
Constructing Perceptions of Vulnerability: Personal Relevance and the Use of Experiential Information in Health Judgments

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The perceived self-relevance of a health issue determined whether participants relied on recalled content or experienced ease of recall in assessing risk. Participants recalled either three or eight behaviors that increase or decrease risk of heart disease. Although recalling three risk factors was relatively easy, people had difficulty recalling eight risk factors. When heart disease was not considered self-relevant, participants used a heuristic judgment strategy and relied on their ease of recall. They reported greater vulnerability after having recalled three rather than eight risk-increasing behaviors and lower vulnerability after having recalled three rather than eight risk-decreasing behaviors. When heart disease was considered self-relevant, people used a systematic processing strategy and relied on the content of the information recalled. They reported greater (lower) vulnerability after having recalled eight rather than three risk-increasing (decreasing) behaviors. Theoretical implications concerning the interplay of recalled content and ease of recall in judgment and applied implications for risk perception are discussed.

Nearly every day, information is disseminated to the public about a wide range of health threats. The media are replete with advice on what to do (e.g., exercise regularly) and what to avoid (e.g., a high-fat diet). Although the effectiveness of these informational interventions rests on people's ability to first evaluate the information and then integrate it into their perceptions of personal risk, the process by which risk perceptions are constructed is not well understood. Given an initial feeling of vulnerability, people presumably choose to adopt behaviors that reduce their risk or to curtail behaviors that increase their risk (Weinstein, Rothman, & Nicolich, 1998). Although perceptions of personal risk are responsive to actual behavioral practices (e.g., Ger-

rard, Gibbons, Benthin, & Hessling, 1996; van der Velde, van der Pligt, & Hooykaas, 1994), little is known about the selectivity with which people use information in forming judgments of risk (see Salovey, Rothman, & Rodin, 1998, for a review). This is surprising given the crucial role attributed to perceived vulnerability in nearly all theories of health behavior—for example, Health Belief Model (Rosenstock, Strecher, & Becker, 1988), Protection Motivation Theory (Rogers, 1983), and Theory of Reasoned Action (Ajzen & Fishbein, 1980).

Paralleling similar discussions in the attitude (e.g., Schwarz & Bless, 1992; Sudman, Bradburn, & Schwarz, 1996; Wilson & Hodges, 1992) and decision-making literatures (e.g., Payne, Bettman, & Johnson, 1993; Fischhoff, 1991), two general approaches to risk perception can be distinguished. In some accounts, risk perceptions are considered relatively stable beliefs that are retrieved from memory when needed. From this perspective, a temporary shift in the accessibility of risk-relevant information is thought not to alter perceived risk. Any change in perceived risk is assumed to reflect the conscious integration of new information. For example, a man might reassess his risk of heart disease after learning that heart disease runs in his family. Alterna-

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tively, risk perceptions can be conceptualized as the output of a context-specific judgment process. From this perspective, risk perceptions are constructed when needed. Because people do not consider all potentially relevant information but rather truncate the search process as soon they have formed a judgment with sufficient subjective certainty, these judgments should reflect the relevant information that is currently most accessible (e.g., Bodenhausen & Wyer, 1987). Accordingly, temporarily heightening the accessibility of factors that increase (or decrease) one's risk should raise (or lower) perceptions of personal risk.

This general accessibility hypothesis has been well supported in social cognition research (Higgins, 1996), but its focus on the content that comes to mind captures only part of the underlying processes. In addition to the implications of recalled content, the experienced ease with which the material can be brought to mind is informative in its own right, as proposed in Tversky and Kahneman's (1973) availability heuristic. Extending this theme, Schwarz et al. (1991) demonstrated that people may draw conclusions that seem to contradict the implications of accessible content when they find it difficult to bring the information to mind. For example, imagine that a health practitioner asks a man to list factors that increase his risk for heart disease. This task should render these risk factors more accessible, perhaps raising his perception of personal risk. However, imagine that he finds it difficult to generate a list of risk factors. In this case, he may interpret his experience of difficulty as indicating that there are only a few factors that increase his risk for heart disease and, hence, may infer that his risk is low. Accordingly, thinking of risk-increasing factors should raise perceptions of risk when they easily come to mind but should lower perceptions of risk when the recall task is experienced as difficult (see Rothman & Hardin, 1997; Schwarz et al., 1991; Wänke, Schwarz, & Bless, 1995, for examples from other research domains).

Given that recalled content and experienced ease or difficulty of recall may have different implications for a judgment, it is important to understand on which of these sources of information people are likely to draw. Do they habitually prefer one form of information over another, or do they selectively rely on accessible content and subjective accessibility experiences depending on features of the task? Given that nearly all social cognitive models rely on assumptions about the use of accessible information, the development of more sophisticated models is contingent on our ability to identify the parameters that guide the use of accessible content and subjective experiences in judgment (Hardin & Rothman, 1997; Higgins, 1996; Schwarz & Clore, 1996).

Although people's feelings of personal risk can accurately reflect their behavior as well as their knowledge

about a particular domain (e.g., Gerrard, Gibbons, & Warner, 1991; Rothman, Klein, & Weinstein, 1996), interventions that have forced people to reflect on their own behavior have not always altered risk judgments (Harris, 1996; Klein & Weinstein, 1997; Weinstein & Klein, 1995). The failure to consider the hypothesized interplay of accessible content and subjective accessibility experiences may help to explain the inconsistent pattern of findings. In the health domain, researchers have frequently emphasized the specific type of information (i.e., risk-increasing vs. risk-decreasing) considered prior to judgment. For example, Weinstein and Klein (Experiment 4) instructed participants to generate either risk-increasing or risk-decreasing factors prior to providing estimates of personal risk. Although rendering risk-decreasing factors salient led to lower perceptions of risk for a serious weight problem, a similar manipulation failed to alter perceptions of risk for a drinking problem. The relative ease with which information comes to mind has similarly been examined. People were less likely to think that they might catch a disease if it was described in terms of difficult-to-imagine as compared to easy-to-imagine symptoms (Sherman, Cialdini, Schwartzman, & Reynolds, 1985). Although this result could reflect the relative ease with which participants could imagine having the disease, it could also have been due to differences in the accessibility or familiarity of specific symptoms.

We believe that focusing solely on either accessible content or subjective accessibility experiences is insufficient to understand how people formulate risk judgments. In the present research, we sought to determine when people will rely on the amount of risk-relevant information brought to mind and when they will rely on the ease with which it came to mind. Specifically, immediately prior to providing judgments of personal risk, male college undergraduates recalled either three or eight factors that increase (or decrease) risk of heart disease. If people rely solely on accessible content in forming a risk judgment, they should evaluate their risk as higher after recalling eight rather than three risk-increasing factors and after recalling three rather than eight risk-decreasing factors. However, if people base their judgments on their subjective experiences of ease or difficulty of recall, the pattern of judgments should reverse. Provided that they find it more difficult to recall eight rather than three risk factors, they should evaluate their risk as lower after recalling eight rather than three risk-increasing factors and after recalling three rather than eight risk-decreasing factors.

What determines the particular type of accessible information on which people draw? In previous research, participants relied on the experienced ease or difficulty of recall unless the diagnosticity of this infor-

mation was called into question (Schwarz et al., 1991). Other aspects of the judgment task may similarly influence whether people rely on experiential information. The use of experienced ease of recall in judgment is considered a heuristic strategy (Tversky & Kahneman, 1973). Consistent with dual-process models of attitude change, we assume that people rely on a heuristic strategy unless an aspect of the decision-making process elicits more systematic processing of the available information (see Chaiken, Liberman, & Eagly, 1989; Eagly & Chaiken, 1993; Petty & Cacioppo, 1986). Perceiving the judgment task as personally relevant is one factor that has been shown to lead people to invoke a systematic processing strategy. If this is true, people should process health-related information systematically when the health issue is thought to be of personal relevance but process it heuristically when it is not.

Are judgments of personal risk always considered personally relevant? Although at first glance questions about personal risk would seem to be of substantial personal importance, this may not necessarily be true. Judgments of risk for distal events may not be seen as particularly relevant or meaningful, especially for young adults who generally hold optimistic views of their future (Taylor & Brown, 1988). One possible way to increase the personal relevance of a health issue is to focus people's attention on information that pertains directly to their own risk. In this case, a person who generated a list of risk factors based on their own personal history might be motivated to engage in a systematic processing strategy, whereas someone who generated a list of more general risk factors would be content to rely on the ease with which the information came to mind—a heuristic processing strategy.

However, having people consider information that directly pertains to themselves may not be sufficient to render the task personally meaningful. Recall that people are generally optimistic about their own risk. This sense of optimism may mitigate any impact of the personally relevant risk information, and this may be particularly true when people provide risk estimates that have little or no consequence for their own behavior. In fact, rendering self-relevant information about a health threat accessible may be taken as personally meaningful only to the extent that people have previously thought about the implications of this health issue for themselves. Smith (1994) has proposed that features of a situation that elicit the systematic processing of information may be particularly effective when similar information has been processed systematically in the past. If so, rendering the personal relevance of a health issue salient may elicit systematic processing strategies among people who are most likely to have previously considered the issue in a systematic and detailed manner. A background variable

that might serve to heighten the personal relevance of information related to heart disease is a family history of the disease. Specifically, people with a family history of heart disease may be more likely to find information that pertains directly to their own risk as sufficiently involving to engage in systematic processing. Moreover, people with a family history of heart disease may be more likely to have previously processed risk-relevant information systematically (Smith, 1994). In either case, we would predict that people with a family history of heart disease will be more sensitive to situational cues that elicit systematic processing than will be people without a family history of heart disease.

Given that bringing to mind factors that increase or decrease one's health risk could have the effect of either raising or lowering risk perceptions, it is not surprising that manipulating the accessibility of risk-relevant information has had a complex influence on risk judgments. In this study, we examine the selectivity with which people use accessible information in forming risk judgments within the context of two distinct instantiations of personal relevance: a situational manipulation of relevance based on the accessibility of information that does or does not directly pertain to one's personal risk and a dispositional instantiation of relevance based on whether someone has a family history of the health problem.

OVERVIEW AND HYPOTHESES

We recruited male college undergraduates to participate in a brief health survey that asked them to list either three or eight factors that either increase or decrease the risk of developing heart disease. Immediately following the recall task, participants answered a series of questions concerning the likelihood that they would develop heart disease at some point in their lives. The personal relevance of this issue was operationalized in two ways. First, we assessed whether participants had a family history of heart disease, assuming such a history would render the issue more personally relevant and indicate previous consideration of the issue. Although clinical records were not available, participants' reports reflect the subjective perception that there is a history of heart disease in the family. Given our interest in perceived relevance, this criterion was sufficient. A second, more situationally based manipulation of personal relevance had half of the participants list risk factors that pertained to themselves and the other half list factors that pertained to the average person.

This procedure allowed for the assessment of four distinct predictions. First, the failure to detect any systematic variation in perceptions of risk, other than a difference between people with and without a family

history of heart disease, would indicate that these perceptions are insensitive to temporary shifts in the accessibility of relevant information. This result would provide support for the hypothesis that risk perceptions are relatively stable beliefs stored in memory (Salovey et al., 1998). The observation that judgments of risk are sensitive to the accessibility of risk-relevant information would be consistent with a mental construal perspective. The specific outcome obtained, however, would depend on the underlying judgmental processes. If people draw on the implications of the information that is most accessible in memory, then they should provide higher estimates of personal risk after having thought about risk-increasing as compared to risk-decreasing factors (Higgins, 1996). Furthermore, this difference should be more pronounced when eight rather than three risk factors are rendered accessible and when these factors are personally relevant. A third prediction is that the implication of the accessible information is qualified by the experienced ease or difficulty with which the information is brought to mind (Schwarz et al., 1991; Tversky & Kahneman, 1973). In this case, thinking about risk-increasing (risk-decreasing) factors should result in judgments of greater (lower) risk when the recall task is experienced as easy as compared to when it is experienced as difficult.

However, we believe that the use of accessible content versus experienced ease or difficulty of recall will depend on the perceived personal relevance of the health issue. People who are not sufficiently involved with the judgment task should process information heuristically, relying on the ease with which risk-relevant information comes to mind. We assume this to be the default information processing strategy that people use. On the other hand, people who are personally involved with the judgment task should process information systematically, focusing on the content of the accessible information. In the context of the current experiment, we predict that the people most likely to engage in systematic processing are those with a family history of heart disease who have recalled information that pertains directly to their own risk. It is less clear whether merely having a family history of heart disease or considering self-relevant information in the absence of a family history will provide sufficient motivation for people to engage in systematic processing.

METHOD

Design

Participants were randomly assigned to one of eight conditions in a 2 (number of risk factors: 3, 8) \times 2 (type of risk factor: risk-increasing, risk-decreasing) \times 2 (target of risk factor: self, average man) factorial design. Based

on information collected at the close of the experiment, participants were categorized based on whether they reported having or not having a family history of heart disease. Thus, the complete factorial design employed in this experiment was a 2 (family history) \times 2 (number of risk factors) \times 2 (type of risk factor) \times 2 (target of risk factor) between-subjects design.

Participants

Research participants were recruited from a variety of locations across the University of Michigan campus and received no compensation. Agreeing to participate in this experiment were 167 male undergraduates; 155 provided completed questionnaires. Ten participants failed to complete either the generation task or the dependent measures, and 2 participants accidentally completed the dependent variables before the generation task. The sample of participants ranged in age from 17 to 30 years old (median = 20) and included a nearly equal proportion of freshman, sophomores, juniors, and seniors.

Materials

Generating risk factors. Participants were provided with a cover sheet indicating the investigators' interest in gathering general information about factors that influence the health status of college undergraduates. Each participant was told that to reduce respondent burden, he would be asked to respond to only one health issue. The first part of the questionnaire requested that the participants generate either three or eight factors that may increase (or, conversely, decrease) the risk of developing heart disease. The personal relevance of this information was manipulated by having half of the participants generate factors that pertained to their personal risk of developing heart disease and having the other half generate risk factors that pertained to the average man's risk of developing heart disease. For example, people who generated three personally relevant, risk-increasing factors received the following instructions: "We would like you to list 3 factors (e.g., behaviors, personal characteristics) that may increase your personal risk for developing HEART DISEASE some time in your life. Only list those factors that are personally relevant." Alternatively, those who generated eight risk-increasing factors pertaining to the average man received the following instructions: "We would like you to list 8 factors (e.g., behaviors, personal characteristics) that may increase the average man's risk for developing HEART DISEASE some time in his life." Participants were encouraged to be honest in their responses and were reminded that the information would remain

TABLE 1: Mean Perceptions of Difficulty in Generating Risk Factors by Family History of Heart Disease, Number of Risk Factors Generated, Type of Risk Factor Generated, and Target of Risk Factor Generated

Family History	Type of Risk Factor	Target of Risk Factor			
		Self		Average Man	
		Three Risk Factors	Eight Risk Factors	Three Risk Factors	Eight Risk Factors
Yes	Decreasing factor	3.30	4.40	2.89	4.55
	Cell size	10	10	9	9
	Increasing factors	4.09	5.41	2.67	5.36
	Cell size	11	12	9	11
No	Decreasing factors	2.54	5.87	3.00	5.70
	Cell size	11	8	11	10
	Increasing factors	2.62	4.87	2.80	6.00
	Cell size	8	9	10	8

NOTE: Judgments of difficulty were made on a 9-point scale. Higher values indicate greater difficulty.

anonymous and confidential. Finally, space was provided for them to provide the requested number of risk factors.

Perceptions of risk and concern. Following the generation task, all participants were asked to complete a brief questionnaire concerning their opinions about health issues. A series of five questions assessed their perceptions of (a) concern about the chance of personally suffering from heart disease, (b) the chance that they will suffer from heart disease some time in their life, (c) the need to change their current behavior to reduce the risk of developing heart disease, (d) the control they have over the chance that they will suffer from heart disease, and (e) the chance that the average man will suffer from heart disease some time in his life. All responses were recorded on 9-point Likert scales, with 1 indicating *not at all concerned, no chance, no need, or no control* and 9 indicating *very concerned, very likely, strong need, or a lot of control*.

Demographics and manipulation check. On a separate page, participants rated how difficult they found the earlier task of generating risk factors. The rating was made on a 9-point Likert scale ranging from 1 (*not at all difficult*) to 9 (*extremely difficult*). Finally, a series of yes/no questions assessed a participant's smoking status, whether he considered himself overweight, and whether there was a history of heart disease in his family.

Procedure

Participants were randomly assigned to one of eight experimental conditions and completed the questionnaire individually. After receiving brief verbal instructions concerning the survey, participants completed the generation task. After generating risk factors, they completed the health belief questionnaire, followed by the manipulation check and the demographic questions.

Finally, participants were debriefed about the experimental manipulation included in the survey.

RESULTS

Health Relevant Demographics

We first review the demographics of the sample because of its relevance to the pattern of risk judgments obtained. Of the 155 participants who completed the materials, 81 reported having a family history of heart disease. Responses to the remaining demographic questions revealed that the majority of men neither perceived themselves to be overweight (83%) nor identified themselves as smokers (75%). Of the sample, 17% considered themselves occasional smokers, and 8% identified themselves as regular smokers. Because of the small number of participants who either smoked or were overweight, the influence of these variables on judgment could not be examined.

The Relative Difficulty of Generating Risk Factors

As expected, participants found it more difficult to generate eight risk factors ($M = 5.26$) than to generate three risk factors [$M = 3.01$; $F(1, 139) = 72.27, p < .0001$]. However, there was a significant interaction between family history of heart disease and the number of risk factors generated, $F(1, 139) = 4.76, p < .05$. Although the generation manipulation was somewhat more effective for people without a family history of heart disease, the difference in difficulty between generating three and eight risk factors was significant in both family history comparisons [family history $t(79) = 4.47$ and no family history $t(72) = 7.74, ps < .0001$]. Table 1 presents the mean perception of difficulty in each condition, illustrating that across every comparison it was more difficult to generate eight than three risk factors.

TABLE 2: Mean Perceptions of Vulnerability to Heart Disease by Family History of Heart Disease, Number of Risk Factors Generated, Type of Risk Factor Generated, and Target of Risk Factor Generated

Family History	Type of Risk Factor	Target of Risk Factor			
		Self		Average Man	
		Three Risk Factors	Eight Risk Factors	Three Risk Factors	Eight Risk Factors
Yes	Decreasing factors	5.75	3.75	4.94	5.83
	Increasing factors	4.63	5.37	5.94	4.27
No	Decreasing factors	3.09	4.25	3.73	3.45
	Increasing factors	3.87	3.18	3.85	4.62

NOTE: Judgments of vulnerability were made on a 9-point scale. Higher values indicate greater vulnerability.

Judgments of Personal Vulnerability

The men who completed the health survey provided a series of judgments concerning their vulnerability to heart disease. Because judgments of personal risk and feelings of concern about personal risk were highly intercorrelated, $r(154) = .66$, $p < .0001$, they were combined into a single index. All other beliefs about heart disease were examined separately. Although the data were analyzed using a standard 2 (family history) \times 2 (number of risk factors) \times 2 (type of risk factor) \times 2 (target of risk factor) ANOVA, we have chosen to present the results of these analyses in a stepwise manner to illustrate the judgmental processes underlying the observed judgments of risk.

The simplest assumption to hold about perceptions of personal risk is that they represent stable attitudes and are therefore insensitive to temporary shifts in the accessibility of risk-relevant information. A quick inspection of the means presented in Table 2 indicates that participants' judgments did vary across experimental conditions. Hence, the findings are incompatible with the assumption that risk assessments reflect only stable attitudes retrieved from memory.

But what is the underlying nature of this sensitivity? Do perceptions of personal vulnerability reflect the relative accessibility of factors that increase or decrease one's risk? If so, participants who recalled risk-increasing factors should report greater feelings of vulnerability than those who recalled risk-decreasing factors. Moreover, this difference should be greater when the risk factors concern one's own behavior. A comparison of the judgments provided by participants who generated risk-increasing versus risk-decreasing factors revealed no significant difference in perceived vulnerability, $F < 1$. This held true even if the comparison was limited to participants who generated risk factors that pertained directly to their own risk, $F < 1$. Hence, the findings are also incompatible with the assumption that risk judgments simply reflect the implications of the most accessible risk information.

A third hypothesis was that risk judgments are based on the ease with which risk-relevant information comes to mind. Having a difficult time generating risk-increasing factors should result in lowered perceptions of vulnerability, whereas having a difficult time generating risk-decreasing factors should result in a heightened sense of vulnerability. Yet, the predicted interaction between the number and type of risk factor generated was not significant, $F < 1$.

Each of the preceding two hypotheses assumes that people consistently prefer one judgment strategy. However, attributes of both the situation and the participant may have influenced the specific judgmental strategy on which people relied. Not surprisingly, perceptions of risk were consistently higher among those participants who reported a family history of heart disease, $F(1, 139) = 34.74$, $p < .0001$. More important, this main effect was qualified by a significant four-way interaction between family history, number of risk factors, type of risk factor, and target of risk factor, $F(1, 139) = 21.38$, $p < .0001$. Perceptions of vulnerability were sensitive to the relative accessibility of risk-relevant information, but the nature of this effect was contingent on two aspects of the context in which the judgment was rendered: (a) whether someone had a family history of heart disease and (b) whether the risk factors generated pertained to one's own behavior and personal characteristics. The specific means underlying the interaction are presented in Table 2. To clarify the nature of the interaction, judgments of vulnerability were analyzed separately based on whether the information pertained directly to one's own personal risk.

Risk factors that concern one's own behavior and personality. First, consider judgments provided by participants who listed risk factors that pertained directly to their own risk. We expected that thinking about this information would elicit systematic processing but entertained the possibility that the self-relevance of the information might have more impact on those participants with a family history of heart disease. The data supported the latter expecta-

tion. Family history of heart disease moderated the influence of information on judgment, as indicated by a significant Family History \times Number of Risk Factors \times Type of Risk Factor interaction, $F(1, 70) = 13.06, p < .001$. In the absence of a family history of heart disease, people relied on the relative ease or difficulty with which risk factors had come to mind in determining their vulnerability to developing heart disease, $F(1, 31) = 5.13, p < .05$. Specifically, they reported higher perceptions of personal vulnerability after generating eight rather than three risk-decreasing factors but reported lower perceptions of personal vulnerability after generating eight rather than three risk-increasing factors. This pattern of results reflects a heuristic strategy and was obtained even though participants had recalled risk factors that pertained to their own risk.

A different pattern of judgments was obtained among participants who reported a family history of heart disease. In this case, judgments of vulnerability were a function of the number of personally relevant risk-factors that had been generated, as revealed by the significant number of risk factors by type of risk factor interaction, $F(1, 39) = 8.70, p < .01$. Specifically, these participants reported higher perceptions of vulnerability after having generated eight rather than three risk-increasing factors and lower perceptions of vulnerability after having generated eight rather than three risk-decreasing factors. This pattern of results reflects a systematic processing strategy and was obtained even though participants consistently found it more difficult to generate eight risk factors.

In summary, when our participants generated personally relevant risk factors, men with a family history of heart disease relied on a systematic processing strategy, drawing on the content of the information they had recalled. In contrast, men without a family history of heart disease relied on a heuristic processing strategy, drawing on the experienced ease or difficulty with which information came to mind. In combination, these findings suggest that simply focusing on self-relevant information is not sufficient to elicit systematic processing in the absence of additional factors that augment the perceived relevance of that information (e.g., family history). This observation is also consistent with the prediction that situational factors are more likely to prompt systematic processing if an issue has previously been thought about in a detailed manner (Smith, 1994).

Risk factors that concern the average man's behavior and personality. Next, consider judgments made by participants who listed risk factors that pertained to the average man. We expected that thinking about risk factors in more general terms would be less likely to elicit a systematic processing strategy. Again, the data supported this assumption. Although the Family History \times Number of

Risk Factors \times Type of Risk Factor interaction was significant, $F(1, 69) = 8.51, p < .005$, the pattern of simple effects underlying this interaction differed from that identified in the preceding analyses. Risk judgments provided by participants without a family history of heart disease were unaffected by the relative accessibility of risk-increasing or risk-decreasing factors.¹ In the absence of a family history of heart disease, they apparently considered both the content and the ease with which general risk information came to mind irrelevant to judgments of personal risk.

The risk judgments provided by people with a family history of heart disease were sensitive to the accessibility of information about the general risk of heart disease but in a manner different from thinking about personally relevant risk factors. In this case, perceptions of vulnerability reflected the ease with which risk factors concerning the average man came to mind, $F(1, 34) = 11.52, p < .005$. Specifically, participants who generated eight risk-increasing factors reported lower perceptions of risk than those who generated only three risk-increasing factors, whereas those who generated eight risk-decreasing factors reported higher perceptions of risk than those who generated only three risk-decreasing factors. Although people with a family history of heart disease found general information about the risk of heart disease to be pertinent to judgments of personal vulnerability, they did not process this information systematically, presumably because risk factors that pertained to the average man were not sufficiently self-relevant.

Summary. These findings suggest that participants' family histories of heart disease and the personal relevance of the risk factors generated had an additive effect on participants' involvement with the judgment task. Specifically, situationally heightening the relevance of the health information invoked systematic processing—but only among those people who had an additional reason to find the issue personally relevant (i.e., a family history of heart disease). In situations in which only one factor heightened personal relevance (i.e., family history, relevance of the risk factors), people consistently relied on the ease with which information came to mind, that is, a heuristic strategy. Finally, the influence on judgment of either type of accessible information was contingent on a minimum degree of perceived relevance, as indicated by the judgments provided by those participants who had both no prior connection to the health issue and considered risk factors that pertained to the average man.

Beliefs About Personal Risk-Relevant Behavior

In addition to providing judgments of personal vulnerability, participants estimated their need to change

TABLE 3: Mean Perceptions of the Need to Change Current Behavior to Reduce the Risk of Developing Heart Disease by Family History of Heart Disease, Number of Risk Factors Generated, Type of Risk Factor Generated, and Target of Risk Factor Generated

Family History	Type of Risk Factor	Target of Risk Factor			
		Self		Average Man	
		Three Risk Factors	Eight Risk Factors	Three Risk Factors	Eight Risk Factors
Yes	Decreasing factors	5.20	4.70	4.33	5.44
	Increasing factors	3.63	6.25	5.67	4.27
No	Decreasing factors	3.00	5.62	3.54	4.60
	Increasing factors	3.37	2.87	3.00	4.62

NOTE: Judgments concerning the need to change current behavior were made on a 9-point scale. Higher values indicate a greater need to change.

current, risk-relevant behavior and the degree to which they control their chance of developing heart disease.

Behavior change. A 2 (family history) \times 2 (number of risk factors) \times 2 (type of risk factor) \times 2 (target of risk factor) ANOVA on judgments concerning the need to change one's behavior revealed a significant four-way interaction, $F(1, 139) = 15.79, p < .0001$. The pattern of effects underlying this interaction replicated that observed for judgments of vulnerability (see Table 3 for relevant means). When participants generated factors that pertained directly to their own risk, the influence of information on judgment depended on whether there was a family history of heart disease, $F(1, 70) = 13.79, p < .0005$. Men without a family history of heart disease provided judgments that were a function of the ease with which risk-relevant information came to mind. They expressed the greatest need to change their behavior after having either a difficult time generating eight risk-decreasing factors or an easy time generating three risk-increasing factors, $F(1, 31) = 8.26, p < .01$. Men with a family history of heart disease provided judgments that reflected the number of risk-factors they had generated. They expressed the greatest need to change their behavior after having generated either three risk-decreasing behaviors or eight risk-increasing behaviors, $F(1, 39) = 6.46, p < .02$.

Participants responded differently to the accessibility of risk factors that pertained to the average man. Although the three-way interaction between family history, type of risk factor, and number of risk factors was only marginally significant, $F(1, 69) = 3.54, p < .07$, the underlying pattern of judgments was consistent with that previously observed. In forming their judgments, men with a family history of heart disease relied on the ease with which risk factors pertaining to the average man came to mind. They expressed a greater need to change their behavior after having either a difficult time generating eight risk-decreasing factors or an easy time generating three risk-increasing factors, $F(1, 34) = 5.01, p < .04$. Unexpectedly, men without a family history of heart disease expressed a stronger need to change their behav-

ior after having generated eight risk factors regardless of whether they were risk-increasing or risk-decreasing factors, $F(1, 35) = 5.08, p < .05$.

Perceived control. Perceptions of control over developing heart disease were consistently high across all experimental conditions. Although judgments of control were sensitive to the number of risk factors previously generated, this effect was qualified by a significant Number of Risk Factors \times Target of Risk Factor interaction, $F(1, 139) = 3.87, p = .05$. Perceptions of control were significantly lower when participants had listed only three personally relevant risk factors ($M = 5.47$) as compared to those generated in the other three conditions (eight personally relevant factors $M = 6.60$, three average man factors $M = 6.46$, eight average man factors $M = 6.47$).

Perceptions of the Average Man's Vulnerability

Finally, judgments of the average man's risk for developing heart disease were examined. The ANOVA revealed a significant Number of Risk Factors \times Type of Risk Factor \times Target of Risk Factor interaction, $F(1, 139) = 14.66, p < .0005$. The four-way interaction including family history did not approach significance, $F(1, 139) = 2.03, p < .16$. As can be seen in Table 4, the pattern of risk judgments obtained differed depending on whether the risk factors did or did not concern one's own personal and behavior personal risk. Judgments of vulnerability reflected the number of risk factors generated when they were personally relevant, but they reflected the ease with which the risk factors came to mind when they pertained to the average man, $F(1, 74) = 7.83$ and $F(1, 73) = 8.51, ps < .01$.²

GENERAL DISCUSSION

Although complex, the present findings and their implications are easy to summarize. First, we note that assessments of health risk are the output of a context-specific judgment process and do not reflect stable attitudes recalled from memory. This, of course, is not surprising given the broad range of findings that support a construal approach in the domain of attitude research

TABLE 4: Mean Perceptions of the Average Man's Risk of Developing Heart Disease by Number of Risk Factors Generated, Type of Risk Factor Generated, and Target of Risk Factor Generated

Type of Risk Factor	Target of Risk Factor			
	Self		Average Man	
	Three Risk Factors	Eight Risk Factors	Three Risk Factors	Eight Risk Factors
Decreasing factors	5.42	4.66	4.70	5.15
Increasing factors	5.05	5.75	5.57	4.68

NOTE: Judgments of vulnerability were made on a 9-point scale. Higher values indicate greater vulnerability.

(see Schwarz & Bless, 1992; Schwarz & Sudman, 1992; Sudman et al., 1996; Tourangeau & Rasinski, 1988; Wilson & Hodges, 1992, for reviews) and decision making (see Payne et al., 1993, for a review). Second, we emphasize that the context dependency of these judgments does not follow the straightforward accessibility notion inherent in many models of social cognition (e.g., Bodenhausen & Wyer, 1987; Sedikides & Skowronski, 1991; Wyer & Srull, 1989). According to these models, judgments reflect the information that is most accessible in memory. Hence, heightening the accessibility of risk-increasing or risk-decreasing factors should have the effect of raising or lowering judgments of personal vulnerability, respectively. This perspective fails to recognize that retrieving information from memory provides two distinct sources of information: the content that is retrieved and the experienced ease or difficulty with which it is brought to mind (Schwarz et al., 1991). Ironically, these two sources of information can lead to different conclusions. Judgments will correspond to the content of the information recalled when the recollection task is experienced as easy but not when it is experienced as difficult.

Although the interplay of accessible content and subjective accessibility experiences has been demonstrated in our previous research (Rothman & Hardin, 1997; Schwarz et al., 1991; Wänke et al., 1995), the present study extends this work in important ways. Specifically, the present findings indicate that the use of content versus ease of recall depends not only on the perceived diagnosticity of the information but also on the perceived relevance of the judgment task. In general, reliance on subjective accessibility experiences reflects a heuristic judgment strategy, as suggested by Tversky and Kahneman's (1973) availability heuristic. The likelihood that people rely on heuristic processing is thought to decrease as the perceived personal relevance of a task increases (Chaiken et al., 1989). In the present study, perceived relevance was varied through a task manipulation (risk factors pertaining to oneself or the average man) and participants' family history of heart disease. Importantly, we observed systematic processing only when both factors operated in combination—that is,

when participants with a family history of heart disease thought about self-related risk factors. This observation is consistent with a framework outlined by Smith (1994), who suggested that a given processing strategy is more likely to be evoked when it has been used for similar issues in the past. Yet, a family history of heart disease was not sufficient in and of itself to evoke systematic processing. When the accessible information pertained to the average man, participants relied on their ease of recall. Finally, participants without a family history of heart disease relied on a heuristic processing strategy when the recall task involved self-relevant risk factors but were unaffected by the recall task when it pertained to the average man. Taken together, these findings suggest that attention must be paid to features of both the person and situation if one is to accurately predict the selective use of accessible information.

Applied Implications

Beginning with research on the persuasiveness of fear-based appeals (e.g., Janis, 1967; Leventhal, 1970), it has become increasingly clear that people respond to risk-relevant information in a myriad of ways. The present findings contribute to this complexity by demonstrating that merely bringing risk-related information to mind is insufficient to predict its impact. On the positive side, we note that people who are aware that they may be particularly vulnerable to a given health threat—such as those with a family history of the disease—were likely to attend to risk-related information. When this information did not concern one's own behavior or personality, these people were likely to process it in a heuristic manner, as was the case in the present study for information pertaining to the average man. Although this information influenced perceptions of risk, the specific form of its influence was not particularly adaptive, as these participants inferred lower risk the more risk-increasing factors they identified.

Moreover, changes in risk perception that are based on a heuristic processing strategy may be short-lived because heuristic strategies do not foster any elaboration of the possible implications for oneself. In contrast, when risk-related information is personally relevant,

people who are aware of their potential vulnerability appear likely to process it systematically. This may foster its integration into existing knowledge structures, thus rendering its influence potentially more enduring. Finally, people who do not consider themselves particularly vulnerable appear unaffected by general risk information. They do, however, attend to information that is self-related but seem likely to process this information in a heuristic manner, again rendering the form of its impact undesirable.

The present findings also bear on the discussion of self-serving biases in judgments of health risk. In the present study, participants could potentially infer high or low risk, depending on whether they chose to draw on the content or the ease of recall. To the extent that people are motivated to minimize their perceived risk for a serious health threat, as suggested by Taylor and Brown (1988), one might expect they would selectively emphasize the particular source of information that implies their risk is low (see also, Kunda, 1990). For example, people might rely on experiential information after easily recalling a handful of risk-decreasing factors but focus on the (small) amount of information accessible when risk-increasing factors have easily come to mind. Yet, there was no indication in the present study that people relied on accessible information solely to minimize their perceived personal risk. Rather, changes in either accessible content or experienced ease or difficulty resulted in both raised and lowered perceptions of personal risk, depending on the judgment strategy chosen. Even those participants who were personally involved with the issue were willing to draw on information that raised their perceptions of risk. However, there are likely situations in which health information will be processed in a biased fashion. For example, Liberman and Chaiken (1992) have elegantly demonstrated that increased personal relevance can elicit the biased assessment of new, threatening health information. In that case, participants had the opportunity to argue against the validity of the information that they were given to read, which is not as easy to do when people generate the relevant information for themselves.

Evidence for the selective use of different sources of information may potentially be obtained when a relevant moderating variable is taken into account. Across a provocative series of studies, Gerrard and her colleagues observed that people low in self-esteem are more likely to increase their perceptions of risk in response to relevant information than people high in self-esteem (e.g., Gerrard, Kurylo, & Reis, 1991; Gibbons, Eggleston, & Benthin, 1997; Smith, Gerrard, & Gibbons, 1997). People high in self-esteem would appear to possess cognitive strategies that enable them to avoid acknowledging risk-enhancing information. The observation that the man-

ner in which people process information is contingent on their prior experience and skills is conceptually analogous to the current finding concerning people with a family history of heart disease. However, it is an open issue whether people high in self-esteem would selectively draw on experienced ease versus content of recall in judgment. If they did, the present set of findings should be obtained only for people low in self-esteem. Given the size of the obtained effects, we consider it unlikely that they are solely due to participants low in self-esteem; yet, a more direct test is needed to address this issue.

Finally, the methodology employed in the present experiment might be taken to suggest that these findings pertain only to situations in which an individual has personally recalled information about a health issue. In many cases, however, the subjective experience of ease may be directly affected by the health information provided by others. Sherman et al. (1985) observed that describing a disease with a set of difficult-to-imagine symptoms reduced people's perceptions that they might contract the disease. Moreover, experiences of ease or difficulty may be elicited whenever people try to relate risk information to their own personal situation. For example, learning that a diet high in fat increases one's risk of heart disease is unlikely to affect behavior unless one concludes that one's diet is indeed high in fat. In making this determination, one may consider the number of greasy meals recently eaten or the ease with which they can be brought to mind, much as illustrated in the present experiment. Accordingly, the interplay of accessible content and subjective accessibility experiences may play a crucial role in determining the lessons people draw from messages designed to alert them to health risks.

In conclusion, our findings suggest that people primarily rely on the ease with which information comes to mind but may draw on the specific content of the information retrieved when a judgment task is considered sufficiently relevant to motivate a systematic processing strategy. That people use different sources of information depending on the particular processing style adopted is consistent with other research on dual-process models of judgment and attitude change (Chaiken et al., 1989; Petty & Cacioppo, 1986). However, it is not the case that having people consider self-relevant information automatically elicits the systematic processing of accessible information. The facility with which features of the situation elicit a specific processing style appear to be a function of an individual's prior experience in a particular domain of judgment. This previously unobserved contingency may underlie apparent inconsistencies in the literature on health risk perception, which is an issue that awaits further research.

NOTES

1. Although perceptions of vulnerability appeared somewhat higher after participants generated risk-increasing factors, this effect was not significant, $F(1, 35) = 1.76, p < .20$.

2. Because the pattern of finding paralleled that previously observed only among men with a family history of heart disease, additional analyses were conducted separately for men with and without a family history of heart disease. Analyses of the judgments provided by men with a family history of heart disease were consistent with the pattern of results obtained on other dependent variables. Analyses of the judgments provided by men without a family history of heart disease revealed only that perceptions of the average man's risk were consistently higher when risk-increasing factors had been generated, $F(1, 66) = 4.35, p < .05$. Thus, although the overall four-way interaction was not significant, the underlying pattern of judgment suggests that the observed effects were primarily a function of judgments provided by people with a family history of heart disease.

Perception of the average man's risk for heart disease can also be compared to participants' perception of their own risk. People with a family history of heart disease consistently perceived little difference between their own risk and the average man's risk ($M = -.37$). People without a family history of heart disease perceived their own risk to be lower than that of the average man ($M = -1.52$), although the relative size of this discrepancy did vary somewhat across conditions.

REFERENCES

- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice Hall.
- Bodenhausen, G. V., & Wyer, R. S. (1987). Social cognition and social reality. In H. J. Hippler, N. Schwarz, & S. Sudman (Eds.), *Social information processing and survey methodology* (pp. 6-41). New York: Springer-Verlag.
- Chaiken, S., Liberman, A., & Eagly, A. H. (1989). Heuristic and systematic processing within and beyond the persuasion context. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 215-252). New York: Guilford.
- Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. New York: Harcourt Brace Jovanovich.
- Fischhoff, B. (1991). Value elicitation: Is there anything there? *American Psychologist*, *46*, 835-847.
- Gerrard, M., Gibbons, F. X., Benthin, A. C., & Hessling, R. M. (1996). The reciprocal nature of risk behaviors and cognitions: What you do shapes what you think, and vice versa. *Health Psychology*, *15*, 344-354.
- Gerrard, M., Gibbons, F. X., & Warner, T. D. (1991). Effects of reviewing risk-relevant behavior on perceived vulnerability. *Health Psychology*, *10*, 173-179.
- Gerrard, M., Kurylo, M., & Reis, T. (1991). Self-esteem, erotophobia, and retention of contraceptive and AIDS information in the classroom. *Journal of Applied Social Psychology*, *21*, 368-379.
- Gibbons, F. X., Eggleston, T. J., & Benthin, A. C. (1997). Self-esteem maintenance among relapsed members of smoking cessation clinics. *Journal of Personality and Social Psychology*, *72*, 184-195.
- Hardin, C. D., & Rothman, A. J. (1997). Rendering accessible information relevant: The applicability of everyday life. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 10, pp. 143-156). Hillsdale, NJ: Lawrence Erlbaum.
- Harris, P. (1996). Sufficient grounds for optimism?: The relationship between perceived controllability and optimistic bias. *Journal of Social and Clinical Psychology*, *15*, 9-52.
- Higgins, E. T. (1996). Knowledge: Accessibility, applicability, and salience. In E. T. Higgins & A. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133-168). New York: Guilford.
- Janis, I. L. (1967). Effects of fear arousal on attitude change: Recent developments in theory and experimental research. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 3, pp. 166-224). New York: Academic Press.
- Klein, W. M., & Weinstein, N. D. (1997). Social comparison and unrealistic optimism about personal risk. In B. P. Buunk & F. X. Gibbons (Eds.), *Health, coping, and social comparison* (pp. 25-62). Hillsdale, NJ: Lawrence Erlbaum.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, *108*, 480-498.
- Leventhal, H. (1970). Findings and theory in the study of fear communications. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 6, pp. 119-186). New York: Academic Press.
- Liberman, A., & Chaiken, S. (1992). Defensive processing of personally relevant health messages. *Personality and Social Psychology Bulletin*, *19*, 669-679.
- Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. New York: Cambridge University Press.
- Petty, R. E., & Cacioppo, J. T. (1986). The Elaboration Likelihood Model of persuasion. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 19, pp. 123-205). New York: Academic Press.
- Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. T. Cacioppo & R. E. Petty (Eds.), *Social psychophysiology* (pp. 153-176). New York: Guilford.
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, *15*, 175-183.
- Rothman, A. J., & Hardin, C. D. (1997). Differential use of the availability heuristic in social judgment. *Personality and Social Psychology Bulletin*, *23*, 123-138.
- Rothman, A. J., Klein, W. M., & Weinstein, N. D. (1996). Absolute and relative biases about personal risk. *Journal of Applied Social Psychology*, *26*, 1213-1236.
- Salovey, P., Rothman, A. J., & Rodin, J. (1998). Health behavior. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* Vol. 2 (4th ed., pp. 633-683). New York: McGraw-Hill.
- Schwarz, N., & Bless, H. (1992). Constructing reality and its alternatives: Assimilation and contrast effects in social judgment. In L. L. Martin & A. Tesser (Eds.), *The construction of social judgment* (pp. 217-245). Hillsdale, NJ: Lawrence Erlbaum.
- Schwarz, N., Bless, H., Strack, F., Klumpp, G., Rittenauer-Schatka, H., & Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology*, *61*, 195-202.
- Schwarz, N., & Clore, G. L. (1996). Feelings and phenomenal experiences. In E. T. Higgins & A. Kruglanski (Eds.), *Social psychology: A handbook of basic principles* (pp. 433-465). New York: Guilford.
- Schwarz, N., & Sudman, S. (Eds.) (1992). *Context effects in social and psychological research*. New York: Springer-Verlag.
- Sedikides, C., & Skowronski, J. J. (1991). The law of cognitive structure activation. *Psychological Inquiry*, *2*, 169-184.
- Sherman, S. J., Cialdini, R. B., Schwartzman, D. F., & Reynolds, K. D. (1985). Imagining can heighten or lower the perceived likelihood of contracting a disease: The mediating effect of ease of imagery. *Personality and Social Psychology Bulletin*, *11*, 118-127.
- Smith, E. R. (1994). Procedural knowledge and processing strategies in social cognition. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd edition, pp. 99-152). Hillsdale, NJ: Lawrence Erlbaum.
- Smith, G. E., Gerrard, M., & Gibbons, F. X. (1997). Self-esteem and the relation between risk behavior and perceptions of vulnerability to unplanned pregnancy in college women. *Health Psychology*, *16*, 137-146.
- Sudman, S., Bradburn, N., & Schwarz, N. (1996). *Thinking about answers: The application of cognitive processes to survey methodology*. San Francisco, CA: Jossey-Bass.
- Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, *103*, 193-210.
- Tourangeau, R., & Rasinski, K. A. (1988). Cognitive processes underlying context effects in attitude measurement. *Psychological Bulletin*, *103*, 299-314.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, *5*, 207-232.
- van der Velde, F. W., van der Pligt, J., & Hooykaas, C. (1994). Perceiving AIDS-related risk: Accuracy as a function of difference in actual risk. *Health Psychology*, *13*, 25-33.

- Wänke, M., Schwarz, N., & Bless, H. (1995). The availability heuristic revisited: Experienced ease of retrieval in mundane frequency estimates. *Acta Psychologica, 89*, 83-90.
- Weinstein, N. D., & Klein, W. M. (1995). Resistance of personal risk perceptions to debiasing interventions. *Health Psychology, 14*, 132-140.
- Weinstein, N. D., Rothman, A. J., & Nicolich, M. M. (1998). Using correlational data to examine the effects of risk perceptions on precautionary behavior. *Psychology & Health, 13*, 479-501.
- Wilson, T. D., & Hodges, S. D. (1992). Attitudes as temporary constructions. In L.L. Martin & A. Tesser (Eds.), *The construction of social judgments* (pp. 37-65). Hillsdale, NJ: Lawrence Erlbaum.
- Wyer, R. S., & Srull, T. K. (1989). Memory and cognition in its social context. Hillsdale, NJ: Lawrence Erlbaum.

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