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## Accentuate the Relevant

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## Special Section

# ACCENTUATE THE RELEVANT

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**Abstract**—People need information in order to make effective choices and to feel competent in managing their own affairs. Decision-making research provides tools for identifying and addressing these informational needs. The tools allow formal analyses of what information is critical to particular decisions, as well as descriptive analyses of how well those facts are understood. Communication should be focused on critical information that is either missing or available but not understood. Decision-relevant situations range from ones posing well-formulated, imminent choices to ones in which people are trying to understand what choices are even possible. This article reviews briefly the formal and descriptive approaches to dealing with such decisions. Including these approaches in behavioral interventions might help people to be as systematic as they would like in their decision making. It might even make them want to be more systematic.

Information is central to some decisions, peripheral to others. When it matters, people need the right information if they are to act in their own best interests. They also need to know how good their information is. If people exaggerate their own knowledge, then they may get themselves into trouble by acting with unjustified confidence. If they underestimate their own understanding, then they may be needlessly paralyzed. If they realize that they know too little, then they should lack a feeling of self-efficacy, which many behavioral interventions attempt to create (e.g., Ewart, 1991). When people cannot think their way through to satisfying decisions, they may give up thinking altogether and act on their emotions. Just as uncontrolled affect can undermine good thinking, so can poor thinking heighten reliance on affect.

The importance of information is recognized in many behavioral treatments. Whether through lectures, pamphlets, videos, counseling, or discussions, health professionals tell people things. Selecting the right things to tell (and ensuring that they are understood) is critical to these interventions. It is also critical to the credibility of the intervenors. The implicit contract between speaker and spoken-to requires the former to respect the time of the latter. Listeners will not like communications that repeat well-known facts or introduce irrelevant ones, while ignoring topics of interest. Nor will listeners appreciate information that conflicts with their existing beliefs, with other experts' claims, or with everyday experience—unless the discrepancies are explained. Nor will listeners be happy with information that seems to be filtered or distorted by people hoping to manipulate their choices (Fischhoff, 1995a; National Research Council, 1989).

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Conceptually, determining what information to communicate is straightforward: First, describe the decisions that people face; then, determine what information is most critical to those decisions; then, assess what people already know; finally, identify the critical gaps in this current knowledge. All too often, though, the particular facts that were chosen for health messages do not appear to have emerged from any systematic investigation. The remainder of this article presents procedures from behavioral decision research that address this problem. Some involve formal modeling for determining what information matters. Some involve descriptive research for determining what people already know. The concluding section discusses, even more briefly, the problems of helping recipients to use information once they have it. The emphasis, though, is on helping communicators fulfill their part of the bargain.

## A CONTINUUM OF DECISIONS

The value of information is situation dependent. An important fact in one context can be entirely irrelevant in another. Consider, for example, the information needs of an individual when betting in a March Madness pool and when contemplating elective surgery, or when considering the surgery with and without coverage by health insurance. As a result of such differing information needs, interventions must consider the particulars of specific decisions. Their design of such interventions should benefit from the knowledge of both specialists in the domain and specialists in decision making.

Within a domain, people often face a continuum of decisions, varying in their specificity. At one extreme lie well-formulated decisions, for which people need just a single fact; once they get it, they can "compute" the likely outcomes of the various possible actions. For example, parents contemplating a pertussis vaccination may need just the rates of brain damage among infants who get the disease and infants who get the shot. At the other extreme lie nascent decision situations, in which people just need to know what is going on; with that knowledge, they can determine whether they need to do anything and, if so, what their options are. In this case, people need broader substantive knowledge so that they can begin formulating the decisions within which more precise estimates could play a role. For example, parents may wonder how vaccines could possibly be dangerous, who stands behind them, and what pertussis is like.

In practice, this continuum of decisions is often less tidy. Receiving substantive knowledge can lead people to reformulate their decisions, thereby changing which precise estimates are needed. For example, vaccine doses are set by convention to a level that "usually" confers immunity; learning that fact might interest parents in finding the "sweet spot" in the dose-response curves for immunity and side effects. Conversely, a quantitative estimate may show a risk to be so low that there is no point in learning about it, much less contemplating

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any decisions. Nonetheless, the endpoints of the continuum point to complementary methods for identifying relevant information.

**WELL-STRUCTURED DECISIONS**

**What information matters?**

Some of life's sharpest decisions involve medical interventions. Candidates for a procedure often receive a laundry list of possible side effects (as do potential participants in psychological research and behavioral treatments). Although candid, such disclosure may also be incomprehensible. Recipients may have difficulty understanding what the individual side effects really mean, much less what the big picture is. As a result, they may both make poor choices and resent the people who pose such decisions.

Approximately half of the states in the United States have a materiality standard for ensuring informed consent. That is, patients must be told whatever is material to their decisions. Unfortunately, the judicial record provides little guidance on what exactly that means. Decision theory offers value-of-information analysis for determining how much specific facts matter (Raiffa, 1968). We (Merz, Fischhoff, Mazur, & Fischbeck, 1993) applied this test to the decisions facing candidates for carotid endarterectomy. Scraping out the main artery to the brain reduces the probability of stroke for individuals with arteriosclerosis there. Were there no side effects (and were money no object), every candidate for the surgery would take it. Unfortunately, it can also cause many problems, including iatrogenic strokes.

In this study, the attractiveness of surgery was computed for a hypothetical population of patients having a distribution of physical states (e.g., stroke risks) and personal values (e.g., time horizons). Assuming that these patients received (and understood) the best available information about possible side effects, 15% would find that the risks of dying from the surgery outweigh the risks of the disease (Table 1). Another 5% should decline surgery upon learning the risks of stroke and neurological deficit. Learning about most of the other side effects should affect few additional patients. Thus, physicians

**Table 1.** Percentage of a patient population that would decline carotid endarterectomy upon learning of each additional risk (sequentially from the top of the list) (from Merz, Fischhoff, Mazur, & Fischbeck, 1993)

Perioperative outcome	Percentage	SD
Death	15.0	0.3
Stroke and neurological deficit	5.0	0.2
Nerve paralysis (temporary and permanent)	3.0	0.2
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

seeking informed consent should focus on conveying these few key risks. Indeed, the duty to inform should begin with thinking hard about patients' decisions (Fischhoff, 1985).

**What do people know already?**

Understanding these critical risks means knowing their probability and severity. Determining what people know already, prior to professional communication, requires asking them precise questions. All too often, knowledge tests include vague questions and vague answers (Gerrard, Gibbons, & Bushman, 1996). The response options are typically verbal quantifiers, such as "likely" and "rarely," even though the interpretation of such terms can vary widely by individual and context (Budescu & Wallsten, 1995). Some interesting science describes the determinants and implications of this variability; however, it cannot rescue meaning from murk. As a result, it is hard to know what respondents mean by their answers. By contrast, we routinely use a graphic response mode that presents probabilities from .01 to 1.00 on a linear scale and smaller ones on a six-order log scale (Linville, Fischer, & Fischhoff, 1993; Quadrel, Fischhoff, & Davis, 1993). With a little instruction, even high-risk (e.g., incarcerated) juveniles seem able to use it, or at least they use it similarly to low-risk teens (and the parents of those teens, for that matter).

Having clearer response options should increase the pressure for clearer questions. A typical survey item is "How likely is it to get AIDS through sex with someone with AIDS?" (Gerrard et al., 1996). Logically, one cannot answer without additional details, such as how much sex and what kind (e.g., oral, anal). We posed this question, then asked respondents what it meant in terms of the nature and quantity of sex. Despite being a relatively homogeneous group (students at an Ivy League college), these subjects disagreed with one another considerably (Fischhoff, 1994). In another study (Quadrel, Fischhoff, & Palmgren, 1996), teens asked to think aloud as they answered a variety of such questions wanted, on average, half a dozen additional details per question, meaning that they found the questions greatly underspecified. If such questions appeared on a test, respondents would have to guess the missing details. Investigators would then have to guess how respondents had read between the lines of these deceptively simple questions.

Even with clearly specified questions and answers, caution is still needed when interpreting responses. When respondents are unfamiliar with the scale, their estimates can be sensitive to procedural features such as salient anchors, unfamiliar units, or decimal values (Fischhoff & MacGregor, 1983; Poulton, 1989). Unless proper precautions are taken, these estimates are subject to large artifactual influences. Nonetheless, numerical responses should reveal people's risk perceptions more clearly than ambiguous verbal quantifiers. Without this precision, the people designing interventions are left guessing at what people believe (Fischhoff, 1992). Wrong guesses will leave people vulnerable (by failing to provide needed information) and unduly responsible for their failures (by leading them to feel that experts feel that they have provided it).

**ILL-STRUCTURED (PRE)DECISIONS**

**What information matters?**

In order to care about a quantitative estimate, people need to care about the variable it describes. For example, an estimate of condoms

effectiveness against herpes matters only to someone who recognizes the existence of herpes, its modes of transmission, the possibility of prevention, and so on. That person needs, in effect, an accurate intuitive theory of how the risk is created and controlled. Such understanding allows people to see where choices are needed, to fashion possible responses, to adapt general advice to their specific circumstances, and to monitor the success of their efforts. It provides a legitimate base for feelings of self-efficacy. It can help make experts' advice intelligible.

By contrast, if people feel inundated by poorly selected and presented facts, then they may feel both alienated and paralyzed. In this case, too, formal analysis can help. Figure 1 shows one method of defining what one needs to know in order to predict the magnitude of a risk and the effects of attempts to control it, applied to HIV. It is an *influence diagram*, in which the value of the variable at an arrow's point depends on the value of the variable at its tail (Howard, 1989). The variables in rectangles (e.g., alcohol use) are set by deliberate choices; the other

variables are set by natural processes. For example, the probability that a behavior will transmit the virus depends on the prevalence of HIV among immediate associates (source); that depends, in part, on its prevalence in the area and the success of screening partners.

When an influence diagram's links are estimated, risks can be calculated (e.g., the expected AIDS death rate with a particular HIV prevalence, level of sexual activity, availability of confidential testing, etc.). One also can calculate the impact of potential interventions (e.g., improved screening, reduced alcohol consumption). In this way, such modeling can help focus behavioral treatments (and research) on the most important links. It can also characterize the content (and omissions) of educational (and research) programs.

### What do people know already?

Any formal representation provides a template for evaluating current knowledge. People need to understand the major links and the

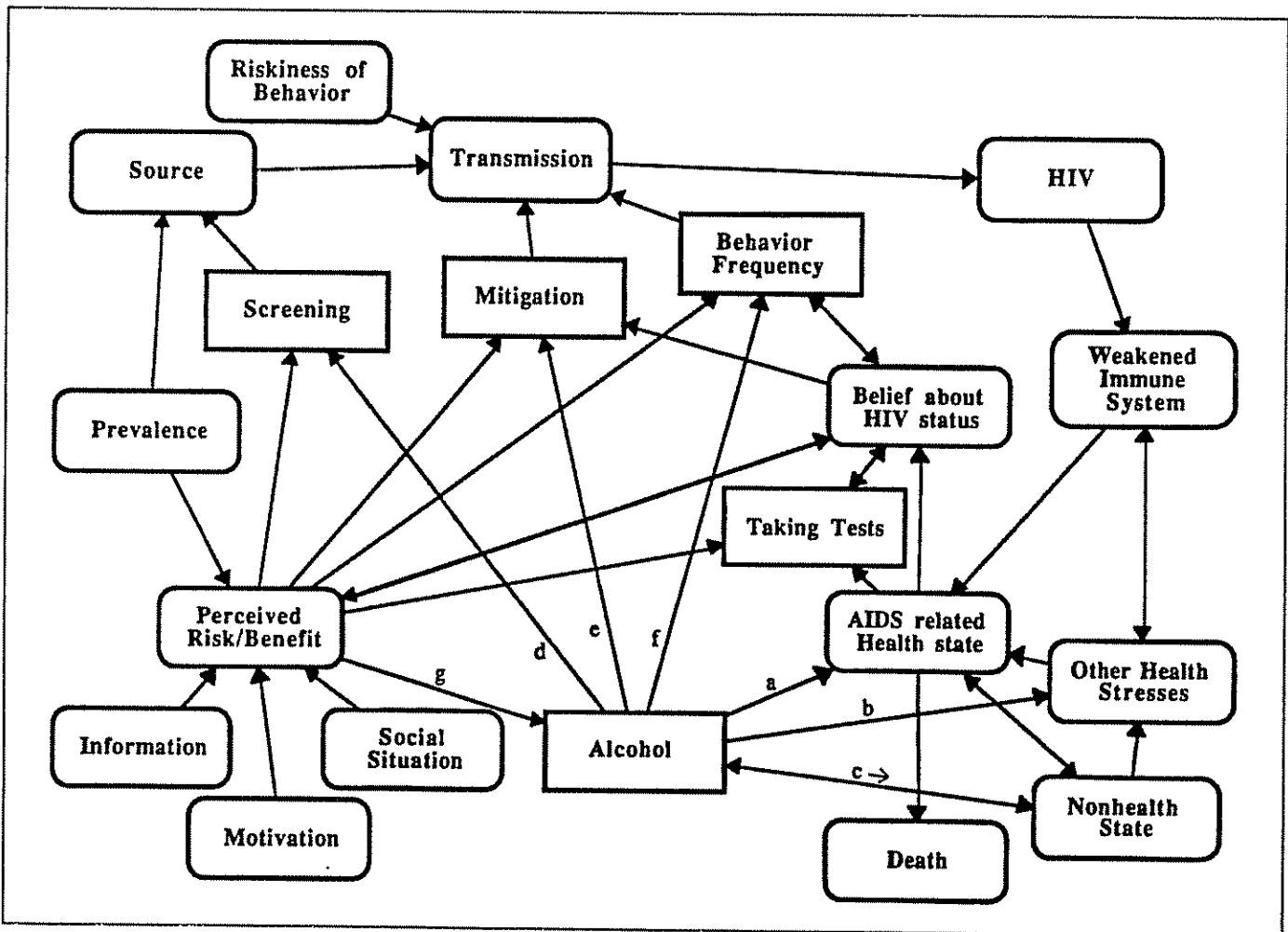


Fig. 1. Influence diagram for the AIDS epidemic. Variables in rectangles are set by deliberate choice other variables are set by natural processes. The value of the variable at the point of an arrow depends on the value of the variable at its tail. For example, chronic alcohol consumption can aggravate the disease (a), as well as create other health stresses and adverse nonhealth states (e.g., employment problems) (b,c). Episodic consumption can affect how (well) people screen potential sources of the virus (e.g., sex or drug partners), use mitigation strategies, and select potential risk behaviors (d,e,f). It can be affected, in turn, by people's beliefs about the risks and benefits associated with drinking (e.g., how important is it to keep their wits about them?) (g).

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**Table 2.** Context-dependent sensitivity to exposure (Quadrel, Fischhoff, & Palmgren, 1996)

Exposure	Ambiguous cause-and-effect relationship								
	Drunk driving and accident	Smoking and Cancer	Cocaine and addiction	Sex and AIDS	Smoking and addiction	Cocaine and poor health	Marijuana and clouded thinking	Alcohol and addiction	Sex and pregnancy
Amount	49	52	39	2	40	31	32	41	5
Potency	15	13	1	0	12	5	7	8	0
Method	4	3	7	4	1	10	10	1	4

*Note.* The numbers in the table indicate how many subjects (of 61 total) mentioned each exposure factor as being necessary to answer an ambiguous probability question. For example, 52 needed to know the amount (dose) of smoking in order to predict 'the probability of lung cancer from smoking.'"

background information required to make sense of them. However, a knowledge test (or communication) that addressed all significant links might still miss important misconceptions. As a result, knowledge assessment must begin with open-ended interviews, allowing intuitive theories to emerge (in respondents' natural language). Our own work has included several such approaches:

- Have people think aloud as they assess the probability of deliberately ambiguous events. Table 2 shows partial results from one such study that investigated the factors people said were needed to answer ambiguous probability questions. Overall, most of these teen respondents wanted to know the dose for seven of the nine events that they considered. The two exceptions were sex-related events; for neither did they see the risk as related to the number of exposures (Quadrel et al., 1996).
- Have people reflect on past and present decisions. In interviews with teens, we found that they were sensitive to many issues, but that their decisions followed very simple structures (e.g., decisions focused on a single option) (Fischhoff, 1996).
- Have people list all of a decision's options, consequences, and sources of uncertainty. In studies on preventing sexual assault, lay respondents seemed more sophisticated than experts assumed (Fischhoff, 1992).
- Have people describe how risky processes evolve and are controlled, gently drawing their attention to the major areas of the influence diagram (Morgan, Fischhoff, Bostrom, Lave, & Atman, 1992).

Studies using such strategies often find that people possess much relevant information—whose value is undermined by “bugs” in their understanding. For example, one study (Bostrom, Fischhoff, & Morgan, 1992) found that people knew that radon is a colorless, odorless, radioactive gas, but not that its radioactivity is short-lived. Believing that radon could permanently contaminate their homes needlessly discouraged people from testing for it. Another study (Leventhal & Cameron, 1987) found that confusion about hypertension's lack of visible symptoms interfered with patients' adherence to drug regimens. In ongoing studies, we find teens remarkably fluent with the public language of HIV, but confused about its details, such as how risk adds up through repeated exposure (Fischhoff, 1995b). Other researchers have also found confusion in related areas, such as what is meant by the term “safe sex” (McIntyre & West, 1992).

**DISCUSSION**

Any social science methodology makes a statement about the human condition. When it comes to focused interventions, details matter. Presuming to interfere with people's lives requires looking hard at their goals and predicament. Behavioral decision-making research provides some tools for this task, and some recurrent results from their application. One reason why it developed these particular approaches is its ethical neutrality. The intention is to help people achieve whatever goals they themselves happen to have. Behavioral decision making does not manipulate people beyond helping them to understand their desires (Fischhoff, 1991; Herrnstein, 1990; Ritov & Kahneman, in press).

Many other behavioral interventions, however, reflect a public-health perspective, a less accepting philosophy. They will do whatever it takes (within some ethical bounds) to evoke (or suppress) a behavior. Their interventions would resemble those of behavioral decision making only if recipients accept the communicator's values and behavior is cognitively driven. Otherwise, better information could help the recipients attain unacceptable ends.

Behavioral decision making makes no statement about the overall role of cognition in people's behavior. Rather, it asks how people think about decisions and how well they succeed at making good decisions—when they choose to try. The likelihood of trying to make a good decision should vary by person and situation. Some people have a higher need for cognition than others (Cacioppo & Petty, 1982); some situations seem more amenable to analysis than others. Possibly, people think more when they have better information and greater confidence in their own cognitive skills. Testing that proposition has theoretical importance for behavioral decision research and practical importance for behavioral interventions. Whatever its role, the cognitive part of an intervention needs to be done right. As experts, when we offer information, we hold people responsible for what we tell them. If our message is poorly selected and sloppily presented, then recipients may have little chance to understand and apply it.

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## REFERENCES

- Bostrom, A., Fischhoff, B., & Morgan, M.G. (1992). Characterizing mental models of hazardous processes: A methodology and an application to radon. *Journal of Social Issues*, 48(4), 85-100.
- Budescu, D.F., & Wallsten, T.S. (1995). Processing linguistic probabilities: General principles and empirical evidence. In J.R. Busemeyer, R. Hastie, & D.L. Medin (Eds.), *Decision making from a cognitive perspective* (pp. 275-318). New York: Academic Press.
- Cacioppo, J.T., & Petty, R.E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, 42, 116-131.
- Ewart, C. (1991). Social action theory for a public health psychology. *American Psychologist*, 46, 931-946.
- Fischhoff, B. (1985). Cognitive and institutional barriers to "informed consent." In M. Gibson (Ed.), *To breathe freely: Risk, consent, and air* (pp. 169-185). Totowa, NJ: Rowman & Allanheld.
- Fischhoff, B. (1991). Value elicitation: Is there anything in there? *American Psychologist*, 46, 835-847.
- Fischhoff, B. (1992). Giving advice: Decision theory perspectives on sexual assault. *American Psychologist*, 47, 577-588.
- Fischhoff, B. (1994). What forecasts (seem to) mean. *International Journal of Forecasting*, 10, 387-403.
- Fischhoff, B. (1995a). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis*, 15, 137-145.
- Fischhoff, B. (1995b). What do people need to know about AIDS? In *Accessing the social and behavioral science best for HIV/AIDS prevention and intervention: Background papers* (pp. 31-43). Washington, DC: Institute of Medicine, Division of Neuroscience and Behavioral Health.
- Fischhoff, B. (1996). The real world: What good is it? *Organizational Behavior and Human Decision Processes*, 65, 232-248.
- Fischhoff, B., & MacGregor, D. (1983). Judged lethality: How much people seem to know depends upon how they are asked. *Risk Analysis*, 3, 229-236.
- Gerrard, M., Gibbons, F.X., & Bushman, B.J. (1996). Relation between perceived vulnerability to HIV and precautionary sexual behavior. *Psychological Bulletin*, 119, 390-409.
- Herrstein, R. (1990). Rational choice theory. *American Psychologist*, 45, 356-367.
- Howard, R.A. (1989). Knowledge maps. *Management Science*, 35, 903-922.
- Leventhal, H., & Cameron, L. (1987). Behavioral theories and the problem of compliance. *Patient Education and Counseling*, 10, 117-138.
- Linville, P.W., Fischer, G.W., & Fischhoff, B. (1993). AIDS risk perceptions and decision biases. In J.B. Pryor & G.D. Reeder (Eds.), *The social psychology of HIV infection* (pp. 5-38). Hillsdale, NJ: Erlbaum.
- McIntyre, S., & West, P. (1992). What does the phrase "safer sex" mean to you? Understanding among Glaswegian 18 year olds in 1990. *AIDS*, 7, 121-126.
- Merz, J., Fischhoff, B., Mazur, D.J., & Fischbeck, P.S. (1993). Decision-analytic approach to developing standards of disclosure for medical informed consent. *Journal of Toxics and Liability*, 15, 191-215.
- Morgan, M.G., Fischhoff, B., Bostrom, A., Lave, L., & Atman, C.J. (1992). Communicating risk to the public. *Environmental Science and Technology*, 26, 2048-2056.
- National Research Council. (1989). *Improving risk communication*. Washington, DC: Author.
- Poulton, E.C. (1989). *Bias in quantifying judgment*. Hillsdale, NJ: Erlbaum.
- Quadrel, M.J., Fischhoff, B., & Palmgren, C. (1996). *Intuitive definitions of risk behaviors*. Manuscript submitted for publication.
- Quadrel, M.J., Fischhoff, B., & Davis, W. (1993). Adolescent (in) vulnerability. *American Psychologist*, 48, 102-116.
- Raiffa, H. (1968). *Decision analysis*. Reading, MA: Addison-Wesley.
- Ritov, I., & Kahneman, D. (in press). How people value the environment: Attitudes vs. economic values. In M. Bazerman, D. Messick, A. Tenbrunsel, & K. Wade-Benzoni (Eds.), *Environment and ethics: Psychological contributions*. San Francisco: Jossey-Bass.

