

Working with Policy Makers on Their Choices: A Decision Analyst Reminisces

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As a decision consultant and researcher, I discuss 40 years of working with policy makers on energy, environmental and foreign policy, defense, and other national issues, making heavy use of applied decision theory. I focus attention on decisions with significant human interest—where clients have sought not only to improve their own decisions, but also to justify them and to influence the decisions of others. I reflect on political, administrative, legal, and personal considerations involved.

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1. Introduction

I have spent nearly half a century on the methodology and practice of decision making, mostly on live government issues (see Brown 1987).¹ I want to discuss some of the hundred or so consulting projects² I have been involved in, and insights I have gained (some of them quite unexpected). My work draws heavily on tools of applied decision theory (ADT),³ which I was first exposed to in the 1960s, teaching Harvard MBAs under Howard Raiffa and Robert Schlaifer.

2. Decision Aiding Proper

At that time, I, like others, saw ADT solely as stand-alone aid to help deciders make a sound choice. I have

since become persuaded that it must be integrated with intuition and other decision aiding tools, and that it has other commendable uses.

2.1. Making the Decision

◆⁴Permit a reactor to operate? One case of “standard” ADT use for decision aiding was to help a nuclear regulator⁵ decide what to do about a reactor he judged to be unsafe. The company responsible had spent \$4 million on a “probabilistic risk assessment” (PRA), which claimed that this reactor was one of the safest in the United States. However, my client and his safety inspectors had seen a good deal of evidence to the contrary, including several recent accident near-misses. He wanted us to help him make sense of those conflicting messages and come to a sound and defensible decision. He had already concluded that *something* had to be done, but not which of several alternatives (including shutting down the reactor) he should require.

We did a small multiattribute utility analysis (MUA)⁶ based on *all* available evidence, including the

¹ For a comparable discussion of earlier business applications, see Ulvila and Brown (1982a).

² Working for Washington-based consulting and research companies Decisions and Designs and Decision Science Consortium.

³ Applied decision theory—known to insiders as “decision analysis”—involves, in any given situation, quantifying the decider’s factual and value judgments, and calculating what action they logically imply. A simplistic example is as follows: You are deciding whether to have surgery. You give it 5:1 odds of success, an outcome that you value at 100 (bearing cost in mind). However, if it fails your value is zero. Accordingly, you value surgery at the average—80 (80% of 100 plus 20% of 0). No surgery leaves you with the health you have now, which you value at 70. Seventy is less than 80, so you prefer surgery. This footnote is for nonspecialists.

⁴ The symbol ◆ signifies case material.

⁵ Tom Murley, formerly Head of Nuclear Reactor Regulation at the Nuclear Regulatory Commission.

⁶ MUA is a variant of ADT, which splits out option consequences into separate criteria and weights them according to importance. See Keeney and Raiffa (1976). This footnote is for nonspecialists.

PRA (see Brown and Ulvila 1988). It indicated that the reactor was indeed seriously unsafe. The PRA had only counted well-documented sources of risk (such as pipe breaks), but ignored others (such as fires, earthquakes, and the pervasive effects of poor safety culture). After rerunning the MUA with plausible alternative inputs, our regulator was satisfied that the reactor was unacceptably dangerous. He required the company to install costly safety measures.

Even when ADT is used to help the decider make a sound choice, it is often performed *after* he has essentially made up his mind on intuitive or informal grounds, as was the case here. ADT then serves as a *check* on the soundness of what the decider proposes to do.

2.2. Combating Judgment-Free Analysis

The disconnect between this regulator's ultimate negative evaluation of the reactor's safety and the company's earlier upbeat PRA was due, I believe, to the pernicious imperative in risk analysis and decision science circles of insisting that analysis be free of personal judgment. PRA, for example, only considers firmly documented "hard" data in a risk assessment, thereby disregarding any critical "soft" information, which a responsible decider (like this regulator) normally takes into account. Unavoidable subjective judgment can be camouflaged in PRA by unobtrusively slipping in arbitrary assumptions, such as there being no sources of risk other than those authoritatively documented. In this case, important sources of risk were treated as nonexistent, and so seriously understated total risk.

With the presumed object of saving taxpayer money, regulated industries are usually required to commission and pay for their own risk analysis; that is, the fox is entrusted with guarding the chickens. Fortunately (for the fox) they are allowed—indeed, required—to assess risk with PRA (which should perhaps stand for "partial reliability assessment"). A major benefit of ADT, more generally, is that it combats such self-serving use of "judgment-free" analysis, including conventional "cost-benefit analysis" (see the Arctic case in §6.4).

2.3. Private vs. Public Interest

A reactor will sometimes meet regulations on health and safety—unlike the reactor case above and yet still

be ruled unacceptable. The notorious 1979 Three Mile Island accident does not appear to have harmed anyone's health, but it embarrassed the regulatory agency badly, and one of our client's predecessors lost his job. This consideration pressures the regulator to take account of the "hullabaloo factor" privately (because he cannot acknowledge it publicly).

I do not doubt that most "public servants" do indeed give priority to serving the public. However, it is often on just those occasions where their private interests intrude that the role of ADT becomes particularly relevant. Accordingly, I will be paying particular attention to those cases.

Unlike businessmen, who must focus on making money, the government bureaucrat has the luxury of taking greater care of his private interests. However, he will not normally want any conflict of interest to show up in a public ADT analysis (see the first bulleted case in §5.2).

◆**Institute a \$100 million anticrime program?** The Senate Judiciary Committee was deciding whether to authorize a community anticrime bill that would fund local initiatives (like Neighborhood Watch) and cost \$100 million per year. An MUA model, using taxpayer cost and impact on crime as the main criteria, strongly favored the bill for a wide range of plausible model inputs. However, we learned that the politically influential Association of Chiefs of Police opposed the program (which would bypass the regular criminal justice system), and that the committee chairman, Joe Biden, was sensitive to their political goodwill. Therefore, we prudently added "electoral security" to the criteria, and left the model with the chairman to privately assign his importance weights. The bill failed to pass.

3. Individual vs. Institutional Decider?

3.1. Who Is the Client?

It was not always clear what client I was working for. Should I be responsive to the interests of whoever engaged me, or of society, or of some intermediate institution (such as a government department)?⁷ Even

⁷ My colleague, Jon Baron, had a poignant teaching experience. An adolescent student was deciding whether or not to become a drug

when I was acting as personal advisor to an individual, at his initiative, there were usually a number of other people, with their distinctive interests, participating in the decision.⁸

I have usually opted to serve “society” rather than the “client,” but as the above anticrime case (see §2.3) shows, it was not always possible to ignore conflicts of interest (if for no other reason than the fact that whoever hired us could fire us!; see §6.4).

3.2. Society’s Values

If ADT (or any analysis, for that matter) is to indicate a specific choice, value judgments come into play. In government, they can be the source of much frustration and dysfunction. (By contrast, in business, the dominant goal of making money is relatively straightforward to deal with.)

◆**Divert the Connecticut River?** The Secretary for the Environment of Massachusetts⁹ had to recommend whether or not the Connecticut River should be diverted to ease water shortages in eastern Massachusetts. The choice turned on the relative importance of the interests of three parties: eastern Massachusetts, who would get the water; western Massachusetts, whose land would suffer environmentally; and the State of Connecticut, through which the river flowed. We braced for major controversy about what the importance weights should be.

However, our analysis indicated that, unless eastern Massachusetts was given at least 80% of the weight, no diversion was justified. No one involved in the decision argued for such imbalance, so we could avoid the delicate task of assigning specific importance weights. The diversion was abandoned without controversy (the avoidance of which proved to be ADT’s primary role here).

Other cases involving social value judgments were less tractable.

dealer (no kidding!). ADT based on his declared objectives (short-term material gain, indifference to others’ welfare, etc.) suggested the answer might be yes—for him, as he existed then. What should a socially responsible decision aid teacher do?

⁸ For example, in the reactor and waste siting cases in §§2.1 and 6.4, respectively.

⁹ John Bewick, who studied decision theory at Harvard Business School with me.

◆**When to mobilize for war.** In the course of a military planning exercise, we had to predict how long it would take for the North Atlantic Treaty Organization (NATO) to respond to ambiguous intelligence about an impending Soviet attack (see Brown et al. 1977). We estimated first how NATO *ought* to respond to unfolding intelligence, and then what delay there would be, resulting from NATO political interactions. Our prescriptive modeling on the first question required institutional value judgments about the relative harm of

A. False alarm—mobilizing for war when the threat of an attack is unfounded, and

B. Being caught unprepared—failing to mobilize in time, when an attack does occur.

As surrogates for NATO command, two retired generals both produced importance ratios of 20:1, *but in opposite directions*. This would affect mobilization delay greatly. The more serious a false alarm was considered (relative to being caught unprepared), the longer NATO would wait before mobilizing. We used makeshift importance weights, and our confidence in predicting mobilization suffered.

3.3. Avoiding Value Judgments

In view of the difficulties of—and decider resistance to—ascribing value judgments to populations and organizations, I have often addressed just the factual parts of the decision reasoning, and let existing institutional processes handle the rest. Deciders are often glad to be let off the hook of having to admit (or misstate) their value judgments (or of even specifying what options they are considering).

◆**Market research.** Ford Motor Company spends a great deal on forecasting sales of a new product, but little on integrating that knowledge into deciding on launching the product. That would call for value judgments and information about Ford decision processes, which they would presumably not want competitors to know about.

◆**By what means to transport oil.** Nevertheless, clients often do want us to tell them what to do. The Alaska office of the Corps of Engineers (COE) was deciding whether or not to permit British Petroleum (BP) to build a causeway to transport oil from an Arctic island. This involved the COE making politically delicate trade-offs (for example, between impacts

on the environment, national energy independence, and company profitability), which I thought they would be happy for us not to get into. On the contrary, they insisted we do a complete analysis leading to a specific recommendation (see Brown 2005a, Appendix 9A.2). They may have valued having a precedent, which they could base subsequent permitting decisions on and be shielded from controversy.

4. Justifying Action to Others

A persistent motivation with government officials is “cover your back.” ADT can not only make the decider more confident in his own decisions, but also inspire confidence in a third party, which may be more important to him (see the waste sitting case in §4.2). In the reactor case (see §2.3), MUA gave the regulator ammunition to defend his action if the reactor company protested the expense of a safety measure. On the other hand, an honest ADT, which demonstrates conflict of interest (which was not the case here), may get deciders effectively challenged (see the anticrime case in §2.3).

4.1. Role of ADT in Controversial Issues

ADT can help the decider to present a defensible rationale for his choice, say, to the public or a court of law in controversial cases.¹⁰

◆**Should NATO embargo computer exports?** An Administration advisory committee¹¹ had to recommend whether or not NATO should embargo sales of high-power computers to the Soviet Bloc (as it then was). We modeled the committee’s thinking in the form of a small MUA model that traded off military threat against U.S. commercial and other interests. Based on a consensus of committee inputs, the analysis favored an embargo on only the most powerful computers, which is the policy that the United States officially adopted (not necessarily due to us).¹²

¹⁰ A law professor told me that an action would not be considered legally “arbitrary and capricious” if it could be shown to result from some systematic process, like applied decision theory—even if it is “Garbage In, Garbage Out.” However, no less an authority than Supreme Court Justice Stephen Breyer informs me that this is not true.

¹¹ President’s Council on International Economic Policy.

¹² The President’s national security advisor, then Henry Kissinger, insisted the findings be reported to him without reference to any quantitative analysis, only the corresponding qualitative argument.

However, the committee chairman made a point of advising us to keep our classified report away from U.S. senators. Some of them were known to favor the computer industry, and might try to manipulate the model in its favor.

◆**Should Russia develop Siberian gas?** Toward the end of the Gorbachev era, the Soviets were about to develop vast gas reserves in western Siberia. However, a new Ministry of the Environment required demonstration that any action responsibly balanced environmental against economic considerations. As a supposedly disinterested outsider, I was asked by the official in charge of the project¹³ to conduct a formal analysis of the issue, hoping, I suspect, that it would support the development. However, after lining up Russian experts to quantify their judgment on various elements of a decision model, I had to go back to the United States for a few months. When I returned, the official informed me that formal justification was no longer required. Yeltsin had come to power and decided that the gas would be developed, regardless of environmental impact. (The gas field was developed and became a major engine of Russia’s economic resurgence.)

Thus, the opportunity for ADT to be used to justify a major environmental intervention fell through, and I have not heard of comparable Russian efforts since then.

◆**Where to put nuclear waste?** The Department of Energy (DOE) had made a decision about siting a nuclear repository that appeared to conflict with a large published ADT analysis (Department of Energy 1987). I did a quick alternative analysis, based on plausible inputs, for the lead DOE decider,¹⁴ which confirmed that the action they took was consistent with a perfectly defensible analysis. (However, the decider told me it was too late to use this exercise for political cover.)

4.2. Rewriting Past Analyses

Similarly, heading off criticism can sometimes take the form of revising an analysis after the fact.

◆**What terms to offer in a foreign treaty?** National Security Council staff were evaluating possible negotiating positions for a U.S. diplomatic mission to

¹³ Ivan Mazur, Deputy Minister of Oil and Gas Construction.

¹⁴ Ben Rusche, Head of the Office of Civilian Radioactive Waste Management (OCRWM).

Saudi Arabia. The issue was what accommodation to Arab interests the United States should offer in return for a secure source of oil. One input to our ADT analysis was the probability of an Arab-Israeli war within the next four years.¹⁵ A consensus of CIA and other experts put it at 5%. In fact, three weeks before the mission was due to leave for Saudi Arabia, the Yom Kippur War broke out. Negotiations with Saudi Arabia were cancelled, so our analysis became irrelevant. Our classified report (see §7.7.8 in Keeney and Raiffa 1976, Brown et al. 1975) was hurriedly recalled and reissued, but the 5% probability of war was replaced by a less embarrassing 50%.¹⁶

4.3. “Coming Clean”

Sometimes deciders have no choice but to disclose in an analysis their private agendas, to safeguard their own interests. They may be obliged to subscribe to an “honest” analysis that acknowledges private motivations if a selfless model would otherwise pressure them to support action that they do not want.

◆**Outsource government computing?** The General Services Administration was determining whether government computer services should, as a rule, be contracted out. Government computer managers were part of the decision process, so we made an MUA model to capture their thinking. Initially, we included only straightforward criteria, such as cost to the taxpayer and service to the public. However, it became clear that, if computer services were contracted out, these managers would have their operations cut back. So we added empire building to our criteria, diplomatically calling it “administrative morale.” (Creative labeling is often the key to successful decision aiding!) Some managers were prepared to participate in the analysis and to assign importance weights to the criteria. Surprisingly, they were prepared to put as much weight on “administrative morale” as on combating crime. Presumably, they preferred suffering embarrassment by admitting to self-serving priorities rather than losing their empires. Their candor was rewarded and the outsourcing proposal was rejected.

¹⁵ We had difficulty directly eliciting a utility function for the price of oil from a busy policy expert. However, when we presented him with plausible alternatives and their different action implications, he had no trouble choosing among them (see §2.3).

¹⁶ In addition, a politically sensitive criterion, “impact on pro-Israeli sentiment,” was camouflaged as “cultural relations.”

5. Non- “Decision Aiding” Roles for ADT

The main value of ADT in government may not be to help individuals make up their own minds, but to perform some other useful institutional function.

5.1. Vehicle for Communication

ADT can streamline communication within a complex (and sometimes perverse) bureaucratic decision process.

◆**Congressional committee deliberations.** The chief counsel for a congressional committee supported ADT as a tool to help manage their crushing workload (see the anticrime case in §2.3). Like other congressional committees, the staff had such a crowded agenda that they often could not spend more than an hour or two analyzing the pros and cons of any single issue. Once they were comfortable using an ADT model (with help from analytic specialists), it could speed up their deliberations, incorporate input economically from various sources, and assure that their usual hurried deliberations were at least minimally sound.

5.2. Requiring Others to Justify Their Decisions

A client may want to prescribe how *others* make or justify their decisions.

Having to make a decision rationale public puts pressure on a decider to make the decision conform to the public interest, rather than his own (see §2.3). This tends to discourage deciders from making their decision process transparent.

◆**Should the Executive Branch have to validate decisions?** A congressional agency was evaluating a bill that would require the Administration to justify any action involving over \$100 million, using some kind of systematic analysis (not necessarily ADT). I asked a former Cabinet member¹⁷ if he was in favor of justifying his decisions in this way. “I will oppose it to my dying day!” he said. “Congress gets to meddle enough already” (see §4.1 on the embargo case and §5.4 on the torpedo case).

◆**A congressman’s perspective.** I talked to one congressman about how one might implement such a bill, and in particular, where value judgments (such as the

¹⁷ William Ruckelshaus, Secretary of the Environment.

value of a life) might come from. I suggested legislators, as the elected representatives of the public. He was sure that they would refuse the responsibility, because whatever they proposed would raise a political outcry. In any case, he said that “using ADT in government would not attract the support of voters, because they don’t vote based on a logical process. Rather, they vote on the anticipated results and on the personal qualities of the candidate.” This conversation persuaded me to try teaching decision skills to adolescents, so they might turn into wiser voters (see Baron and Brown 1991).

5.3. Social Cost of Transparent Decisions

Requiring a government decider to specify exactly how he makes a decision can have a social downside. In particular, official regulations may contain ill-considered requirements that, if implemented with the rigor of ADT, would lead to inappropriate action.

◆**Long- vs. short-term harm.** The Nuclear Waste Policy Act requires that avoiding long-term radiation effects—as much as 10,000 years in the future—should take precedence over short-term effects in siting a nuclear waste repository. (This was possibly due to the political appeal of protecting future generations from the selfishness of today’s generation.) If acted upon literally, this would favor transporting hazardous waste through densely populated areas to get to a site that would better isolate waste for 10,000 years. The electorate would surely not have approved of the plausible-sounding regulation had they appreciated its implications.

5.4. Contingent Decision Rules

Another form of defensive decision aid is a decision rule that indicates in advance what action to take if some event occurs.

◆**When to fire a torpedo?** Navy authorities were concerned that, in fleet exercises, submarine commanders waited too long to fire torpedoes and ran too high a risk of being sunk in wartime (Brown 1982). They wanted an on-board decision tool to help commanders act more “rationally.” However, when we evaluated their past practice in fleet exercises, we found the commanders were acting perfectly rationally, in terms of their own private interests.

Their performance was evaluated (for career advancement purposes) according to how accurately they pinpointed where enemy submarines were; they were not penalized by the risk of getting killed in a real war. They didn’t need decision aiding; they needed a different reward system (which the Navy was not interested in having us explore).

5.5. Premature Commitment

We generally decline to develop such decision rules on the grounds that all the considerations can rarely be adequately anticipated far in advance.

◆**Cases of inappropriate rule studies.** For this reason, we turned down an invitation to work on a computerized decision rule for the “Star Wars” program that would automatically launch a nuclear strike in the event of certain evidence of a Soviet attack. Similarly, we declined to design a decision rule for approving a nuclear waste site according to the pre-specified results of site research, only due in 10 years.

6. Inappropriate Use of Decision Aid

Decision aiding is often perverted from its proper purpose. The client sponsoring the aid may be concerned not so much with helping a decider make his mind up responsibly, as with inducing the decider to act in the *client’s* interest. He doesn’t want real decision aiding; he wants advocacy.

6.1. Covert Persuasion

Usually, the advocacy is covert or at least undeclared.

◆**Build solar satellites?** A Department of Energy office had us evaluate legislation to fund a national Satellite Power System (SPS), which would orbit massive satellites that would beam the Sun’s rays by laser down to earth. We found that, although the SPS did indeed promise to solve our energy problems eventually, it was not worth the \$1 trillion it would cost over 20 years to build before any benefits were realized. The client, who had invested his career in SPS, cancelled our study before it was made public. Congress turned down the SPS anyway, but without the benefit of our analysis.

◆**Is the Clean Air Act worth its cost?** A Democratic Congress mandated a large project to judge whether the 1970 Clean Air Act was worth its cost. In this case, breaking with prevailing cost-benefit analysis practices (see §2.2), all impacts of the act, no matter

how intangible or uncertain, were to be estimated. Our task was to integrate into an ADT macromodel issue-specific studies by major research organizations (such as a U.S. Geological Survey study on geological impacts).

None of these organizations would agree to release *any* findings until those findings met scholarly standards that would not embarrass them in scientific circles. For policy purposes, however, what was needed was the best judgment available at the time a decision had to be made. As a result, the project dragged on with nothing to show, until Republicans took over Congress and cancelled the effort.

◆**Detect nuclear proliferation?** In the 1980s, the Department of State needed an authoritative probability that if some country were developing nuclear weapons (in defiance of the Non-Proliferation Treaty), the International Atomic Energy Agency (IAEA) would detect it with enough evidence to stop them. Apparently, the Department of State was hoping for a probability high enough to dissuade Israel from bombing an Iraqi reactor (which in fact they did). Brookhaven National Labs had produced a detection probability of 97%. The Department of State funded the IAEA to have us give a second opinion (Brown and Ulvila 1983). When our interim results (see Ulvila and Brown 1982b) suggested a very low probability (approximately 3%), the Department of State had the project cancelled and we were forbidden to share our work with the IAEA, although they were our nominal client!

Apparently, Brookhaven's reasoning behind their 97% probability was as follows. They had identified about 100 paths that a country could take to secretly divert nuclear materials to military purposes. Ninety-seven of these could be detected by the IAEA, so (their argument ran) *the* detection probability was 97%. This took no account of the fact that a diverter (such as Iraq) would know which three paths were undetectable, and they would almost certainly pick one of them and avoid detection.¹⁸

6.2. Legal Advocacy

Unlike covert advocacy that is presented as "decision aiding," legal advocacy is an overt and respectable

component of our adversarial judicial system. ADT has a distinctive potential role to play in it.

◆**Adjudge an election law unconstitutional?** In 1979, the Republican National Committee (RNC) filed a suit against the Federal Election Commission, charging that a campaign financing law should be voided as unconstitutional (Brown 1979). The law limited the amount that could be spent on a presidential election campaign to \$20 million. The RNC held that it would favor Democrat Jimmy Carter in the upcoming election. A federal court and ultimately the Supreme Court would adjudicate the case.

I testified for the RNC on the soundness of their case, which depended, in part, on the value of the trade unions' efforts (which escaped the law) on behalf of the Democrats.¹⁹ To estimate what that value had been in the recent 1976 election, they wanted me to sample the records of 50,000 union locals. However, union lawyers would only agree to sampling if no more than 17 locals were sampled and if their lawyers gathered the data. I volunteered my professional judgment that any estimate from such a survey could be off by a factor of 20. With straight faces, the lawyers for both sides "stipulated" (possibly for political and criminal liability reasons) that they would accept any resulting estimate without question. We went ahead with the sampling, and the unions' contribution to the Democratic campaign was duly entered into the legal record as exactly \$500,000, without challenge.

I did testify in court on some other issues pertaining to the case. However, RNC lawyers complained that my testimony there was not responsive to their needs, and that was the end of my career as an expert witness! (The RNC withdrew their lawsuit when political action committees emerged and largely bypassed that election law.)

This experience taught me that logic (for example, through ADT) comes a poor third, after politics and legal maneuvers, when it comes to influences on the judicial process.

6.3. Avoiding Advocates

I have nothing, in principle, against the adversarial aspects of our political and legal systems. However, I have been reluctant to provide selective assistance to

¹⁸ This is another example of the perils of judgment-free assessment (see §2.2).

¹⁹ As the author of a work on inference and estimation (Brown 1968).

one side or another, and still claim to be objective. The pressure to compromise my professional standards is, to say the least, uncomfortable. A reliable indicator that a client really wants advocacy rather than decision aid is his interrupting the project when it doesn't appear to be going where he wants.

◆**Bombers vs. carriers?** The Navy asked us to “help” Congress decide whether to fund bombers or aircraft carriers. I agreed on condition that whatever our findings proved to be, they would be made public. The Navy immediately lost interest.

6.4. Censorship

Interested parties can often distort government decisions in their own favor, by getting an analysis they do not like cut off.

◆**Where to allocate research effort?** The head²⁰ of a DOE waste management program was allocating more than a billion dollars among research contractors (see Brown 2005b). For bureaucratic reasons, our consulting contract was administered by one of these contractors, who got to see what we were doing. When they saw we were considering a reallocation of funding that would lose them over a hundred million dollars, a vice president threatened to get us fired if we were not “docile” (his term). We were not docile and we *were* fired.

◆**Permit Arctic construction?** The Federal Arctic Research Commission (ARC), on the advice of the Alaska Oil and Gas Association (AOGA), hired us to develop a “scientific basis” for regulating environmentally hazardous construction (see Brown et al. 1997 and §3.3, second case study). At that time, the prevailing method for evaluating regulations was a form of cost-benefit analysis. As then practiced, this only took account of firmly documented costs and benefits (such as industry expense), and treated more uncertain impacts (such as environmental benefits) as exactly zero. This, of course, weakened any case for regulation, so industry was all for it. (Possibly AOGA had expected that our work would smooth the way for oil drilling in the Alaskan National Wildlife Refuge.) When it became clear that our MUA approach (see Appendix 9A.2 in Brown 2005a) was addressing *all* impacts, however uncertain, a BP vice

president publicly denounced us and the ARC accommodatingly cancelled our contract.

7. Methodology Lessons Learned

This paper has been mainly about behavioral aspects of client-aider interaction. I have discussed methodological aspects elsewhere (see Brown 2005c, 2006), but some of those issues deserve mention.

7.1. Refining Method

My professional practice has been to alternate working on real problems with developing methodology to address any deficiencies that surface. This “build-test-build-test” paradigm has generally led me in directions different from (but complementary to) university-based research. The latter is usually discipline-specific, pursues authoritative findings, and builds on past research. Our research, by contrast, tends to be problem-specific, exploratory, and unprecedented—and is more difficult to get funded.

As I became more experienced in making ADT useful in government (with some chastening setbacks), my methodological practice evolved radically. In my teaching (Brown 2005a), I have replaced much of the decision aiding guidance (but not the underlying logic) that I taught in the sixties (see Schlaifer 1969).²¹

7.2. Multiple Evaluations

In particular, I now try to make sure we use all relevant knowledge that is available to the decider.²² To this end, I urge combining intuition²³ with multiple decision-making approaches that tap into different sources of knowledge and judgment (see Brown and Lindley 1976, 1986; Lindley et al. 1979). These approaches include alternative ADT formulations, and other “internal” methods (such as operations

²¹ Brown et al. (1974) was based on that guidance, basics of which are still widely taught in business schools (see Clemen and Reilly 1998). The change in my own practice is reflected in Brown (2005a) and foreshadowed in Brown (1992).

²² For example, overlooking the scope for what I now call “multiple evaluation and synthesis,” sometimes known as “plural evaluation.”

²³ Often in the form of pattern recognition (Zsambox and Klein 1997).

²⁰ John Bartlett, the subsequent head of OCRWM.

research) and “external” methods (such as observing what has actually happened in similar cases).²⁴

7.3. Modest Expectations

I now realize that it usually takes more effort and skill to make an ADT model cost-effective than can be justified by improved decision quality. As a result, I do not generally favor constructing explicit numerical ADT models, unless they serve some purpose beyond straight decision aiding (such as communicating or validating a choice). On the other hand, *training* in developing and using formal ADT models can powerfully educate a decider’s informal reasoning and intuition.

7.4. Building on Decider Wisdom

Alternating practical decision aiding with methodological enquiry has given me great respect for what successful and experienced deciders can teach us (and why so few of them have, so far, paid much heed to the “aid” part of what we offer). Most of my research has been on formulating useful ADT procedures based on smart (but unaided) decision practice. Improving on that practice comes from paring off human imperfections and disciplining them to be logically coherent.²⁵

7.5. The Human Factor

Decision-aiding success depends more on solving people problems than logic problems. (Psychologists outnumbered engineers in our consulting company.)

8. Conclusion

8.1. Impact of ADT on Decision Quality

It has been rewarding to work on burning issues of the day,²⁶ often with senior deciders. I am not sure, however, of having changed many minds, or if I did, that it had very much direct impact. An individual decider usually has limited control, because

government decisions are a diffuse process. An assistant secretary of defense²⁷ told me his influence was much like punching a pillow: it soon returns to its original shape. The ponderous bureaucracy that he was nominally in charge of had generally enough inert mass to thwart his initiatives.

Potentially, ADT may have more to offer to government than, say, to business or medicine in helping a decider make up his mind (whatever his motives may be). The room for improvement in a government decider’s ability to make sound decisions is usually much greater (even if the decider has less incentive to make that improvement). The issues tend to be more complex (because the criteria are not limited, for example, to money or health). Moreover, the decider is likely to have less experience of his current decision domain. For example, the lead National Security Council staff member on the Mideast foreign policy case (see §4.2) was previously a submarine commander. People in high places tend to move from one area to another (e.g., among cabinet positions) and change with each administration.

8.2. Role of ADT in Government

However, in government at least, the main value of inserting ADT into the decision process has not, I think, been in improving decisions, but in oiling the wheels of government. In particular, it can pinpoint sources of disagreement and promote their resolution, focus attention on what issues matter, save wasted effort, and facilitate communication between multiple decision participants and interested parties.

At least two of the original Raiffa-Schlaifer team went on to become significant government deciders themselves. Here is what they had to say about ADT for policy makers now, with 40 years of perspective.

Ed Zschau, who became a member of the House of Representatives, said,

ADT can be used as a tool or aid (but not the final answer) for deciders in complex public policy situations, in order to incorporate a variety of facts, assessment, and considerations into their thinking about the alternatives and probable outcomes. As a side perspective, within such a set of themes...personal interests

²⁴ The distinction between internal and external methods corresponds roughly to what Hammond (2007) calls “coherence” and “correspondence.”

²⁵ See Brown (1969; 1978; 1989a, b; 1990a, b; 1992; 1993; 1994; 2000; 2005c; 2006), Brown and Pratt (1996), Brown and Ulvila (1977), Brown and Watson (1977), Martin and Brown (1991), and Ulvila and Brown (1978).

²⁶ For further reading, see my website, <http://mason.gmu.edu/~rbrown>.

²⁷ Robert B. Pirie, formerly Assistant Secretary of Defense for Manpower, Reserves and Logistics.

sometimes prevail, but at least the decider can understand the trade-offs for basing the decision on personal interests.²⁸

Bob Glauber, who became undersecretary for finance at the Treasury, said,

Applying ADT to public policy decisions faced by government decision makers can be even more complicated than in either business or private settings. Objectives typically have multiple dimensions, many difficult to quantify. Information for assessing likelihoods is dispersed among many sources. And the decision-making officer has biases which, to make the process effective, need to be illuminated.²⁹

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References

- Baron, J., R. V. Brown, eds. 1991. *Teaching Decision Making to Adolescents*. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Brown, R. V. 1968. Evaluation of total survey error. *Statistician* 17(4) 335–355.
- Brown, R. V. 1969. *Research and the Credibility of Estimates*. Graduate School of Business Administration, Division of Research, Harvard University, Boston.
- Brown, R. V. 1978. Heresy in decision analysis: Modeling subsequent acts without rollback. *Decision Sci.* 9 543–554.
- Brown, R. V. 1979. Deposition before U.S. District Court for the Southern District of New York, for Republican National Committee vs. Federal Election Commission.
- Brown, R. V. 1982. Organizational factors in systems design. M. S. Cohen, R. V. Brown, D. A. Seaver, J. W. Ulvila, W. G. Stillwell, eds. *Operability in Attack Submarine Combat Systems: An Exploratory Review* (Technical Report), Decision Science Consortium, Falls Church, VA, 149–155.
- Brown, R. V. 1987. Decision analytic tools in government. K. B. Levitan, ed. *Government Infostructures*. Greenwood Press, Westport, CT, 69–88.
- Brown, R. V. 1989a. Normative models for capturing tactical intelligence knowledge. S. E. Johnson, A. H. Levis, eds. *Science of Command and Control: Part II Coping with Complexity*. AFCEA International Press, Fairfax, VA, 68–75.
- Brown, R. V. 1989b. Toward a prescriptive science and technology of decision aiding. *Ann. Oper. Res., Volume on Choice Under Uncertainty* 19 467–483.
- Brown, R. V. 1990a. Diffuse risks from adversarial sources: An emerging field of risk analysis. L. A. Cox, Jr., P. F. Ricci, eds. *New Risks Issues and Management*. Plenum Press, New York, 379–388.
- Brown, R. V. 1990b. Assessment uncertainty technology for making and defending risky decisions. *J. Behavioral Decision Making* 3 213–228.
- Brown, R. V. 1992. The state of the art of decision analysis: A personal perspective. *Interfaces* 22(6) 5–14.
- Brown, R. V. 1993. Impersonal probability as an ideal assessment based on accessible evidence: A viable construct? *J. Risk Uncertainty* 7 215–235.
- Brown, R. V. 1994. The role of statistical decision theory in decision aiding: Measuring decision effectiveness in the light of outcomes. P. R. Freeman, A. F. M. Smith, eds. *Aspects of Uncertainty: A Tribute to D. V. Lindley*. John Wiley & Sons, New York, 913–918.
- Brown, R. V. 2000. Fitting decision aids to institutions: Organizational design issues. Working paper, George Mason University, Fairfax, VA.
- Brown, R. V. 2005a. *Rational Choice and Judgment: Decision Analysis for the Decider*. John Wiley & Sons, New York.
- Brown, R. V. 2005b. Logic and motivation in risk research: A nuclear waste test case. *Risk Anal.* 25(1) 125–140.
- Brown, R. V. 2005c. The operation was a success but the patient died: Aider priorities influence decision aid usefulness. *Interfaces* 35(6) 511–521.
- Brown, R. V. 2006. Making decision research useful—not just rewarding. *Judgment Decision Making* 1(2) 162–173.
- Brown, R. V., D. V. Lindley. 1976. Rationality and the resolution of incoherence. Report, Department of Statistics, University College, London.
- Brown, R. V., D. V. Lindley. 1986. Plural analysis: Multiple approaches to quantitative research. *Theory Decision* 20 133–154.
- Brown, R. V., J. W. Pratt. 1996. Normative validity of graphical aids for designing and using estimation studies. R. J. Zeckhauser, R. L. Keeney, J. K. Sebenius, eds. *Wise Choices: Decisions, Games, and Negotiations*. Harvard Business School Press, Boston, 42–62.
- Brown, R. V., J. W. Ulvila. 1977. Selecting analytic approaches for decision situations. Report, NTIS AD A047965/A047880/A048228, Decisions and Designs, McLean, VA.
- Brown, R. V., J. W. Ulvila. 1983. The role of decision analysis in international nuclear safeguards. P. Humphreys, O. Svenson, A. Vari, eds. *Analyzing and Aiding Decision Processes*. North-Holland, Amsterdam, 91–104.
- Brown, R. V., J. W. Ulvila. 1988. Does a reactor need a safety backfit? Case study on communicating decision and risk analysis information to managers. *Risk Anal.* 8(2) 271–282.
- Brown, R. V., S. R. Watson. 1977. Pretesting innovation: Methodology for testing the design of management systems. *Theory Decision* 8 315–336.
- Brown, R. V., N. E. Flanders, O. I. Larichev. 1997. Decision science for regulating the Arctic environment. *Arctic Res. US* 10(Fall-Winter) 24–33.
- Brown, R. V., A. S. Kahr, C. R. Peterson. 1974. *Decision Analysis for the Manager*. Holt, Rinehart, and Winston, New York.
- Brown, R. V., C. R. Peterson, J. W. Ulvila. 1975. An analysis of alternative Mideastern oil agreements. Report, NTIS AD A025079, Decisions and Designs, McLean, VA.

²⁸ Personal communication to author, September 2008.

²⁹ Personal communication to author, October 2008.

- Brown, R. V., C. W. Kelly, III, R. R. Stewart, J. W. Ulvila. 1977. A decision-theoretic approach to predicting the timeliness of NATO response to an impending attack (U). *J. Defense Res. Special Issue 77-1 (Crisis Management)* 126–135.
- Clemen, R., T. Reilly. 1998. *Making Hard Decisions*, 3rd ed. Wadsworth, East Windsor, CT.
- Department of Energy. 1987. A multiattribute utility analysis of sites nominated for characterization for the first radioactive waste repository. Report, U.S. Department of Energy, Washington, D.C.
- Hammond, K. R. 2007. *Beyond Rationality*. Oxford University Press, New York.
- Keeney, R. L., H. Raiffa. 1976. *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*. John Wiley & Sons, New York.
- Lindley, D. V., A. Tversky, R. V. Brown. 1979. On the reconciliation of probability assessments. *J. Roy. Statist. Soc., Ser. A* **142**(2) 146–180.
- Martin, A. W., R. V. Brown. 1991. Analog devices for teaching decision skills to adolescents. J. Baron, R. V. Brown, eds. *Teaching Decision Making to Adolescents*, Chap. 10. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Schlaifer, R. O. 1969. *Analysis of Decisions Under Uncertainty*. McGraw-Hill, New York.
- Ulvila, J. W., R. V. Brown. 1978. Step-through simulation. *Omega: Internat. J. Management Sci.* **6**(1) 25–31.
- Ulvila, J. W., R. V. Brown. 1982a. Decision analysis comes of age. *Harvard Bus. Rev.* (September–October) 130–141.
- Ulvila, J. W., R. V. Brown. 1982b. A weighted average of diversion path detection probabilities as a measure of detection capability. Report, prepared for the International Atomic Energy Agency. Decision Science Consortium, Falls Church, VA.
- Zsambox, C. E., G. Klein. 1997. *Naturalistic Decision Making*. Lawrence Erlbaum Associates, Mahwah, NJ.