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Informed Consent for Eliciting Environmental Values†

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Agreeing to participate in a study eliciting environmental values means agreeing to abide by the commitment implied by any proposal that one accepts or rejects in it. That might mean anything from addressing the gist of an issue to expressing an explicit willingness to pay for an environmental change. By soliciting such participation, investigators promise to provide the information that participants need in order to evaluate the proposals being presented. This paper proposes a standard for providing such information that must be met in order to conduct valid and ethical value-elicitation studies. Namely, investigators must secure the *informed consent* of participants. Drawing on research in risk analysis and communication, this approach allows setting priorities among the facts that could conceivably be conveyed. It also leads to two general strategies for increasing the capacity of the communication channel. The paper concludes by discussing how the policy relevance of value-elicitation studies depends on their ability to ensure informed consent.

Introduction

Physicians are often required to secure *informed consent* from the participants in their procedures. Social researchers often must do the same for participants in their studies. Individuals who sign the associated consent forms agree (a) that the benefits of participation outweigh the risks, (b) that they have received the information needed to make that determination, and (c) that they were free to decline before starting—and are free to leave midstream if their expectations are not met. Like their medical counterpart, research informed-consent procedures were designed primarily to protect participants. However, they can also protect the user of a study's results by ensuring the quality of its data. The user can be assured that participants knew what they were talking about and accept the use made of their responses.

This paper applies the informed-consent standard to studies eliciting environmental values. In this context, the standard means creating conditions such that respondents will stand behind researchers' interpretations of their responses—as expressing their informed personal preferences. The next section sets out the importance of providing such quality assurance. The following section operationalizes this principle in decision analytic terms, using existing risk analyses to set priorities in communicating task-related information and to evaluate a study's success. Two complementary strategies are then proposed for using best the limited opportunity for communicating essential information. The final section considers the options facing policy-makers hoping to use value-elicitation studies responsibly.

Risks and Benefits

Before deciding to participate in a study, a candidate should receive a candid disclosure of its risks and benefits. Studies eliciting environmental values seldom pose *direct* risks to participants, except perhaps depressing them about the state of the environment (although, see ref *1*). For most potential participants, those small direct risks should be outweighed by the (perhaps small) direct benefits of thinking about the issues, along with any payment for responding. Such impacts should be over once the task has been completed. It should pose little problem for investigators to inform potential participants about what they would be getting themselves into. People have thought and talked about the environment before.

However, policy-related research can have *indirect* effects extending long after the data collection is over. Such effects are familiar to many environmental researchers. For example, a study finding pollution in a community can undermine its economic viability and its residents' insurability; it can also get their plight taken seriously. These possibilities have prompted protective procedures, like those used by the Agency for Toxic Substances and Disease Registry, as well as increased calls for *participatory research* with citizens involved in the design, conduct, and reporting of studies (*2, 3*). Without an understanding of how the data will be used, citizens may hesitate to provide their views, much less tissue or soil samples.

With studies eliciting environmental values, the indirect impacts of participation depend on how literally responses are interpreted. At one extreme, lie what might be called *gist* studies: Investigators claim to have received no more than general answers to general questions, reflecting respondents' general attitude toward a general topic (e.g., supporting the environment, worrying about pollution, having confidence in industry, mistrusting government). Gist responses provide only vague direction for policy-makers. As a result, the indirect effects of such studies on respondents *should* be small. They have not said very much; no one should read very much into their responses. Of course, policy-makers may claim strong mandates on the basis of such weak indicators, producing strong indirect effects. However, in that case, they will have misrepresented what respondents said. Researchers who followed the use of their work would then be obligated to deny such misuse, saying in effect, "All they (the public) said was that they wanted cleaner cars; they didn't say that they wanted to mandate that particular fuel system."

At the other extreme, lie *contract* studies: Specific transactions are proposed to respondents, to support claims such as "people are willing to pay 7% for 'green' products" or "to incur a 0.2% rise in unemployment in order to meet Kyoto obligations". By participating, respondents will promote those policies that fit the investigator's interpretation of their responses. Respondents will benefit if those are policies that they actually desire. They will lose if the investigators misinterpret them. That could occur malevolently through deliberate misrepresentation. However, it could also occur if the investigator simply understands the contract differently than do respondents. One form of misinterpretation is mistaking gist responses for contractual ones (e.g., assuming that support for the World Trade Organization implies knowledge and advocacy of all its environmental provisions).

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TABLE 1. Compatibility between Respondent and Researcher View of Study Intent

	respondent's view	
researcher's view	gist	contract
gist	casual, general response taken casually and generally; respondent works no harder than is warranted; researcher makes no more of responses than is warranted	serious response taken much more casually than intended; respondents have invested much more effort than was warranted; researcher has ignored the details that respondents considered when formulating their responses
contract	casual, general response treated much more seriously than intended; researcher assumes that respondents have processed details of contract, when they have just considered general issue; degree of commitment overstated	specific response taken as seriously as it was intended; respondents are rewarded for the effort that they invested in considering the details of the contract

These possibilities can be seen in the familiar context of contingent valuation (CV) studies (*4*), eliciting respondents' willingness to pay (or to accept compensation) for proposed environmental changes. Participation provides a unique opportunity for citizens to evaluate specific environmental issues. That chance presumably encourages many people to accept and stick with CV tasks despite the hard work required. However, unless their responses are interpreted as intended, participants will have signed an IOU that they were not really willing to pay (or an invoice that they did not really intend to deliver—when someone else will pay the contingent value). That could happen if respondents missed a critical task feature (which the investigator assumed was understood), leading them to evaluate a different transaction than the one that was offered. Or it could happen if they simply did not realize how seriously their response would be taken, hence gave but a gist (which the investigator treated as contractual).

For present purposes, I assume that people mean what they say in order to focus on the possibility that they do not understand the task well enough to know what they are talking about. Thus, I will not consider the contentious issue of strategic behavior (deliberately misrepresenting one's true beliefs) and hypotheticality (when the evaluated good may not really be provided and the amount that respondents claim to be willing to pay may not really be extracted). Extensive discussions of each can be found in the general literature.

Explaining the Terms of a Study

When investigators go to secure informed consent, their first obligation is to explain how responses will be used by placing their study on the gist—contract continuum. Doing so should be simple. Just say (the equivalent of) either "we're interested in your general opinion about [this general topic]: or "your response will be used literally in setting policy, hence will be treated as though you absorbed and acceded to every detail in the description to follow". However, an investigator's aspirations may not go without saying. Table 1 suggests what can happen when respondents take their task much more or less seriously than was intended. One of the sustained controversies regarding CV studies focuses on whether they lie in the lower right or lower left quadrant. Critics argue that respondents typically cannot translate their feelings about the goods presented in such studies into hedonically equivalent changes in wealth. When that happens, they provide general expressions of concern, little related to an economic interpretation of WTP (*5, 6*). Were that true, then respondents would be in a gist study that researchers (and policy-makers) have treated as a contractual one, violating their informed consent.

Investigators' next obligation is to provide the conditions that participants need to generate responses of the required depth. For gist studies, that should be easy. Their "come as you are" perspective means that respondents need not (indeed, should not) be provided with additional information about the topic. Moreover, as long as respondents share a common culture with the researchers (and policy-makers), the meaning of possible responses should be quickly apparent. Everyone involved should extract a similar message from a general opinion about the environment.

If a contract question is familiar, then the same thinking applies. Conveying its content is easy if the work has already been accomplished by natural processes. For example, as the vote approaches on a widely debated referendum, many citizens should know what commitment it implies and respond reliably to a poll eliciting their values. Many citizens know the verdict that they want from our periodic show trials, as those near their conclusions, and what would happen if their views determined how the law of the land was applied.

Communicating a novel contract can, however, be much more challenging. Many different features could matter to respondents. Table 2 shows a framework for specifying contractual tasks eliciting environmental values (*7*). In this view, a properly informed respondent must understand how the investigator interprets the *good*, the *payment*, and the associated *social context* of a proposed *transaction*. If not, then respondents are answering a different question than the one being asked. An investigator who secures informed consent for a contractual study promises to ensure that level of mutual understanding.

Doing so could constitute *reactive measurement*, whereby the elicitation experience changes respondents. However, it could just make the task clear enough that respondents can express their unchanged selves, just as would happen with a "plain English" car, apartment, or video rental contract. Nonetheless, seeing the issues laid out in a concentrated form might lead some respondents to think differently about them than they would otherwise. If so, then the researcher would want to treat them as expressing the views of any (similarly selected) citizens who made a similar effort. For some purposes, that might be the appropriate level of involvement for determining citizens' values on important issues. Indeed, policy-makers might want researchers to take the extra step of informing participants about the underlying issues (and not just about the specific question). Those individuals might be treated as a citizens jury, impaneled to examine the issue on behalf of their fellow citizens, or as a projection of what others might think were the issues publicly aired.

The specific examples in Table 2 were culled from studies eliciting values for changes in atmospheric visibility. Each represents a feature that might need to be understood to evaluate a proposal. When a contractual response requires understanding many such features, investigators bear a heavy communication burden. The remainder of this paper con-

TABLE 2. Framework for Defining Transactions; Features That May Require Specification If an Evaluation Task Is To Be Understood Similarly by Respondents, Investigators, and Policy-Makers[a]

The Good (e.g., Visibility)

substantive definition (aspects of proposed change in good that may matter to evaluators)
- focal attribute(s)
  - (e.g., haze intensity, visual range, plume color, light extinction)
- context (giving particular value to attribute)
  - [e.g., natural or built, judged uniqueness, associated activities (such as hiking, viewing, playing), significance (such as religious, cultural, historical)]
- source of change (in focal attribute)
  - predominantly natural (e.g., vegetation, forest fires, dust storms, humidity) or human (e.g., power plant, other factory, field burning, slash burning, motor vehicles)

formal definition (specifying extent of change in valued focal attributes)
- reference and target levels (of good, before and after change)
  - magnitude and direction of change, statistical summary, form of representation (mode, richness, organization)
- extent of change
  - geographical, temporal
- timing of change (when will it happen)
- certainty of provision (will it really happen)

The Value Measure (e.g., Money, Time, Discomfort, Effort)

substantive definition (aspects of proposed change in payment that may matter to evaluators)
- focal attribute(s)
  - dollars (for money)
  - foregone leisure or work (for time)
  - physical or emotional toll (for discomfort or effort)
- context
  - electric bill, sales tax, income tax, park entry fee, environmental fund (for money)
  - when convenient, when demanded (for time)
  - when rested, when exhausted (for effort)
- constituency

formal definition (specifying extent of change in valued focal attributes)
- reference and target levels
  - magnitude and direction of change, statistical summary, elicitation procedure (response mode, response format, cues, feedback)
- extent of payment
  - frequency, duration
- timing of payment (when will it happen?)
- certainty of payment (will it really happen?)

The Social Context

other people involved
- provider of the good
- others present

resolution mechanism (determining whether transaction will actually occur)
- determining parties
- iterations, constraints

other stakes involved
- externalities
- precedents
- legitimacy of process

[a] Source: Ref *7*.

siders analytical and psychological approaches to meeting that challenge and to assessing investigators' success in doing so.

I like this framework and have used it in various contexts (*8*−*12*). Its set of potentially relevant details seems initially daunting. As discussed below, not all or even many need be relevant in a given application. However, the communication burden created by the relevant features reflects the complexity of the contractual choice, not the specific framework used to characterize it. Unless investigators make a relevant feature clear, respondents must make it up. If respondents and investigators make the same assumption about an unstated feature, then it might "go without saying". If not, then respondents are answering different questions than the one attributed to them. Respondents who chanced upon the investigators' reports could justifiably ask, "How dare you interpret my responses that way? I meant nothing of the kind. You have violated my informed consent to participate in your study."

A Materiality Standard for Informed Consent

The legal doctrine for informed consent arose in medicine. It has two general expressions. About half of the United States have a *professional* standard: physicians must say what their peers say. Although they pool the judgments of a community, professional standards can also entrench flawed practices. These risks may be particularly large when there are few opportunities for systematic feedback and evaluation.

The remaining states have a *materiality* standard: physicians must say whatever is "material" to their patients' decisions. One way to implement this demand is to provide a laundry list of possible side effects. As in the pasta sauce ad, everything that one could possible want is "in there" somewhere. However, although that form of assurance may satisfy lawyers, it can frustrate patients—whose time, energy, and cognitive capacity are all limited. [The same might be said of Material Safety Data Sheets and many other warnings (*17*).] The same challenge would face respondents trying to master the essential details of a contractual study. In either

Carotid endartarechtomy involves scraping out the artery leading to the brain. It can reduce the risk of stroke for patients with arteriosclerosis there. However, having a sharp object in one's neck can also cause problems, as can major surgery itself. Consider a population of patients, for all of whom the surgery would be a rational choice, if there were no risks (and were money no object). They vary in their physical condition, represented by probability distributions over possible consequences, and in their values, represented by distributions of tradeoffs across those consequences. Monte Carlo sampling produces a set of hypothetical patients, each characterized by a combination of physical states and personal values. Calculate the expected utility of the surgery decision for each such patient, ignoring all risks. Then recalculate it, including knowledge of the probability of each possible consequence. Information about a risk is material, if it changes the expected utility of surgery from positive to negative.

The table shows the results of such an analysis. About 15% of such patients should decline the surgery, upon learning the probability of immediate death. Another 5% should decline, if told the risk of iatrogenic stroke. An additional 3% should be dissuaded by hearing the risk of facial paralysis. Although many other side effects are possible, few would affect many choices. Thus, although the set of potentially relevant facts is large, the set of critically relevant ones is small.

The percentage of a simulated patient population that would decline carotid endartarechtomy, upon learning of each risk.

Outcome	Percentage declining (standard deviation)
Death	15.0 (0.3)
Stroke & neurological deficit	5.0 (0.2)
Facial Nerve paralysis	3.0 (0.2)
MI (myocardial infarction)	1.1. (0.1)
Lung damage	0.9 (0.06)
Headache	0.8 (0.1)
Resurgery	0.4 (0.03)
Tracheostomy	0.2 (0.03)
Gastrointestinal upset	0.09 (0.1)
Broken teeth	0.01 (0.01)
Liver damage	0.01 (0.01)
Parotiditis	0.01 (0.01)
Kidney dysfunction	0.01 (0.01)

(Source: Merz et al., 1993)

FIGURE 1. Materiality standard for prioritizing information.

case, a systematic approach is needed to set priorities so that attention is focused primarily on the features that really matter.

If materiality is interpreted as focusing on what people most need to know, then it can be operationalized in *value of information analysis* terms (*13, 14*). That is, information is material to the extent that receiving it affects the expected utility of recipients' choices (*15, 16*). The next section considers two general strategies for achieving this standard and for assessing the success of attempts.

Two Strategies for Communicating Material Facts Efficiently

Investigators can approach their communication challenge in a piecemeal or holistic way. That is, they can strive either to convey the most material individual facts or to create a meaningful whole that facilitates recalling and inferring material facts.

Piecemeal Strategies: Identifying a Supply Curve for Information. Other things being equal, communication should focus on the facts that respondents most need to know but currently do not. Figure 1 shows a medical example, setting priorities among information about treatment side effects (whose probability has been estimated, with appropriate uncertainty, by risk assessors). In this case, although many facts might have been material to patients, the communication task turns out to be fairly easy. Only three side effects matter much, in the sense that knowing them has much chance of affecting patients' evaluation of the surgery option. Moreover, the probabilities of these three side effects turn out to be large enough to be readily comprehended (rather than being, say, thousandths of a percent). The nature of the two top side effects (death, stroke) should be familiar, especially to candidates for this procedure who face them already. As a result, not much needs to be said about the events to which those probabilities are attached. Thus, communication might focus on what the third side effect (facial nerve paralysis) is like.

The example in Figure 1 assumes patients who know nothing about the probabilities of the possible outcomes. That seems reasonable for an unfamiliar surgery. For patients with prior beliefs, the analysis would simply consider how different facts would update those priors. In either case, the analysis creates a *supply curve*, showing the optimal order for providing new facts. That order would change if some important facts proved too hard to communicate. De-emphasizing them saves recipients' time—while acknowledging that less overall understanding is possible. The order would also change if some facts proved redundant, so that respondents who know one fact can predict the others. With artificial tasks, any two features can appear together (e.g., the sizes and probabilities of gains and losses in laboratory gambles), allowing no such efficiencies. However, when evaluating real environmental changes, respondents may already have many beliefs and be quick to infer more. If respondents can guess the investigators' intentions, even a short description may communicate a lot. Thus, efficient communication requires a combination of analytical and empirical research.

The supply curve perspective also allows evaluating the adequacy of imperfect communications, as might occur when recipients can only absorb a few facts (*17*). Sometimes (as in Figure 1), only a few things really matter; sometimes, many things do. If participants cannot get very far in understanding the value elicitation question (much less their response to it), then investigators have two options. One is using a more intensive and potentially reactive communication procedure (*1, 18, 19*). The other is settling for a gist study, admitting that it is impossible to ensure the understanding needed for a contract study.

Holistic Strategies: Completing Mental Models. People absorb information more quickly when they can organize it into *chunks*, clusters of facts cognitively processed as units (*20*). Mnemonists have mastered this skill to a high art (*21*). They can create chunks from diverse sets of facts by integrating their members into highly flexible templates. Ordinary people tend to organize information spontaneously into less coherent, domain-specific *mental models*. When accurate and appropriate, these mental models provide a platform for integrating task features. Invoking a mental model takes advantage of existing beliefs, allowing some task features to go without saying while making others easier to absorb. However, mental models can also encourage unintended inferences, while hindering the processing of unexpected features. For example, "referendum" is a widely used metaphor in studies eliciting environmental values, with respondents being asked to imagine that they are voting on a proposed transaction. How well it works depends on the appropriateness of the associations that it evokes for respondents in a given study. (Imagine that they infer a government sanctioned, legally binding, take-it-or-leave-it choice, decided by majority rule and open to all citizens? How should the data be analyzed, if the researcher knows some of these assumptions to be false?).

Psychology has developed many approaches to studying mental models (*22–27*) suited to particular domains. Our research group has developed a version for use with complex, loosely bounded problems with substantial uncertainty, like many health, safety, and environmental issues. Our approach attempts to accommodate the messiness of lay cognitions while still allowing them to be analyzed in terms of scientific understanding (so as to guide communications). We have applied it to varied topics, including radon, climate change, solvents, EMF, mammography, HIV/AIDS, and nuclear energy in space (*28–31*).

Each application begins by creating an *expert model* of the problem, capturing its formal structure and the uncertainty in the scientific community. To the extent possible, we make these models computationally tractable, even if we lack many of the requisite parameter estimates. Doing so

Condition (= length of proposed cleanup)	Offered Values of Stimulus Features			
	Miles of River in Proposed Cleanup			
	0-100 miles	101-1000 miles	1001-10000 miles	Don't Know
30 miles	**62**	9	1	29
1000 miles	4	**34**	32	31
	Feasibility of Proposed Cleanup			
	Eliminated Completely	Good Headway	Not Much Progress	Did not Think
30 miles	**35**	46	4	13
1000 miles	**18**	52	10	18
	Payment Vehicle of Proposed Cleanup			
	Taxes	Higher Prices	Donations	Other
30 miles	63	**25**	22	19
1000 miles	65	**31**	28	16

In a phone interview, Pittsburgh-area respondents were asked about their willingness to pay (in **higher prices** for goods and services) for completely cleaning up the following problem: "Presently, a large number of the rivers in Pennsylvania are seriously polluted. These rivers include the Delaware, Susquehanna, Monongahela, Allegheny, Ohio, Clarion, Schuylkill and Lehigh. All together, there are more than 3,000 miles of rivers, of which more than **1,000 miles** are polluted. Authorities caution against swimming in or eating fish caught from these polluted portions of the rivers." The **30-mile** condition mentioned only the Susquehanna River. (Source: Fischhoff et al., 1993)

FIGURE 2. Manipulation checks. Percent of respondents choosing each option; boldface type indicates the value actually given in stimulus.

increases the opportunities for formal analyses of information needs as well as sharpening our own thinking. We then conduct semi-structured, open-ended interviews, eliciting respondents' beliefs about the domain, trying to evoke their natural ways of thinking and talking. The interviews begin with a request to "tell me whatever you know or have heard about [the topic]". Follow-up questions ask respondents to elaborate on what they say and then to elaborate on their elaborations. Once they lose momentum, respondents are asked more specific questions about the major domains in the expert model. For example, respondents who have not discussed remediation are asked, "what can be done about...?".

What respondents say is then compared with the expert model. As with the piecemeal strategy, the analysis attempts to identify the critical gaps between what people know and what they need to know. However, the resulting communication attempts to take advantage of the coherence of natural systems and create a picture of the problem as a whole—not just fill in isolated facts. If successful, it allows recipients to integrate their fragmentary beliefs, absorb new information, and make inferences about additional issues. With this base of understanding, they can begin the next task, identifying their value for the environmental good.

Measuring Success

Whether investigators use these methods or others, their success must still be assessed. One standard method for determining what respondents take away from task descriptions is the *think-aloud protocol* (*32–34*). Respondents describe what comes into their minds as they read the task. The interviewer asks them to elaborate on what they say as a check on their intended meaning. People often use words in ways that differ from their official definitions—for example, "safe sex" (*35*), "climate" (*36*), "employed", or "room" (*37*).

"Manipulation checks" provide a second and less costly way to measure success. Placed at the end of a task, they ask respondents to report their understanding of its critical elements. Figure 2 shows the results of three such checks, administered after a short environmental evaluation task. Only the first check revealed a majority of respondents reporting the value actually used in the description. Despite the brevity of this task, most respondents did not hear, remember, or believe these details. They were, in effect, answering a different question than what the researchers intended to ask. In such cases, their answers would have to be discarded or reinterpreted (*11*).

When think-aloud protocols and manipulation checks are performed on pretests, they allow investigators to tell potential participants in the actual study how far a good-faith effort should get them. Leveling with them fulfills an ethical obligation (when requesting informed consent). It might also encourage them to try harder, by enlisting them as collaborators. When performed on actual respondents, such measures of success help the users of a study to decide what conclusions it can support—by determining where respondents fall relative to the acceptable level of misunderstanding.

Discussion

Before answering an evaluation question (in a study or in life), one needs to understand it. Before agreeing to try, one should understand how tractable that task is. Unless respondents understand their task, investigators should have little to report (although, unless they measure their success, they may not know what questions respondents are really answering). Unless potential respondents understand how far they will get, investigators should not engage their service or report their answers.

As a result, environmental risk communication is an essential part of environmental change evaluation. Most researchers take these obligations seriously, subjecting their designs to hard thought and pretests. However, they typically rely on their own intuitions to get things right and to measure their success. With basic research, investigators pay the price if these intuitions are wrong. If a task confuses respondents, then interesting signals can be lost in the resultant noise. If a task misleads respondents, then their evaluations will mislead the investigator, producing conclusions that cannot be replicated. However, when research has policy implications, the respondents themselves are at risk. Their views could be missed or misinterpreted. The claim made in this paper is that the front end of environmental value elicitation requires explicit empirical research. Trusting intuition places respondent, investigator, and policy-maker at risk.

In the short run, the additional design work will increase costs—even if it takes advantage of cognate literatures (e.g., refs *37–39*). In the long run, though, deliberate design research should reduce costs by creating a cumulative empirical record, focused on issues specific to environmental value elicitation (e.g., how to convey the magnitude of an environmental change or the time period for a payment, how to convince respondents that a change will really happen). In some cases, this research will show clever ways to simplify tasks. However, it may also show us, as investigators, to be victims of the *curse of cleverness*: We prize novel tasks whose formulation captures nuances that eluded our colleagues or which address emerging policy concerns. Yet, such tasks are even more novel for respondents. As a result, the tasks may lie beyond respondents' grasp. At least within the constraints of conventional interview and experimental settings, respondents may not be able to understand the task well enough to proceed (even if many will accede to the obligations and pressures of the interview situation and produce some kind of response). Nor may they be able to understand what they want, given the complex tradeoffs involved with real environmental choices. In such cases, respondents may need a more interactive and instructional setting—just to understand what we want from them—before starting to figure out what they want for the environment (*18, 40*).

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