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What They Consider, How They Decide: Best Practices of Technical Experts in Environmental Decision-Making

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WHAT THEY CONSIDER, HOW THEY DECIDE: BEST PRACTICES OF TECHNICAL EXPERTS IN ENVIRONMENTAL DECISION-MAKING

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ABSTRACT

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Drawing from qualitative data gathered from environmental management professionals, this paper describes best practices for decision-making in environmental clean-up. Technical experts are knowledgeable about both cultural and technical rationality and employ both, as appropriate, to achieve more robust decisions. Experts use active, passive, and interactive communicative strategies to reduce uncertainties and manage tensions. Deliberation is used to achieve robust decisions. The analysis suggests that organizations can improve acceptability of decisions by authorizing experts to incorporate cultural rationality early in the decision process.

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RATIONALE

Since 1946, federal agencies have been required to provide opportunities for the public to participate in rulemaking processes pursuant to the Administrative Procedures Act (APA). The APA's mandate for transparency in decision-making is incorporated in environmental laws, including the National Environmental Protection Act of 1969 (NEPA) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). These laws require public involvement in each stage of the environmental decision-making process, from initial scoping activities to identify the project's boundaries, through the weighing of alternatives, to selection of the final decision.

Although extensive research has been conducted to understand and improve the public's roles in environmental cleanup, much less has been done to understand how technical experts – the scientists, engineers, and other environmental management professionals employed by government agencies – incorporate the public's concerns.

The experts' role in decision-making has been little scrutinized because government agencies, part of the third branch of government, are relatively opaque. Unlike federal courts and legislatures, government agencies' daily business is not open to members of the public for reasons including national security, privacy, and safety. Also, most of their internal operations are not a matter of official record. As U.S. Attorney General Clark wrote in 1947, "intra-agency memoranda and reports prepared by agency employees for use within the agency are not official

records since they merely reflect the research and analysis preliminary to official agency action" (Clark, 1947, Section 3). Even matters concerning the official record of agency actions are not open to general inspection. Instead, they "need be divulged only to 'persons properly and directly concerned'; that is, "individuals who have a legitimate and valid reason for seeking access to an agency's records" (Clark, 1947, Section 3).

So while the agencies' employees must provide oversight, document, and make their final decisions available to the public, a level of opacity is added because the discussions leading to the decisions are not recorded or accessible. The opacity is compounded by the agencies' common practice of delegating day-to-day activities, such as characterization, analysis, and design, to contractors, subcontractors, and sub-subcontractors, and by post-9/11 clearance requirements and need-to-know limitations.

Finally, the subject matter in environmental decision-making is highly technical and requires specialized, advanced knowledge to make complex decisions that often comprise geographically and temporally drawn-out processes. Although interactions at public meetings, where alternatives are presented, can be relatively easily captured because they are time- and location-specific, the complete project, from scoping through the final decision, may consume thousands of expert hours and multiple agencies in multiple locations, over the course of weeks, months, or even years.

The study presented here took advantage of the author's unique working relationship with employees at a federal research facility. During more than a decade spent as a consultant on project teams supporting nuclear-related environmental cleanup at U.S. Department of Energy facilities, the researcher worked on several projects in which the Department was required by law to clean up contamination that posed risks to human health and the environment. The project

teams all had the same mandate: solutions must meet legal, technical, and financial constraints, and also be acceptable to the regulatory agencies (e.g., U.S. Environmental Protection Agency), the affected states, and the public. In the course of this researcher's work, she observed the complexities and tensions faced by environmental management professionals. She observed that some of the experts, individually, and some of the teams, collectively, navigated the process with greater success, in that the solutions they put forward were noticeably more likely to be found acceptable by the regulators and the public.

This paper explores best practices of successful environmental management experts and their teams: how their decisions encompass not just the scientific and legal issues but also demonstrate a keen awareness of the broader context that the public uses to weigh the acceptability of proposed environmental solutions. The research is particularly focused on specific ways in which broader societal values ("cultural rationality") are incorporated into the otherwise techno-rational decisions of the agency's technical experts. It also considers the tensions that environmental management professionals face during decision development and examines the communication strategies (such as deliberation) used by the best experts to manage those tensions and achieve successful decisions.

The remainder of this paper presents the relevant literature, describes the methods used for this study, discusses the results, and provides suggestions for how organizations can use these findings. A White Paper describing this research study for a non-academic expert audience is provided as Attachment A. The Interview Guide used to elicit responses is provided as Attachment B. Examples of communication strategies described by participants are provided as Attachment C.

LITERATURE REVIEW

To understand the reasoning that takes place amongst the best experts and compare it fruitfully with previous observations, I begin by identifying experts' role in the environmental decision-making process. Next, I examine the modes of rationality and how small groups reach decisions. The differences between the modes of rationalities and their features result in tensions, especially when science is used to reach socio-political objectives. Science itself, and environmental science especially, is host to inherent tensions, so this literature review ends with a discussion of identities and tensions.

Environmental Experts' Role in the Public Sphere

For federal environmental actions, such as those conducted under NEPA, the opinions of the public sphere are required to be considered throughout the decision process, from the initial "scoping" phases where the project need is identified, defined, and bounded; through creation of alternatives, and finally during the comment period that precedes finalization and signing of the plan.

The public sphere is the deliberative space in which individuals in a society come together as a public and discuss and construct public policy (Habermas, 1991). It is not an actual place that can be identified by geographic coordinates but, rather an abstract term that describes "the communicative context in which problems are discovered, thematised, and dramatized" (Fossum and Schlesinger, 1997, p. 4). The public sphere both advises decision makers and also legitimates decision-makers' authority (Asen and Brouwer, 2001; Fossum and Schlesinger, 1997; Rutherford, 2000).

The public sphere is neither monolithic nor a single entity. Much as an organism contains many parts that work together synergistically to comprise the whole, so the public sphere contains many units of varying sizes and complexity. Two units of interest in understanding where experts fit in the public sphere are strong publics and tiny publics.

Strong publics are formally organized institutions that are invested by the public with the power to make or influence policies and imbued with decision-making power (Fraser, 1996). The strongest publics are elected, such as federal and state legislatures. Other strong publics (albeit less strong than elected groups) include federal, state, and local agencies, such as the federal Department of Energy and state departments of environmental quality. Further along the continuum, but still located on the strong end of the axis, are designated project teams within agencies, such as the expert teams considered in this study.

Tiny publics are those in which the members know each other personally, as opposed to being an anonymous mass (Fine and Harrington, 2004). The opinions formed by a tiny public are reflected outward and augment the opinions of other tiny publics, both strong and weak, in an additive effect. The strongest tiny publics are found within elected groups (e.g., the Democratic caucus in Congress), but tiny publics, such as designated project teams within agencies, also have strength.

The experts and their project teams, designated by the agencies for the purpose of cleaning up the environment in accordance with the preferences of the public sphere, comprise strong, tiny publics: strong because of their designation by the agency; tiny because of the close personal relationships developed over the hundreds of work hours spent on these often multi-year cleanup projects. The teams must operate within the bounds of environmental laws and

reach decisions that not only meet the policies of the agencies and organizations within which they operate but also will be deemed acceptable by the public.

Modes of Rationality

The "two cultures" gap first named by C.P. Snow in his 1959 Rede Lecture (Snow, 1990/1964) has become a touchstone phrase for the distinct differences in the discourses of scientists and non-scientists. Various disciplines have termed the two cultures described by Snow as frames, world views, or competing rationalities (Goffman, 1986). The processes and political implications of these different discourses, which arise from the increasing knowledge and specialization of the sciences, humanities, and other fields since the Enlightenment, have been extensively studied to understand how they differ and the role of these discourses in public policy. Over many years, understanding has evolved to accept that there are not just two cultures or modes of reasoning, but multiple modes and ways of reasoning, and that there is no inherent rank order such that one is more correct than another.

Use of the term *rationality* is not meant in this research paper to describe a binary distinction between right and wrong thinking but rather a mode of reasoning that is "logical and coherent on its own terms," which includes how problems are bounded and defined; what evidence is considered; and who has the standing to be an expert and, thus, provide additional weight and bearing on the decision (Krimsky and Plough, 1988, p. 305). Academic disciplines and occupational groups tend to prefer one mode of reasoning over another. The preferences are the result of social norms established by each group (Berkowitz, 1997; McKerrow, 2006). This study examines the two rationalities most often delineated as contrasting modes in public policy literature: technical rationality, the mode most used by experts, and cultural rationality, the mode most used by the public.

Differences between Technical and Cultural Rationality

In technical rationality, decisions are based on measurable and replicable facts, marshaled and adjudicated by experts accredited in science, engineering, and managerial fields. It is "a risk orientation that is guided by values of science such as quantification, objectification, and comparison across cases" (Duffield Hamilton, 2003, p. 293). In contrast, cultural rationality "values experiential input, analogy, historical precedent, and democratic processes for decision making" (p. 293). The two rationalities are not a dichotomy, however, as one – cultural rationality – subsumes the other:

> Cultural [rationality] does not deny the role of technical [rationality]; it simply extends it. The former branches out, while the latter branches in. Cultural [rationality] does not separate the context from the content ... but incorporates it within a broader decision framework. (Krimsky and Plough, 1988, pp. 305-306)

Cultural rationality, therefore, includes not only technical rationality but also values, ethics, morals, and qualitative judgments. In contrast, technical rationality seeks to make decisions without considering the cultural context.

For purposes of this study, I have operationalized technical rationality as a discourse characterized by emphasis on norms of science, such as quantification, objectification, and replication; and cultural rationality as a discourse that balances science norms with interpretive and qualitative judgments based on historical and societal norms, beliefs, and values.

Use of Rationalities

The two rationalities are often used as ideological lenses "to legitimate some issues over others, some speakers over others, and some values over others" (Berkowitz, 1997, p. 483). We

would expect, then, that scientists and other experts would give greater credence to numerically derived (quantitative) risks over perceived (qualitative) risks and favor, or privilege, the opinions of professionals over those of the public. Scientists are not the only ones who use technical rationality to reach decisions (Fossum and Schlesinger, 1997). Bureaucrats employed by agencies also favor technical rationality as an approach to decision-making because its emphasis on numerical data and scientific facts offers solutions that are seen to be more defensible because they are grounded in the supposed value neutrality of science (Urban, 1982).

The connection of technical rationality to power in public policy leads to two related problems. First, the use of technical rationality contributes to the widely held popular perception that scientists and other such technical experts are out of touch with public opinion and, consequently, political realities. Second, the privileging of technical rationality in bureaucratic decision-making devalues cultural rationality as ignorant, illogical, or "lay" opinion.

Duffield Hamilton (2003) identified ways in which the public and technical experts have begun to embrace the other's mode of rationality, but her findings were based, similar to others who have examined this subject, on meeting transcripts from a specific environmental restoration project, supplemented by official information provided by the Department of Energy as well as newspaper accounts and information from citizens groups. While this is sufficient for understanding the discourse in the public sphere, a more complete understanding can only be obtained by investigating how agency and contractor employees arrive at the proposed solutions they present to the public – whether they use both forms of rationality – in internal meetings that are inaccessible to the public and most researchers. Thus, to study the discourses used by experts, the researcher drew on participants' retrospective accounts of internal meetings supplemented

with the researcher's own recollections of internal meetings in which she participated, as well notes and emails from those meetings in the researcher's personal files.

How Small Groups Reach Decisions

Deliberation

In the public sphere, citizen juries and similar small participatory groups tasked with finding solutions to public policy problems use democratic political deliberation (Burkhalter, Gastil, and Kelshaw, 2002; Delli Carpini, Cook, and Jacobs, 2004; Moy and Gastil, 2006). Deliberation is democratic in that the members of the group have equal footing, and political in that the problems on which it focuses affect many people and require government action to address.

Deliberation typically takes place face-to-face over a relatively short duration of hours or weeks. Although the process can be mediated by technology, face-to-face communications allow the members to more easily reproduce social structures and norms (Giddens, 1984). And although it can take place individually or in dyads, deliberation is best conducted in manageable groups of three or more but small enough to remain a tiny public. The goal of deliberation is to produce reasonable, well-informed, justifiable opinions that can be found acceptable by the public sphere.

A functional theory of how deliberative groups reach outcomes states that the group begins by analyzing the problem or issue, identifying a range of possible solutions, and establishing evaluation criteria (Gouran and Hirokawa, 1983). The process is logical, informed, reflective, and moral (Burkhalter, Gastil, and Kelshaw, 2002). Personal experience is considered a valid part of the knowledge necessary for problem analysis. A broad range of solutions, including those that are seemingly contradictory, are considered. Evaluation criteria include the

values and beliefs of members and consideration of the values and beliefs of non-members. The group balances trade-offs to reach a single best decision based on the data available and identified constraints, and lives with the tensions inherent in not achieving a final "one right answer," but rather a decision specific to that deliberative process (e.g., a trial jury's finding is specific to the facts of that case but not necessarily to other, similar cases). Deliberation embraces conflict, rather than avoids it (Moy and Gastil, 2006).

Operationally, deliberation in an ideal form is egalitarian, providing each participant an equal opportunity to speak and be heard. It is dialogic, "embracing and privileging different forms of understanding" (Putnam, 2001, p. 43), and continually informing and being informed by participants (Anderson, Baxter, and Cissna, 2004). It is dialectic; participants continually deal with conflicting contradictory forces. Participants in deliberative processes carefully weigh the options and potential solutions (Mathews, 1994). Participants are respectful and avoid imposing their own views and beliefs on other participants (Moy and Gastil, 2006). In deliberation, participants examine and set aside their own assumptions and biases, carefully listen to others, and value a plurality of views and voices (Benhabib, 2002; Burkhalter, Gastil, and Kelshaw, 2002; Moy and Gastil, 2006).

Discourse and Dialogue in Deliberation

The discourse of a small participatory group is directed toward a specific audience, and each speech community has its own set of rules and practices, such as how arguments are constructed and who has authority to speak (Goodnight, 1982; McKerrow, 2006). A speech community is defined by its members' knowledge and use of a specialized vocabulary. Outsiders who are unfamiliar with the community's discourse may be excluded and disempowered. The environmental management professionals who comprise the speech community investigated in

this study are educated in the science, technology, engineering, and mathematics (STEM) disciplines; steeped in the scope, schedule, and funding constraints of professional project management, and well versed in the specialized vocabulary of environmental regulations and laws. Their authority to speak results from their appointment to a designated project team. The norms and rules created by the speech community also make it more likely the group will be effective (Hirokawa and Salazar, 1997).

Although the common discourse of a deliberative group can be highly specialized for internal communications, it must be capable of transformation to a commonly understood discourse outside the speech community (Burkhalter, Gastil, and Kelshaw, 2002; Ellinor and Gerard, 1998). Participants must be willing to admit their own biases, to examine their own and others' assumptions, and be "willing to revise preferences in light of discussion, new information, and claims made by fellow participants" (Chambers, 2003, p. 309). The process is iterative.

Although arguments may initially be advanced for discovery, learning, and understanding, ultimately their purpose is persuasion (Daniels and Walker, 2001; Gross, 1996). Persuasion is achieved through dialogue, which, by definition is interactive. "Any utterance or act is always responding to and anticipating other utterances and acts" (Wood, 2004, p. xvi). The dialogue necessary for an expert team to reach a decision is not only interactive but also multi-vocal. Dialogic discourse is heteroglossic, allowing project teams to consider multiple points of view simultaneously without eliminating or privileging a single one over others (Anderson, Baxter, and Cissna, 2004; Duschl and Osborne, 2002). Dialogic discourse also allows for the social and contextual construction of the science and technology necessary for environmental

cleanup (Driver, Newton, and Osborne, 2000). Interactive multi-vocality provides room for both technical and cultural rationality to be employed in the dialogue.

Problems with Deliberation

Two problems have been identified with the use of deliberation in the public sphere (Hicks, 2002; Ryfe, 2005). First, it is difficult to reach closure; without deadlines or due dates, the iterative process can proceed infinitely. Second, the process must be inclusive; an ideal deliberative dialogue must include everyone at the table and everyone must have an equal voice and weight in the discussions (Gastil, 2008).

For the strong, tiny publics of environmental experts, the first problem – inability to reach closure – is moot because legal deadlines carrying substantial financial, political, and employment-related penalties force the teams to reach closure so that the agencies can render decisions. However, the second problem – lack of inclusiveness – arises when any decision is made solely within the technical sphere. By definition, participation in the technical sphere is exclusive because only those experts assigned to the project are included.

Whether and to what extent experts use elements of deliberation to reach environmental management decisions have not been examined by communication studies scholars, likely due to the access constraints described in the Rationale. Based on the author's experience with these teams, however, some or all of these elements may be present in project teams that accept and use cultural rationality in the decision-making process.

Identities, Tensions, and Tension Management

Identities

The people who work as experts have multiple roles in the public sphere: as citizens, they serve as advisers; as voters, they legitimate the public policy decisions directed by the public sphere and enacted by the administration; as experts, they carry out the public sphere's directives and assist administrators to meet policy objectives. These are just three of their many identities (Tracy and Tretheway, 2005). Outwardly, one self may dominate at any given time (i.e., the scientist at work or the parent at home), but inwardly, the self is multi-dimensional, with the strands of each dynamic facet reaching in and across ourselves to form and inform the other strands.

The self of the scientist or engineer, the two primary disciplines from which environmental management professionals emerge, is argued to be particularly pervasive (Leshner, 2003; Franke, 2003). We would thus expect decisions by experts to reflect their core identity as scientists or engineers. If, however, the strand of citizen is equally a core part of their identity, we could expect to find that experts employ both technical and cultural rationality in their internal decision-making processes. We could also expect that although one strand may appear to be dominant at any given time, the other strand(s) would also shape the self, especially that self's values. These multiple, often competing facets would create tensions for the individual, which must be managed.

Tensions

Tensions, the pull of two or more values and priorities contrary to each other, are an inherent part of individuals, groups, and organizations (Barge, 1994; Galanes, 2009; Mintzberg,

1973). Pepper and Larson (2006) show how individuals "[align] themselves with one set of values and priorities over another" (p. 52). Project teams and other small groups continually face paradoxes and contradictions (Barge, 1994). Tretheway and Ashcraft (2004a, 2004b) describe organizations as irrational, and full of paradoxes and dilemmas. Analyzing experts' accounts of the tensions they face may allow us to identify the strategies they use to reach decisions for technologically complex problems.

Technical Rationality vs. Cultural Rationality

One source of tensions emerges from the perception of technical rationality and cultural rationality as a binary. Cultural rationality, as I have operationalized it, calls for a balancing "of science norms with interpretive and qualitative judgments based on historical and societal norms, beliefs, and values." Mass opinion of the public sphere is especially important to elected officials, whose position is legitimated by the public sphere, and to appointed officials, who carry out public policies that derive from opinions formed in the public sphere. Under current practice, environmental teams may choose not to use cultural rationality or may regard it as tangential to their decision process, but they nevertheless remain aware of its importance. Balancing technical rationality and cultural rationality goes beyond merely considering public values to incorporating those values in decisions.

Socio-Political Context

A second source of tensions arises from the socio-political context of environmental cleanup. Environmental management decisions are not made on the basis of scientific and technical input alone but in a much broader context that includes the policy preferences of the current administration, state and local governments, and Congressional appropriations, as well as opinions formed in the public sphere that have not yet resulted in specific policies (Harding,

1998). This is neither accidental nor undesirable. Environmental laws and politics require many aspects to be considered, not simply techno-economic factors, but also social, cultural, religious, aesthetic, historical, and justice factors. NEPA Title I, Sec. 101, for example, acknowledges "the profound impact of man's [sic] activity on the interrelations of all components of the natural environment, particularly the profound influences of … new and expanding technological advances," and recognizes "the critical importance of restoring and maintaining environmental quality." Recognizing that technical rationality was not enough to assure the "social, economic, and other requirements of present and future generations of Americans," the authors specifically required "that presently unquantified environmental amenities and values … be given appropriate consideration in decision-making along with economic and technical considerations" (NEPA, Title I, Sec. 102).

CERCLA is even more specific: any proposed solution must "appropriately balance the trade-offs" with respect to a total of nine evaluation criteria (U.S. Environmental Protection Agency, 1999). The first two criteria are *threshold criteria*, that is, requirements that each alternative must meet in order to be eligible for selection. Once the alternative passes the go/no-go hurdle of the threshold criteria, it is then subjected to the five *primary balancing criteria*, which are used to weigh major trade-offs among, for example, permanence, risks to workers, technical feasibility, and costs. The final two criteria, the *modifying criteria*, are fully considered after the state and/or support agency and the public have an opportunity to comment on the alternatives. After those comments are received, the experts must give equal importance to all seven *balancing* and *modifying* criteria in the final selection. That is, public values are given equal weight as cost and technical feasibility, and the public's preference for reduction of toxicity (as enacted in CERCLA) carries equal weight to risks posed by cleanup to residents and

the environment. Thus, even when internal decision-making processes are based primarily on technical rationality, at some point in the process, societal values must be specifically considered.

Uncertainty of Science

A third source of tensions arises from the uncertainty of science. Science is never done or complete; rather it is constantly in flux, in a state of becoming. For science to be successful and credible, scientists must be willing to "abandon or modify previously accepted conclusions when confronted with more complete or reliable … evidence" (American Physical Society, 1999).

Environmental contamination, especially in the Energy Department complex, is the legacy of complex chemical and biological interactions, often involving mixtures of radioactive, flammable, explosive, and corrosive materials whose behavior may not be well understood (U.S. Department of Energy, 2010). This makes for many unknowns. The lack of complete and comprehensive knowledge about complex environmental problems requires decisions to be made using bounded rationality, that is, using information that is always imperfect or incomplete, and subject to revision (Simon, 1993/1947). The best teams are well aware that their decisions may not be fully comprehensive but rather – like all such science – contingent. In fact, it is not uncommon for an agency to put forward a contingent decision or carry along a contingent alternative, which allows the selected alternative to be modified based on new information or advances in technology (U.S. Government Printing Office, 2006).

Tension Management

All these types of tensions — multiple personal and organizational identities, incorporation of cultural rationality in a largely techno-rational arena, the socio-political context within which their technical data are embedded, and scientific uncertainty and unknowns —

affect environmental decision-making teams and the individuals on the teams. The individuals and teams must acknowledge and manage potential tensions, and do so using communication strategies (Kramer, 2004).

Research Questions

The experts in this study form a strong, tiny public who may incorporate cultural rationality in environmental cleanup decisions. They likely reach technically complex solutions using elements of a dialogic deliberative process that incorporates their skills in scientific (technical) argument and allows them to manage their multiple roles as both experts and members of the public sphere. Thus, the two research questions for this study are as follows:

> Research Question 1: To what extent do experts use cultural rationality in environmental decision-making?
>
> Research Question 2: How do experts who use cultural rationality manage the tensions that arise from its use?

METHODS

The data used to explore the two research questions were collected through qualitative, semi-structured interviews involving retrospective accounts. The interviews were conducted using asynchronous computer-mediated communication and coded using a modified grounded theory approach. Specific details of each step are described below.

Retrospective Accounts

This research drew on retrospective accounts as well as notes and reflections from more than a decade of experience as a team member on cleanup projects, working with the participants who were initially recruited for this study. This triangulation provided additional data points to validate the strategies described by participants.

Qualitative accounts —interviews — are used to provide first-hand accounts of participants' understanding of their lives as revealed through the participants' own choice of language (Kvale, 2007). Communication researchers use interviews to learn how people construct their identities. During the course of an interview, participants can reflect on and construct an understanding of their identities (Harré and Secord, 1973). The resulting narratives thus offer both direct and indirect clues to how people manage multiple identifications (Larkey and Morrill, 1995). Although the researcher is unable to witness the strategies used day-to-day as would be done in an ethnographic study, interviews allow participants to make retrospective sense of the strategies they use to manage the uncertainties and ambiguities inherent in environmental decision-making (Weick, 1995; Weick, Sutcliffe, and Obstfeld, 2005).

Retrospective accounts are used by researchers to elicit the meanings assigned by people to their experiences and the rules or premises they use in sensemaking (Tompkins and Cheney, 1983). Retrospective accounts do this by revealing not only the underlying premises used by the