across the set of potential actions that they are not worth considering. One practical implication for policy debates involving public participants is that some individuals or groups who might be very involved at the start of a deliberation subsequently discover that their particular concerns (e.g., local jobs, songbird habitat) will not be much affected by any of the possible policy actions;

[2] Although not the focus of this paper, similar issues occur whenever input to decisions is asked for from professionals, rather than lay citizens; examples of successful applications are described by Phillips (1982) and Pidgeon and Gregory (2004).

as a result, they effectively drop out of later discussions.[3] Thinking about causal processes also may reveal hitherto neglected consequences. As a result, new participants and new concerns may emerge partway through an ongoing deliberation; deliberative processes need to be sufficiently flexible to be able to respond to such new inputs.

The success of decision analysis depends on the quality of these judgments, as do deliberative processes. However, deliberations rarely provide assistance to participants in constructing their judgments. Even when deliberation is sincerely endorsed, its character is often specified in nebulous terms, emphasizing process over substance. In a typical statement, the U.S. Department of Energy (National Research Council 1994, p. 36) acknowledged that "[s]takeholder participation in assessing risks at DOE facilities must be an integral component of any process that is expected to result in credible, broadly acceptable agreements." Such statements accept processes satisfying decision-analytic standards, but also more perfunctory ones. While minimal efforts may be officially acceptable, many participants will not be satisfied. Inherent to the practice of decision analysis is the belief that the introduction of decision aids—value hierarchies, influence diagrams, probability assessments—can help to bring new insights to judgmental processes and, in turn, facilitate the adoption of better alternatives. Deliberative processes could exploit this same potential (Gregory et al. 1993).

For individuals who are trained in the more quantitative aspects of the decision sciences or policy analysis, this link between the techniques of decision analysis and improved public participation may seem far-fetched. Public groups, at least at first impression, are built on dialogue and often involve community residents with little or no technical training who are worried about the fate of a single issue, such as jobs or forest habitat or school quality. Decision analysts, in contrast, are skilled at quantitative analysis and trained to conduct detailed, probabilistic calculations that integrate across dimensions. However, both deliberative processes and decision analysis share the same core tasks of understanding options (by clarifying concerns and the consequences of actions) and then evaluating them; both require that poorly done efforts be recognized as such. Decision analysis has such standards. Public policy debates do not: facilitation has been viewed as an art as much as a science (Forester 1999), with the integration of analysis and deliberation left as a matter of individual judgment.

[3] As part of a multiparty deliberation in Oregon involving the cleanup of a large coastal estuary, one local stakeholder was very expressive in early sessions due to his concern that access to hiking trails might be adversely affected. His vociferousness and anger were harmful to the group deliberations. After the third session, and an initial identification of objectives and possible management options, it became clear that no major changes in access to hiking trails would take place. This individual then voluntarily retired from the deliberations, without further intervention from the facilitator or other group members.

3. Understanding the Options

This section considers two decision-analytic criteria for ensuring that participants understand a problem, namely that its representation be *complete* and *comprehensible*.

3.1. Completeness

Information often means power. Some political philosophers believe that this should, in fact, be the case, in the sense that better-informed people should carry more weight in society. For example, Pildes and Sunstein (1995, p. 73) advocate having cost-benefit analyses weight lay assessments according to their source: "If lay assessments rest on factual misinformation, or on cognitive distortions . . . they need not be credited. But to the extent they reflect different valuations of risk . . . they are the kind of citizen preferences . . . that democracies should take seriously." A passive interpretation of this charge takes people as they are. A more active interpretation holds a deliberative process responsible for expanding the envelope of meaningful participation. Whether this expansion should be sought is a political question. Whether it can be achieved is an empirical one, best informed by behavioral research.

To create a better-informed public, the managers of deliberative processes must circumscribe the potentially relevant facts and set priorities among them. Without an adequate representation of the policy problem, participants risk becoming captives of the incomplete representations advanced by particular

stakeholders—who either innocently see only part of the problem or deliberately emphasize certain aspects.

An example comes from deliberations over policies for Alaskan offshore oil and gas drilling. Industry participants emphasized how their proposals would create additional jobs and protect the habitat of such visible species as whales and seals. However, that representation neglected other issues critical to local residents. These issues included having managerial positions and year-round employment (not captured by the number of jobs per se). Local residents cared about species diversity, not just a few highly visible marker species. A deliberative process based on decision analysis showed the need to expand an industry's initial problem representation. Once that happened, marginalized stakeholders returned to the process and, fortuitously, identified more widely acceptable alternatives (U.S. Department of Interior 1992).

A familiar decision analysis technique for securing completeness is creating an *influence diagram* (Shacter 1986), summarizing scientific understanding of the processes affecting the probabilities of the focal outcomes. Even when probabilities are not explicitly computed, the formal decomposition can clarify the key variables and interdependencies. This facilitates structured dialogue by (a) reducing the risk of missing critical elements, (b) pooling the expertise of multiple experts, (c) facilitating external review, and (d) focusing attention on key uncertainties. It also encourages clarity about potentially vague terms and relationships, such as ambiguous verbal quantifiers like "small chance" or "rare side effect" (Budescu and Wallsten 1995).

Influence diagrams assist deliberation in another important way—leveling the playing field for knowledge of different types. A common problem in community-based deliberations is not fully integrating the knowledge of local stakeholders, leaving them feeling disenfranchised. By accommodating and graphically displaying lay knowledge, influence diagrams can make stakeholders fuller partners and help them to feel that way.

For example, as part of water-use deliberations at the Bridge River in British Columbia, government scientists and aboriginal representatives from the local Stl'atl'imx Nation disagreed about the likely benefits of a proposed plan affecting local water resources. Fisheries scientists proposed using an influence diagram to document hypotheses about major factors limiting fish populations (Failing et al. 2004). A performance measure, the *spawning success utility index*, combined estimates of spawning success in each tributary (a function of water levels) weighted by each tributary's contribution to overall juvenile recruitment. This measure combined scientific analysis (e.g., how long and at what depth can eggs survive inundation?) and traditional ecological knowledge from the Stl'atl'imx (e.g., how flexible are fish in their spawn timing?). The process built trust by displaying the set of issues that had been explicitly considered in a way that clarified the links between scientists' hypotheses and other stakeholders' values. Doing so legitimated these concerns, so that participants did not feel they had to fight for a hearing, and kept those issues in view, even when other ones were being discussed. If documented, influence diagrams create an audit trail, allowing nonparticipants to review the deliberations and see how their conclusions were reached. While individuals can judge the completeness of personal deliberative processes, public ones should be held to a higher standard. Quantitative models also allow sensitivity analyses of how much (included and excluded) factors matter.

3.2. Comprehensibility

Behavioral decision research shows that the complexity of many decisions quickly outstrips decision makers' unaided cognitive capacity. Decision analysis recognizes this limit and seeks to reduce that cognitive load by decomposing decisions into elements that can be considered in isolation, then systematically reintegrating (von Winterfeldt and Edwards 1986).

In the domain of values, value trees, objectives hierarchies, and means-ends diagrams facilitate depicting relationships among concerns (Keeney 1992). For example, deliberations regarding a hydroelectric project in western Canada required balancing power losses against flood protection, environmental, recreation, and social and cultural benefits. Scientists from federal and provincial governments developed a value tree with "fish" and "wildlife" as separate objectives. Local residents and First Nation (Native American) participants protested what they perceived

to be excessive disaggregation and sought to link fish and wildlife into a more fundamental "ecological health" objective (Failing et al. 2005). Although some scientists initially objected, the revised value tree ultimately met the needs of both parties: Scientists (and other "splitters") were satisfied by the detail shown at lower levels of the tree, whereas aboriginal participants (and other "joiners") were satisfied by the approach explicitly acknowledging higher-level objectives in a way that linked them to a fundamental objective of First Nation's culture.

Multiattribute utility procedures, at their core, recognize that many choices pose cognitively challenging trade-offs. Considering multiple value trade-offs simultaneously risks missing issues and nuances. Considering multiple consequences simultaneously risks missing key elements of the reasons for uncertainty because individual sources often no longer can be distinguished. Decomposition is, therefore, a necessary precursor to the constructive process of creating an overall valuation. Multiattribute utility analysis procedures guide such value decomposition and include diagnostics for how well respondents have performed their task.

This elicitation process may be the central intellectual challenge in an analysis, especially with novel choices and those posing stark trade-offs, such as "your money or your life" and "suffer some now or more later." Unfamiliar choices require decision makers to *construct* preferences, articulating specific values from their basic values. Many health and environmental problems involve incommensurable values, having very different cognitive and affective representations (Fischhoff 1991). When people do not know what to think or say about a trade-off they will seek cues. Decision analysts are accustomed to ensuring that these cues come from relevant sources (e.g., past experiences with similar goods, core ethical principles) and not irrelevant ones (e.g., the scales or metrics being used, unintended nonverbal hints).

Extending decision analysis to the public policy arena poses challenges to conventional analysts. With individual choices, the decision maker is sovereign to decide whether the elicitation process has been fair, deepening their understanding of the trade-offs without biasing them. With public choices, those affected by a choice should also have a right to evaluate the process that produced it. Research into constructive processes (Fischhoff and Manski 1999) has identified features of a proper procedure. One requirement is providing alternative perspectives on value conflicts, along with possible reasons for adopting each perspective. A second requirement is avoiding the subtle pressures that can induce individuals to suppress their uncertainty and answer almost any question (Schkade and Payne 1994).

In the domain of facts, decision trees provide a standard for determining what issues really matter, a precondition for determining how adequately participants understand their choices. It is all too easy to dismiss lay people by demonstrating their ignorance of some fact that is common knowledge to experts without demonstrating whether that fact needs to be known, in terms of its contribution to the overall analysis (Eggers and Fischhoff 2004). One procedure for providing relevant information begins by creating an influence diagram summarizing technical experts' understanding of the decision-relevant science (an *expert model*). It then asks lay people to describe their beliefs, in their own terms (Bostrom et al. 1992). Comparing lay and expert beliefs reveals the critical gaps in lay understanding, thereby disciplining claims about the adequacy of lay comprehension. The approach has been used for a wide variety of risks, including domestic radon, sexually transmitted diseases, climate change, electromagnetic fields, electricity deregulation, breast cancer, breast implants, childhood immunization, and nuclear energy sources in space (Morgan et al. 2002).

A common result in such research is that communications can fill the important missing links in individuals' fragmentary scientific understanding. In work assisting Ontario Hydro with the pricing of electricity transmission services, such interviews revealed aspects of potential rate designs that had not been analyzed clearly enough for citizens to understand the options. Without additional analyses, followed by appropriate communication, the deliberations could not proceed. In response, key issues were addressed in a widely distributed report, followed by an all-stakeholder workshop, where they were further clarified and discussed (Gregory et al. 2003).

4. Evaluating the Options

Once decisions have been understood, they must be resolved. Doing so requires decision makers to

work through the inferential problem of articulating how their basic values apply to those specific circumstances.

Decision analysis offers a variety of evaluation methods suited to the cognitive demands of the task and capabilities of the participants. The research base for facilitating evaluation processes is the study of how people construct preferences for complex goods, making trade-offs across conflicting objectives (Payne et al. 1992, Slovic 1995). It builds on research into people's sensitivity to contextual cues when forming novel judgments (Kahneman and Tversky 1984, Poulton 1994).

4.1. Cognitively Compatible

Cognitively appropriate elicitation methods ensure faithful translation from what people have worked out in their minds to the required response. If people know what they want (e.g., with a familiar task, such as purchasing grocery items), it should not matter how they are asked. With tasks that are novel or complex, and these require constructive processes, responses can be highly sensitive to presentation of the problem (Fischhoff 2005). This can encourage incomplete ways of thinking, even without overt pressure to say certain things.

Decision analysis addresses this challenge by offering techniques that permit participants to express their concerns in a variety of metrics (Keeney 1992). One choice in designing such procedures is the type of attribute used to characterize outcomes. *Natural* attributes have a common interpretation. *Proxy* attributes indirectly relate to an objective. *Constructed* attributes use structured scales to facilitate consistent judgments about objectives that are often seen as beyond measurement. For example, people living in the vicinity of a proposed waste site or incinerator may worry about its health implications for their families and community. A natural attribute is counting the number of fearful people. A proxy attribute may indirectly measure fear levels as the number of people seeking professional advice about their fears or about their health. A constructed index may capture the intensity of those fears by counting social actions (e.g., people joining protest groups), behaviors (e.g., willingness to switch from tap to bottled water), and physical measures (e.g., blood pressure) (Keeney and Gregory 2005). Alternatively, a constructed measure could directly evaluate how fear and other factors influence public support by creating a scale that focuses on the actions and attitudes of various groups. Keeney and Sicherman (1983), for example, used a constructed five-point scale (from "support: no groups opposed" to "strong action-oriented opposition") to evaluate public support for different potential power plant sites.

Using multiple metrics can overcome the undue influence of particular perspectives. Tversky et al. (1988), for example, showed that the weight of an attribute expressed in monetary terms is enhanced if the response mode also uses a monetary measure (see also Sunstein et al. 1998). This finding is a special case of the general phenomenon of stimulus-response compatibility. In the context of evaluating unfamiliar stimuli valued across multiple dimensions, holistic measures (e.g., willingness-to-pay) "ignore these cognitive realities and require people to engage in a truth that exceeds their capabilities" (Gregory et al. 1993, p. 193).

Cognitive-compatibility concerns require defining objectives and alternatives in terms that fit participants' natural terminology and mental models. In the Ontario electricity pricing example, workshops and structured elicitations with key stakeholders led to more transparent descriptions of the proposed transmission rate designs (e.g., renaming an important billing issue) and reframing aspects of the problem (e.g., separating a single connection charge into a line and transformer connection) (Gregory et al. 2003). This demonstration of responsiveness both permitted and encouraged stakeholders to participate more fully in the subsequent discussion of alternatives.

Offering multiple perspectives may aid the deliberative processes by encouraging open debate about the cognitive fit of different methods. For example, as part of evaluating water-use plans, the Alouette River advisory committee was asked to choose among three approaches: (a) multiattribute scoring, (b) translating impacts into dollar terms, and (c) expressing pros and cons in both qualitative (e.g., ecological health) and quantitative (e.g., power revenues) terms (McDaniels et al. 1999). The third approach was accepted after a discussion that considered cognitive compatibility issues. Using multiple approaches might reduce the

"evaluability" effect (Hsee 1996), whereby placing options in a set affects their evaluation by providing a context that gives the options meaning (McDaniels et al. 2003, Poulton 1994).

4.2. Cognitively Tractable

Multiattribute approaches can overwhelm users with details, even after restricting the set to potentially relevant ones. For example, a widely cited approach to helping forest managers think about biodiversity contains seven objectives, 22 elements, and 83 indicators, yet it provides no clues regarding importance, redundancy, or linkages among them (Council of Forest Ministers 1997). A standard decision analysis approach to managing complexity is to organize objectives hierarchically (Keeney 1992). Doing so can reveal the structure of values while avoiding inadvertent double counting. Often, it fortuitously reveals unexpected commonality of values among the participants, obscured in normal discourse, which often focuses on arguments about favored attitudes (Gregory 2002).

Gregory and Keeney (1994) used such value structuring with stakeholders in Sabah, Malaysia, who were deciding whether to protect or develop a pristine rainforest. At a cognitive level, these exercises helped participants to recognize common interests and share factual information, which, in turn, clarified the weights to give to policy objectives. At a social level, the process increased trust and encouraged more open deliberations, broadening the range of concerns and revealing novel alternatives.

Morgan et al. (1996) and Florig et al. (2001) developed a similarly spirited approach to the common challenge of setting priorities among the many risks competing for a community's attention. Their *risk-ranking* procedure offers a standard, multidimensional representation of diverse risks, based on the dimensions that typically emerge in "psychometric" studies of risk (Slovic 1987). These dimensions provide a standard representation of diverse risks, allowing comparison across risk-ranking efforts. A tabular representation helps to reveal dominance relationships, focusing attention on the remaining critical trade-offs. If one of the attributes is monetary impact, it may be possible to extract willingness-to-pay measures, with suitable econometric assumptions. In the process, participants iteratively make holistic and decomposed judgments in group and individual settings. The protocol uses group discussions to increase collective cognitive capacity, while respecting both individual and group valuations. It can reveal both agreements and disagreements, which may otherwise be hidden by the noise of complex processes. A variant has recently been proposed by the British government as a way of improving the compatibility of deliberations and the cost-effectiveness of safety measures (HM Treasury 2004).

4.3. Emotionally Stabilizing

Some outcomes trigger emotional, as well as cognitive, responses that can, in turn, color (and inform) judgments of fact and value (Gray 2004, Loewenstein 1996, Slovic et al. 2002). For example, most negative emotions (e.g., sadness, fear, depression) shape cognitions in ways that induce more pessimistic predictions. However, although anger is experienced as a negative emotion, it tends to induce optimism (Lerner et al. 2003). In group interactions, angry participants may, similarly, find increased confidence in their favored proposals.

The difficulty of some trade-offs can evoke affective responses that lead people to seek escape from the situation, perhaps by adopting simplistic decision rules (e.g., any loss, however small, of a valued resource is prohibited). They may resent those who force them to confront the choice, especially if it includes the possibility of violating a "protected" value (Baron and Spranca 1997). Extreme expressions of "no compromise" are statements of principle, rather than decision rules. The controversies over precautionary principles involve the confrontation between individuals who are comfortable with analytically based trade-offs and ones who are afraid of having their concerns neglected. Such fears may lead to the dogged advance of a single issue, as a counterweight to an analytical process that seems out of control (Löfstedt et al. 2002).

Decision analysis can help to defuse such confrontations by providing alternative ways to express emotion-laden concerns. Analysis starts off on the right foot by explicitly acknowledging participants' feelings and values, which policymakers ignore at their own risk. It provides the further safeguard of separating issues of fact and value (including where values are embedded in facts, such as the definition of "risk" or "benefit"). Rather than focus on

alternatives, which can increase participants' rigidity, analysis focuses on assigning specific weights to dimensions whose general relevance will be acknowledged by most participants. For example, discussions of water-flow policies on the Alouette River improved once environmentalists assigned some benefits to electrical power and engineers recognized environmental concerns (McDaniels et al. 1999)—even though their relative weights differed greatly.

Measures can be created for the specific purpose of capturing the issues that create strong emotions, even if (as with trust, mismanagement, community pride, or local support) they are viewed as unique to the problem at hand. In particular, the ability of decision analysis practitioners to include constructed attributes (in addition to the more familiar natural and proxy attributes) can greatly enhance the responsiveness of the deliberative process by bringing concerns into the formal analysis of consequences that might otherwise be omitted or unfairly represented.[4] Decision analysis also sets out criteria for the development of attributes to ensure they meet minimum standards: namely, they should be unambiguous, comprehensive, direct, understandable, and operational (Clemen 1996, Keeney and Gregory 2005). In our experience, few facilitators of public policy processes adapt, or even recognize, these criteria.

4.4. Appropriately Informative

Making full use of participants' preferences requires clearly defining the problem and the role of stakeholder input. This definition should defend stakeholders from having both their contributions diluted (into some vague advisory status) and unwarranted conclusions attributed to them (extending beyond anything that they explicitly addressed). Without such precision, deliberative processes can become reconnaissance missions, casting a wide net and hoping to find something useful. A sound methodology reduces these risks by clearly identifying the analytical and behavioral assumptions that users must make, along with the grounds for making them.

Achieving these ends requires assessing what participants already know, what they need to know, and what they can learn about the facts and values relevant to a decision. This involves both interaction and iteration, over time, across individuals, and (at times) across problems, learning from successes as well as from mistakes (Dietz 2003). It requires that factual information be collected and presented clearly to the extent that the decision may be altered or the deliberative process may be enhanced (e.g., by building trust among participants). It also requires that decision makers be clear about what they are asking participants. As noted earlier, the questions posed at the beginning of a deliberative process often shift as a result of interactions among stakeholders: New values are brought to the table (or taken off because they no longer seem important); new facts are learned; the problem's dimensions (scope, timing) shift.

A sound deliberative process asks a lot of its participants. Decision makers need to be ready for the subtleties of the answers that it can produce. Decision analysis can strengthen the connection between deliberative results and policy making by preventing policymakers from making too much or too little of citizens' input. For example, because they can use a variety of metrics, decision analysis standards can help to ensure that the preferences expressed by participants are the clearest that citizens have to offer and represent the different perspectives of the individuals providing them rather than the implicit biases of the selected elicitation procedure.

Decision analysis can also help participants respond to dynamic processes. An example comes from deliberations regarding adaptive management plans, which treat interventions as experiments (Walters 1986). Despite strong academic support, adaptive management approaches have seldom been applied successfully because of stakeholders' concerns about poorly defined benefits and costs. As part of the development of plans to restore endangered salmon runs on several rivers near Seattle, decision analysis has allowed resource management agencies to assess whether the planned experiments would (a) discriminate among competing hypotheses regarding ecological responses, (b) have sufficient predictive ability to reduce uncertainty, and (c) have expected benefits that outweigh their costs (including opportunity costs). The analysis ties information more closely to the decision by explicitly considering the probability

[4] If emotions persist, of course, then they also can become part of the deliberation's conclusions, beyond the formal expression captured by cognitively mediated methods.

that, for each adaptive management alternative, the planned experiment would deliver wrong or inconclusive information. These questions, not normally part of deliberative processes, support agency scientists' design of restoration activities and public stakeholders' task of making difficult value and factual judgments.

5. Construct Validity: Looking for Trouble

Construct validity requires measurements to be sensitive to relevant changes in circumstances and insensitive to irrelevant ones (Cronbach and Meehl 1955). Assessing the construct validity of an analytical procedure requires a priori definitions of relevance, given the options being evaluated and the individuals evaluating them. The strength of this test depends on the strength of the theory producing the predictions. For example, it takes little theory to predict that people should prefer more of a positive good to a smaller amount. As a result, many studies have evaluated contingent-valuation procedures by examining respondents' sensitivity to the amount (or *scope*) of environmental (or other nonmarket) goods that they are asked to evaluate (Desvousges et al. 1993, Kahneman and Knetsch 1992). Unfortunately, many other features typically vary across conditions, within and across these studies (Fischhoff and Furby 1988). Without a theory of relevance, opponents and proponents of a method (or a study) can devise ad hoc grounds for accepting or rejecting results.

Sudman et al. (1996) apply a construct validity perspective to evaluate survey research, cast as a task analysis of the stages in answering survey questions: interpreting the question, generating an opinion, determining whether a relevant judgment is stored in memory, formatting a response fitting the available options, and (often) factoring in self-presentation or social norms. Each stage provides interpretative freedom for those determined to support or reject particular results.

Unlike surveys, deliberative procedures need not have a standardized procedure for dealing with each step. Rather, deliberations can adapt to participants' needs, repeating topics that are unclear, triangulating with alternative perspectives, double-checking to establish the limits to resolution, and so on. Such self-critical processes are essential with difficult choices, where people may not know exactly what they want or understand exactly what is being offered. Iteration is also essential to learning and flexibility, when elements of the deliberative process—the definition of the problem, the values of participants, and the knowledge of anticipated consequences—shift over its course. In the Alouette River deliberations noted earlier, for example, the mix of alternatives proposed for the hydroelectric dam shifted considerably after presenting information from multiple sources (academic scientists, Native Americans, local residents), concerning the consequences of different water flows (McDaniels et al. 1999).

Although it can facilitate the process, flexibility can also frustrate its evaluation by blurring the standards—unless analysts are willing to "look for trouble." For example, participants may exhibit a sort of "false fluency," claiming (and perhaps even believing) that they understand a problem better than is actually the case. Unless challenged, they may obscure the confusion in their use of terms (e.g., "sustainable development," "precautionary principle"), verbal quantifiers (e.g., "rare," "likely"), and causal processes. Although such problems can arise in everyday conversations as well as surveys, decision analysts have special opportunities for uncovering and correcting them.

They also have special obligations for doing so. Deliberative processes are *reactive* measurement procedures. They seek to change participants by encouraging them to reflect on their beliefs and values. The resultant changes can reflect respondents' learning—or being pushed around. The process should deepen understanding by providing a balanced, authoritative representation of the issues in an accepting environment. One way to achieve balance is to have proponents of alternative positions review the statements of their views provided to participants. One way to evaluate the procedure's success is to see whether fundamental values are expressed consistently over the course of the process and over alternative question framings. Evaluations of more novel issues should be particularly sensitive to framing effects; however, that should decline as the process progresses and preferences solidify (Fischhoff 1991, Kahneman et al. 1999).

6. Conclusion

The disciplined, interactive procedures of decision analysis, along with its adherence to the construct validity criterion and grounding in behavioral research, provide potential solutions to many of the challenges faced by deliberative procedures. By focusing on the understandability of the decision problem and the evaluation of policy options, decision analysis can help to create better deliberative processes, ones with greater chances of achieving socially preferred outcomes.

Extending decision analysis into public deliberations requires analysts to assume two roles that may make some uncomfortable. The first is to be sensitive to group dynamics, encouraging members to clarify their objectives and helping individuals to probe, and thereby better understand their own views.[5] The second is to establish the contours of agreement (and disagreement) among multiple parties—rather than maximize the utility of individual decision makers. As mentioned, this could be done internally by pooling participants' beliefs and values, then identifying the optimal choice for the aggregate view, or externally, helping individual stakeholders identify their best choice and then aggregating them. Making that choice may, itself, clarify the process.

The success of deliberative processes will both reflect and shape society's commitment to democratic procedures. It depends, in part, on technical execution. An improvisational approach is unfair both to the participants and to those depending on their conclusions. We have proposed the philosophy and methodology of decision analysis, informed by the lessons of case-study applications and behavioral decision research, as a standard for designing and evaluating deliberative processes. We believe that they can extend the envelope of responsible participation, while reducing the risk of sham or incomplete deliberative exercises.

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[5] An alternative solution is to pair a decision analyst with a professional facilitator; in the B.C. Water Use Plan process, for example, this occurred at some sites where a single individual covered both facilitation and analysis responsibilities at other sites.

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