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An Emotion-Based Model of Risk Perception and Stigma Susceptibility: Cognitive Appraisals of Emotion, Affective Reactivity, Worldviews, and Risk Perceptions in the Generation of Technological Stigma†

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A study ($N = 198$) was conducted to examine hypotheses derived from an emotion-based model of stigma responses to radiation sources. A model of *stigma susceptibility* is proposed in which affective reactions and cognitive worldviews activate predispositions to appraise and experience events in systematic ways that result in the generation of negative emotion, risk perceptions, and stigma responses. Results of structural equation modeling supported the hypotheses. Radiation sources that scored higher on a measure of stigma were included in the analyses (i.e., nuclear power plants, radioactive waste from nuclear power plants, radiation from nuclear weapons testing). Individual differences in negative reactivity and worldviews were associated with the strength of emotional appraisals that were associated, in turn, with negative emotion toward stigmatized radiation sources. As hypothesized, the model fit better with perceived risk as a function of negative emotion rather than *vice versa*. Finally, a measure of stigma was associated with negative emotion and, to a lesser extent, with risk perceptions. Risk communication about stigmatized objects may benefit from a more complete understanding of how affective and emotional reactions are constructed and the routes through which they affect responses and behaviors.

KEY WORDS: Affect; emotion; risk communication; risk perception; stigma

1. INTRODUCTION

People respond to hazards according to their perceptions of the risks they pose. The public's top risk concerns, however, do not always agree with those of the experts (Roberts, 1990), leaving government and industry groups with the difficult task of choosing between the rationality of science and the "rival rationality" of the public (Slovic, 2000). The policies of federal agencies may then appear to reflect the public's views rather than those of their own scientists. What the public perceives, why they perceive it that way, and how they will subsequently behave are matters of great import to industries and governments trying to assess and implement technologies.

In the present article, we examine the interaction between two psychological systems—emotion and cognition—and their joint influence on perceptions and acceptability of risks, with particular emphasis on perceptions of radiation sources. We suggest which feelings and thoughts may matter most and

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use structural equation models to test hypotheses concerning how they likely combine.

1.1. Risk Perception, Cognition, Emotion, and Affect

Most psychological studies on risk perception have focused on the cognitive forces that shape risk attitudes and behaviors[3] (e.g., Slovic *et al*., 1979; see Slovic, 2000 for a review). Research following a psychometric paradigm, for example, has led to a factor space for hazards useful for understanding and predicting responses to risks (Slovic, 1987). Specifically, this work suggests that the risk perceptions of laypeople are based on a range of complex and richer considerations than the two variables—the number of lives at stake and the probability of harm—on which the experts focus. Risk perceptions are characterized along two dimensions—*dread risk*, as defined by the extent of perceived lack of control, feelings of dread, perceived catastrophic potential, and the inequitable distribution of risks and benefits; and *unknown risk*, or the extent to which a hazard is judged to be unobservable, unknown, new, and delayed in producing harmful impacts. These simplified cognitive maps appear useful in explaining public reaction to specific technologies. For example, hazards such as nuclear power and DNA technology tend to be judged high on both the dread risk and unknown risk factors. An accident in either of these domains will likely produce a high degree of concern as well as social impacts that extend far beyond the original cost of lives lost or equipment damaged. In the present article, we examine a cognitive appraisal theory of emotion and argue that risk perceptions are primarily emotional phenomena with the emotions inextricably linked to how we think about technologies and what is communicated to us about those technologies.

1.1.1. Affect and Risk Perceptions

Recent psychological work has identified affect and emotion as key ingredients in risk perceptions (Slovic *et al*., 2004). Loewenstein *et al*. (2001), for example, argued that risk perceptions are feelings that also include a cognitive, thinking component. Affect is defined in the present article as good or bad feelings toward an external stimulus (e.g., a city or a consumer good). It is considered integral to a stimulus such as a technological risk in that it is part of that stimulus's representation in the mind of the perceiver. Affect may become associated with an object through careful thought, but also through experiential processes, such as conditioning, familiarity, and priming (Hess *et al*., 2000; Staats & Staats, 1958; Zajonc, 1980).

[3] Some of these "cognitive" forces, however, have an emotional flavor (e.g., the "dread risk" factor described later in the paragraph).

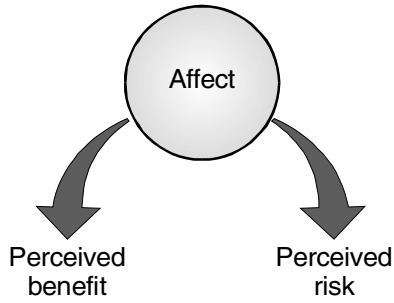

Fig. 1. A model of the affect heuristic explaining the risk/benefit confounding observed by Alhakami and Slovic (1994). Judgments of risk and benefit are assumed to be derived by reference to an overall affective evaluation of the stimulus item.
Source: Finucane *et al*. (2000).

Support for the relationship between affect and risk perceptions comes from a variety of sources. Whereas risk and benefit tend to be positively correlated in the world (e.g., if a stock is riskier, it tends to offer a higher return as well), they are negatively correlated in people's minds (e.g., herbal medicines are perceived as high benefit and low risk). This inverse relationship between perceived risk and perceived benefit of an activity, however, appears to be linked to the strength of positive or negative affect associated with that activity (Alhakami & Slovic, 1994). Their results imply the use of an "affect heuristic" (see Fig. 1, Slovic *et al*., 2002); people appear to base their judgments of an activity or a technology not only on what they think about it but also on how they feel about it. If they feel that an activity is good, they appear to judge risks as low and benefits as high; if they feel that it is bad, they may judge the opposite—high risk and low benefit. Under this model affect comes prior to, and directs, judgments of risk and benefit.

Finucane *et al*. (2000) provided further tests of this model and demonstrated that giving information about benefit changed the perception of risk and *vice versa* (see Fig. 2). For example, information stating that benefit is high for a technology such as nuclear power led to more positive overall affect that, in turn, decreased perceived risk (Fig. 2A). They also tested and supported the hypothesis that less deliberation, as a result of time pressure, greatly increased the inverse relationship between perceived risks and benefits. These two experiments are important because they demonstrate that affect influences judgment directly and is not simply a response to a

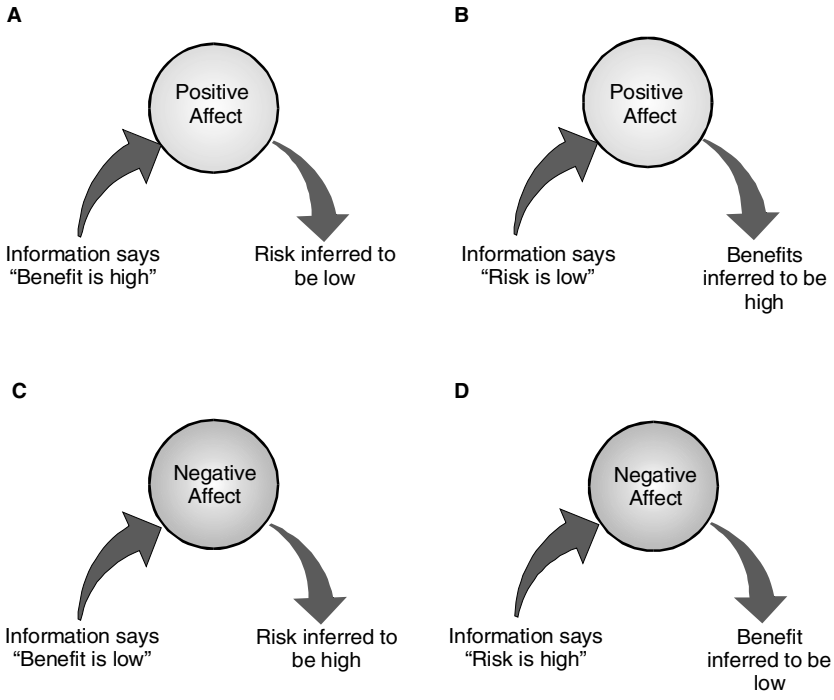

Fig. 2. Model showing how information about benefit (A) or information about risk (B) could increase the global affective evaluation of a technology such as nuclear power and lead to inferences about risk and benefit that are affectively congruent with the information input. Similary, information could decrease the global affective evaluation as in C and D, resulting in inferences that are opposite to those in A and B.

prior analytic evaluation. They are also important because they illustrate the balance between the affective and deliberative systems. As deliberation decreased (through time pressure), affective considerations carried greater weight in judgments.

Affect appears to play a large role in reactions to risk. For example, we appear to be as sensitive to the possibility as to the probability of the strongly affective risky events (Loewenstein *et al*., 2001). Rottenstreich and Hsee (2001) demonstrated that subjects' responses to strongly affective options, such as a kiss from a favorite movie star or an electric shock, were not influenced much by large differences in the probability of obtaining the good; at the same time, responses to less affective goods were quite influenced by probability differences. In addition, greater risk is communicated through the use of frequency data (the number of people at risk) than through a percentage format (the percentage of people at risk; Hoffrage *et al*., 2000). The greater impact of frequencies compared to percentages may be due to the greater affective images elicited by the frequency than the percentage format (Slovic *et al*., 2000).

1.1.2. Risk Perceptions and Affective Reactivity

Individuals can also differ in the strength of their affective reactions, suggesting an important role for individual differences in risk perception. Gray (1981, 1982) hypothesized that two general motivational systems underlie behavior and affect: a behavioral inhibition system (BIS) and a behavioral activation system (BAS). The negative reactivity of the BIS, in particular, may be important to risk perceptions. According to Gray, the BIS is sensitive to signals of punishment, nonreward, and novelty. It inhibits behavior that may lead to negative or painful outcomes. In past studies, individuals high in negative reactivity became more nervous before an anticipated punishment (Carver & White, 1994) and perceived greater risk when judging the same situation as individuals low in negative reactivity (Gasper & Clore, 1998). Those individuals high versus low in negative reactivity also seem to value high-loss options less as evidenced by them learning more quickly to avoid choosing those options (Peters & Slovic, 2000; Peters & Mauro, 2000). Individuals with high BIS sensitivity appear to react more to negative-affect-provoking situations, but they also appear to learn to take action to avoid those situations in the future. Activities and technologies can also differ in the extent to which they elicit a negative reaction. Nuclear objects appear to carry strong associations with our society's early experiences with radiation and nuclear war. Negative reactivity is expected to have a direct influence on the extent of negative feelings toward radiation sources and to have an indirect influence (through these negative feelings) on risk perceptions and stigma responses.

Other emotion-related concepts, besides affect and affective reactivity, have been associated with risk perceptions. We briefly review what is known about how risk perceptions are impacted by cognitive appraisals of emotion and more cognitive worldviews. Subsequently, we propose a model in which underlying tendencies (individual differences in affective reactivity and in worldviews) influence cognitive appraisals of the environment that produce mixed emotional reactions, risk perceptions, and stigma reactions.

1.1.3. Risk Perceptions and Cognitive Appraisal Theories of Emotion

Public reaction to hazards can include more complex feelings than good or bad. It can also include emotions such as fear and anger that are different from affective good/bad feelings. While emotions are generally thought to be derived, in part, from feelings of goodness or badness, they also appear to result from other cognitive appraisals of the environment such as predictability and coping potential (e.g., Ellsworth & Scherer, 2003; Smith & Ellsworth, 1985; Karasawa, 1995).[4] These specific emotions are generally studied as emotion states (such as an angry mood; Loewenstein & Lerner, 2003). In the present article, however, we examine negative emotions that are integral to (part of the representation of) stigmatized radiation sources.

Cognitive theories of emotion contend that people's cognitive appraisal or interpretation of events or circumstances determines the quality of emotion (Frijda *et al*., 1989; Karasawa, 1995; Lazarus, 2001; Roseman, 1984; Scherer, 1984; Smith & Ellsworth, 1985). These theories propose a direct and causal link between specific cognitions and emotion states, such as fear, anger, and happiness. Cognitive emotion theorists assume that the appraisal is conducted along a small number of dimensions that discriminate the emotions. Specifically, Karasawa (1995) reviewed the literature and suggested five major appraisal dimensions that were in common across most appraisal theorists: pleasantness (positive versus negative affect), predictability (predictable versus unpredictable), causation (by self, other, or chance), coping potential, and importance. Although labeled as cognitive, the appraisals are not thought to result from a process of analytical reasoning. Instead, they are presumed to be relatively effortless, intuitive, and automatic evaluations that are sensitive to events related to survival (e.g., loss, threat, injustice) and opportunities (e.g., forming attachments). Appraisal theories are special in that they are the only theoretical attempt to explain how an emotion such as fear or anger is generated. Some elegant work by Lerner and Keltner (2000, 2001) highlights the benefits of examining risk perceptions in an emotion-specific manner. For example, they predicted and found that fear and anger had opposite effects on risk perception. Whereas fearful people expressed pessimistic risk estimates and risk-averse choices, angry people expressed optimistic risk estimates and risk-seeking choices.

In earlier studies, Johnson and Tversky (1983) found that the negative (or positive) mood generated by a news story influenced subsequent estimates of risk perceptions, regardless of the similarity between the depicted event and the other events. They presented college-student subjects with three brief newspaper-style stories about a tragedy involving the death of an undergraduate student. They found that reading about a tragic (fortunate) event increased (decreased) frequency estimates across causes of death and argued that negative and positive moods induced by the newspaper stories produced global changes to risk perceptions.

DeSteno *et al*. (2000) provided evidence that generalization is not limited to positive or negative moods but functions in an emotion-specific manner related to the informational value of the emotion. Specifically, they demonstrated that mood inductions of sadness and anger, two distinct, negative emotions, differentially biased likelihood estimates of sad and angering events. Sad subjects judged sad events as more likely than angry events while angry subjects believed that angering events would be more likely than sad ones. Like the studies by Lerner and Keltner (2000), the DeSteno *et al*. findings suggest that risk perceptions may operate in an emotion-specific manner. These studies have focused on mild mood states and how they influence unrelated subsequent judgments. In the present article, we will focus on the importance of emotional appraisals of specific objects and their relation to risk perception.

To the best of our knowledge, cognitive appraisal theory has not been linked to emotions toward specific objects (with the exception of fear in anxiety disorders; Roseman & Kaiser, 2001) and, instead, has focused on individuals who differ in their tendencies toward specific discrete emotions (Lerner & Keltner, 2000) or has focused on eliciting a specific emotion such as fear or anger and examining its antecedents

[4] While other views on the construction of emotion exist (e.g., social constructions; de Rivera & Grinkis, 1986), in the present article we will focus on cognitive appraisal theory.

or consequences (Smith & Ellsworth, 1985; Frijda *et al*., 1989). In the context of risk perceptions of radiation sources as well as other technologies, the picture is complicated, however, because people often experience mixed emotions about a technology. For example, they may feel angry and fearful about radiation from a nuclear power plant. With mixed emotions, the cognitive appraisals will also be mixed. In the present experiment, we identify cognitive appraisals that are consistent across mixed emotional reactions and examine their impact on risk perceptions.

1.1.4. Risk Perceptions and Worldviews

Worldviews (generalized attitudes toward the world and its social organization) have been shown to orient or guide people's responses in complex situations (Dake, 1991, 1992). Dake, following Douglas (1966, 1992), argues that people's identities and worldviews are mediated by their social relations and the extent to which social prescriptions govern their behavior. Individuals can differ in terms of beliefs about right and wrong, beliefs about where control emanates, beliefs about responsibilities to others, beliefs about the extent to which rules are needed to control behavior, and beliefs about whether these rules should be different across society. Several researchers have related worldviews (i.e., egalitarian, hierarchical, and individualistic worldviews) to affect and risk perceptions of nuclear power (Siegrist, 1999). Peters and Slovic (1996), for example, found worldviews to be instrumental in determining a person's risk attitudes and perceptions and suggested that they might be one system for assessing value. Jenkins-Smith concluded in his studies on worldviews that rather than being passive receivers of information, "people actively impute significance and value to signals in systematic ways" (1993, p. 2). Although a relation has been found between worldviews and affective evaluations of nuclear power, worldview theory has not been related to negative emotion or negative emotion appraisals in past studies. Based on this past research, we will examine whether information about risks may be filtered and interpreted through worldviews such that worldviews relate directly to negative emotion appraisals and only indirectly to risk perceptions.

1.2. Risk Perceptions and Stigma

In this article, we not only examine risk perceptions of various radiation sources but also the extent to which each radiation source appears to be stigmatized.[5] Researchers have not yet agreed on a precise definition of technological stigma. Kasperson *et al*. defined it as "a mark placed on a person, place, technology, or product, associated with a particular attribute that identifies it as different and deviant, flawed, or undesirable" (2001, p. 19). While stigma can be defined in terms of market impacts (e.g., on the local economy, real estate prices), a wholly economic viewpoint overlooks the "complex interplay of psychological, social, and political forces" (Gregory *et al*., 1995, p. 222; Satterfield, 2001) that produces stigma. Stigma certainly has a strong negative emotional component. People are fearful of stigmatized objects and places; they can be angry about them as well. We do not just feel a stigma response, however. We also have distinct thoughts about stigmatized objects that may relate to more general cognitive structures with which we organize our world (e.g., worldviews; Dake, 1991; Peters & Slovic, 1996). Fischhoff characterized stigma as reflecting "a moral statement of what constitutes unacceptable behavior" (2001, p. 367). In the present article we take this definition of technological stigma as a class of risk objects that are generally regarded as disgraceful and unacceptable, and we propose a model of the emotional and cognitive prerequisites for the generation of a stigma response.

1.2.1. Emotion-Based Model of Stigma Susceptibility—Model Description and Rationale

For the proposed theory, we draw upon recent claims that affective reactivity and cognitive worldviews bias subsequent information processing (e.g., LeDoux, 1996; Panksepp, 1998; Dake, 1991; Gray, 1990; Carver & White, 1994; Peters & Slovic, 1996) and upon evidence that emotions such as fear and anger are defined by a set of central dimensions (Smith & Ellsworth, 1985). We propose that affective reactivity and worldviews activate particular cognitive predispositions to appraise hazards and only indirectly influence risk perceptions and stigma responses (see Fig. 3). These appraisals, as described earlier, are interpretations of events and circumstances and are the building blocks of an emotion. We propose that they will result in negative emotional responses, risk perceptions, and, ultimately, stigma responses concerning radiation sources. We call this process *stigma susceptibility*.

[5] In the present article we focus exclusively on technological stigma and not on social stigma (e.g., Heatherton *et al.*, 2000).

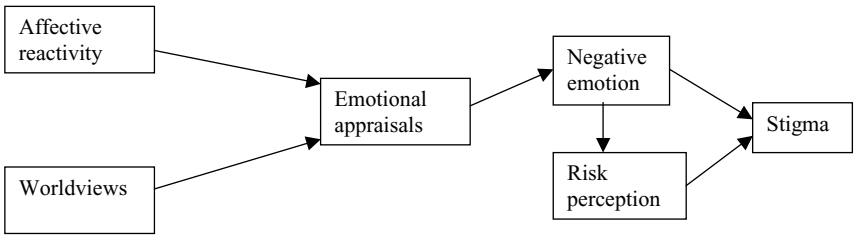

Fig. 3. Emotion-based model of stigma susceptibility.

Stigma susceptibilities are appraisal-based processes through which information is interpreted and result in the generation of an emotional feeling about an object (e.g., a radiation source) and its subsequent motivations and action tendencies. The stigma-susceptibility hypothesis asserts that cognitive appraisals of emotion and the potential for stigma responses are influenced not only by events in the world around us, but also by our individual proclivities so that stigma susceptibility is the product of a person and a stigmatized object. Thus, two persons can be witness to the same series of events, but appraise them quite differently due to individual or cultural differences, and experience qualitatively different emotions and their ensuing action tendencies. Similarly, two events, alike in some ways but different on particular dimensions important to the appraisal process, can occur and activate different appraisals, resulting in different emotional experiences. The appraisals, however constructed, will determine the quality of the emotion felt toward a technological hazard; the negative emotion will influence the extent of perceived risk and stigma.

Because several theories of risk now posit that risk perceptions are influenced by interactions of affect and cognition (Johnson & Tversky, 1983; Loewenstein, 1996; Loewenstein *et al*., 2001; Lopes, 1987; Slovic *et al*., 2002), risk is modeled as being impacted by negative emotion and having a direct impact on stigma. Risk perception, negative emotion, and stigma thus are thought to be highly related but not synonymous.

1.2.2. Hypothesized Relations Between Individual Differences and Emotional Appraisals

The BIS has been related to negative affect and to the experience of anxiety and therefore it may influence cognitive appraisals necessary to the generation of negative emotion. Questions remain, however, about the types of information to which it is sensitive. The experience of fear and anger, central to responses toward stigmatized radiation sources, has been characterized along a number of appraisal dimensions with fear and anger sharing some similar appraisals (events that result in fear or anger are appraised as more negative, more important, requiring more coping, and as caused by another more than the self). Activation of the BIS might make interpretations along some or all of these dimensions more likely. BIS theory has been silent on the specific appraisal dimensions that might be influenced, but Gray (1990) has long been a proponent of the inseparability of cognitive and emotional systems. He argues that all the basic cognitive processes have arisen, through evolution, in relation to the handling of emotional information, and, as a result, are likely to be closely related to the emotion systems. Animal studies of the BIS have indicated that activation of this system results in the inhibition of ongoing activities, increased arousal, and increased attention to environmental cues. As a result, we expected that increased activation of the BIS would be related to more negative affect, increased importance of the object (related to the increased attention), and an increase in the perception that others rather than the self cause the event and have control over its impact on the individual's life (thus, the individual cannot control but can avoid negative events).

Worldviews have not been associated with emotion appraisals prior to the present research, but it has been hypothesized and found that affect and attitudes toward technologies such as nuclear power were systematically related to these more cognitive worldviews. For example, Peters and Slovic (1996) found that individuals high (vs. low) in egalitarianism reported more negative affect toward nuclear power and were less likely to support that technology. According to Dake (1991, 1992), worldviews, defined as generalized attitudes toward the world and its social organization, are "orienting dispositions," serving to guide people's responses in complex situations. As such, they have been found, by Dake and others, to be instrumental in determining a person's risk attitudes and perceptions. Dake argues that people's identities and worldviews are

mediated by their social relations to groups, as well as by the extent of social prescriptions that constrain their behavior. A person can be either more group-oriented or more individual-oriented (e.g., in terms of beliefs about right and wrong, beliefs about where control emanates, and beliefs about responsibilities to others). In addition, the person may believe either that many rules are needed to control behavior and that these rules should be different across society, or that few socially stratified rules are necessary. As a result, four basic worldviews emerge: hierarchical, fatalistic, individualistic, and egalitarian. Those who follow the hierarchical worldview are said to be group-oriented and to believe in a high level of stratified prescriptions. The fatalist also believes in high levels of stratified prescription, but is more isolated and tends to focus on individuals rather than groups. The individualist is hypothesized to be more individual-oriented and to believe that few rules are necessary to govern behavior. The egalitarian is more group-oriented, but also believes in low levels of stratified rules.

Congruent with Jenkins-Smith (1993), worldviews are expected to act as cognitive filters screening information that leads to particular appraisals of negative emotion and stigma responses. In the present research, we included the worldview measures (hierarchy/fatalism, individualism, and egalitarianism) used in past research (Peters & Slovic, 1996). Hierarchists are hypothesized to foster the view that nature is robust to a point and that sustainable development is the rational environmental strategy. Fatalism is confounded with hierarchy in the scale used in the present study. Fatalists are hypothesized to be resigned to stringent controls on their behavior and to have a "why bother?" attitude toward risks such as those represented in the stigmatized set. Because fatalists are resigned and hierarchists have been shown to trust the government and experts, it is hypothesized that individuals scoring high on this scale will perceive the stigmatized objects as more positive, less important, and requiring less coping in the future. Egalitarians, on the other hand, tend to have higher risk perceptions and may be particularly susceptible to having stigma responses in the present study. Because they frame risk-related issues in ethical terms and tend not to trust the government or experts, they may be more likely to have anger responses as well as fear responses to these radiation sources because anger is an ethical statement (e.g., Averill, 1982). Individuals scoring high versus low on this scale were expected to view these radiation sources as higher in negative affect, more important, and requiring more coping. Finally, individualists value decisions stemming from personal judgment, so high versus low scores on this factor were hypothesized to be associated with greater self—rather than other—responsibility and control (causation). Individualists tend to believe that people will produce the abundance that would make up for any hazards that are created in the process. As a result, high scores on this scale were also expected to be associated with less importance of these radiation sources, as requiring less coping, and as higher in positive affect since the technologies are merely serving their purpose in a free market economy.

In the present article, we examined whether responses to stigmatized radiation sources were created through chronic tendencies to experience negative affect and to view the world in terms of social relations and prescriptions. These chronic tendencies in interaction with characteristics of the radiation sources were hypothesized to lead to particular emotional appraisals and, thus, negative emotion responses to these hazards. While generally characterized as an "extreme case of either [a] risk-avoidance or negative-imagery process" (Easterling, 1997, p. 638), stigma is modeled as being directly influenced by negative feelings about the hazards as well as risk perceptions and indirectly associated with individual differences and emotional appraisals of the hazards. Technological stigma is operationalized as a belief that something is disgraceful, unacceptable in general, and unacceptable under any imaginable circumstances.

2. METHODOLOGY

2.1. Participants and Questionnaire

Study participants ($N = 198$) were recruited through an ad placed in a local university newspaper. They responded to a series of 15 objects and activities shown in Table I that included radiation sources (nuclear power plants, radiation from nuclear weapons testing, radioactive waste from nuclear power plants, sun-tanning, radiation therapy for cancer control, radiation to prevent bacteria in food (i.e., food irradiation), radiation from air travel, microwave ovens, medical X-rays, natural background radiation, and cosmic radiation) and other miscellaneous objects thought to be associated with particular emotion states (death of your favorite pet, spring break this year, final exams this term, a series of thefts or crimes in your neighborhood). The nonradiation items were added to provide context and were not

Table I. Means for Stigma, Perceived Risk, Negative Emotion, and Emotion Appraisals for Each Stimulus Item

Stimulus Items	Stigma	Perceived Risk	Negative Emotion	Cognitive Appraisals of Emotion				
				Affect	Importance	Coping	Causation	Predictability
Stigmatized radiation sources (used in subsequent analyses)								
Radioactive waste from nuclear power plants	1.4	3.0	2.8	−1.6	2.4	0.9	4.7	1.7
Radiation from nuclear weapons testing	2.1	2.9	2.7	−1.6	2.3	0.9	4.8	1.7
Nuclear power plants	2.2	2.9	2.3	−0.8	2.0	0.7	4.5	2.0
Means for stigmatized radiation sources	**1.9**	**2.9**	**2.6**	**−1.3**	**2.2**	**0.8**	**4.7**	**1.8**
Nonstigmatized radiation sources								
Radiation to prevent bacteria in food (i.e., food irradiation)	1.2	2.2	1.8	−0.3	2.1	0.0	3.7	1.7
Sun-tanning	0.7	2.4	1.1	−0.3	1.1	−1.1	−5.0	2.8
Radiation therapy for cancer control	−0.5	2.2	1.4	0.6	2.2	0.2	−0.2	1.9
Radiation from air travel	1.0	1.9	1.6	−0.7	1.6	0.0	2.7	1.7
Medical X-rays	0.0	1.3	0.9	0.4	2.3	−0.9	0.2	2.5
Cosmic radiation	0.6	1.3	1.0	−0.3	1.3	2.1	1.7	1.5
Microwave ovens	0.1	1.3	0.8	0.5	1.7	1.8	−2.3	2.2
Natural background radiation	0.3	1.1	0.8	−0.1	1.3	−1.2	1.3	1.7
Means for nonstigmatized radiation sources	**0.3**	**1.6**	**1.0**	**0.1**	**1.6**	**−0.8**	**−0.7**	**2.1**
Significant difference between stigmatized and nonstigmatized radiation sources	$t = 26.6$; $p < 0.001$	$t = 20.7$; $p < 0.001$	$t = 22.0$; $p < 0.001$	$t = -27.4$; $p < 0.001$	$t = 7.8$; $p < 0.001$	$t = 14.1$; $p < 0.001$	$t = 24.5$; $p < 0.001$	$t = -3.9$; $p < 0.001$
Context items (nonradiation)								
A series of thefts or crimes in your neighborhood	2.2	2.3	2.6	−1.4	2.4	0.2	3.3	1.5
Final exams this term	0.1	1.0	1.6	−0.4	2.9	−0.1	−3.5	2.3
Spring break this year	−0.3	0.9	0.3	1.4	2.3	−1.4	−3.6	2.3
Death of your favorite pet	0.8	1.0	2.2	−1.6	2.7	0.0	−0.6	2.1

analyzed further. The radiation sources were thought *a priori* to consist of both stigmatized and nonstigmatized sources. For each object or activity, participants provided ratings on 17 scales designed to tap into feelings, emotional appraisals, risk perceptions, and stigma. At the end of the task, participants provided self-report ratings of affective reactivity and worldviews.

All stimuli were rated on 9 scales designed to represent specific emotion appraisals integral to the radiation source (AFFECT: I feel bad or good about it; PREDICTABILITY: its aftereffects are unpredictable or predictable; CAUSATION: others are responsible/have control over its impact on my life and I am responsible/have control over its impact on my life; COPING: it will require a lot or a little effort from me in the future and I can or cannot adjust to whatever happens; and IMPORTANCE: it is not at all or very important). Participants also responded to two integral discrete emotions—how ANGRY and AFRAID they were about each item as well as rating how RISKY each item was for the American public. Participants responded to five stigma items including how DISGRACEFUL, IMMORAL/MORAL, UNACCEPTABLE/ACCEPTABLE, AND STIGMATIZED each item appeared to be. Participants were also asked if they could IMAGINE A SITUATION in which the item might become acceptable if it was not already. Two of the items (STIGMATIZED and IMMORAL/MORAL) were dropped from further analyses due to the large number of nonresponses. Each of the items is shown in Appendix A; all items were assessed on five-point scales. Finally, participants responded to a negative affectivity scale (BIS negative reactivity, Carver & White, 1994; see Appendix B for items), and worldview scales (Peters & Slovic, 1996). The survey took approximately 40 minutes to complete.

Table II. Correlations of Individual Differences in Negative Reactivity and Worldviews with Perceptions of Radiation Sources[1]

	Stigmatized Radiation Sources				Nonstigmatized Radiation Sources			
	Negative Reactivity (BIS)	Worldviews			Negative Reactivity (BIS)	Worldviews		
		Hierarchical/ Fatalistic	Individualistic	Egalitarian		Hierarchical/ Fatalistic	Individualistic	Egalitarian
Stigma	0.20	−0.35	−0.40	0.36			−0.19	
Risk perception	0.16	−0.30	−0.35	0.30		−0.15		0.15
Negative emotion	0.18	−0.32	−0.33	0.32				0.16
Affect	−0.17	0.33	0.45	−0.33		0.28	0.45	−0.21
Importance		−0.17	−0.18	0.18			0.14	
Coping		−0.18	−0.23	0.21				
Causation	0.23	−0.21	−0.24		0.15			
Predictability								

[1]Correlations are shown only if they are significant at the 0.05 level or below.

3. RESULTS

Prior to further analysis, summary variables were constructed. A single measure of stigma was calculated from the average of responses to Disgraceful, Unacceptable, and Cannot imagine ever acceptable (alpha = 0.82).[6] Although prior research (e.g., Lerner & Keltner, 2001) has examined fear and anger as separate emotions with different effects on judgments, we expected that participants would have mixed emotional reactions of both fear and anger in this context. As expected, these reactions were strongly related in the present data; Negative Emotion was calculated from the average of Angry and Fearful (alpha = 0.90). As predicted and shown in Table I, the three radiation sources thought *a priori* to be stigmatized were rated as significantly higher than the other radiation sources on the measure of stigma (stigma mean for the top three radiation sources = 1.9; for the other radiation sources = 0.3; $p < 0.001$). Stigmatized radiation sources also were perceived as higher in risk and negative emotion than nonstigmatized radiation sources.

Next, summary variables were constructed for two of the five appraisals based on the previous research (e.g., Smith & Ellsworth, 1985). CAUSATION consists of the average of "others are responsible," "others have control," the reverse of "I am responsible," and the reverse of "I have control." As a result, a higher CAUSATION score would indicate a belief that others cause the impact of the technology on the subject's life while lower scores suggest a belief that the subject causes its impact. COPING refers to the perception of how much coping will be required; it consists of the average of "it will require a lot of future effort" and the reverse of "I can adjust to the situation." As a result, higher scores indicate a belief that possible situations produced by the radiation source will require more coping in the future.

Appraisal theories were developed and have been studied in the context of more full-blown emotion states (e.g., imagine and describe a time in your life when you were extremely angry). Our attempt to extend appraisal theory to emotional reactions integral to a hazard appeared successful. The stigmatized and nonstigmatized radiation sources differed on cognitive appraisals as expected based on the mixed emotional reactions of fear and anger about them. Stigmatized sources were perceived as having more negative affect, as being more important, requiring greater coping, being less predictable, and being caused by others rather than by the self (see Table I).

Also as expected, individual differences in worldviews as well as negative reactivity were associated with ratings of the stigmatized radiation sources (see Table II for simple correlations). Individuals high in negative reactivity perceived greater stigma, greater risk, more negative emotion, and had more negative affect. Participants high on Hierarchical/Fatalist and Individualist scales and low on the Egalitarian scale perceived less stigma, lower risk, less negative, and less negative affect concerning the stigmatized sources. As can be seen in Table II, associations with the nonstigmatized sources were less consistent

[6] Results of an earlier pilot study guided the design of the final study. Anger and fear were found to best represent feelings toward the sources thought to be stigmatized; we also found that we needed a direct measure of stigma. Results of the pilot study ($N = 51$) were quite similar to the present results and are available from the first author.

and were always smaller than those with the stigmatized sources (there was one exception—the correlation between Individualism and Affect was identical, $r = 0.45$, for both types of radiation sources). Predictability did not correlate significantly with the individual differences for either type of radiation source. It was not clear from the pattern of correlations whether the four individual-difference measures impacted perceptions of risk and stigma directly or indirectly through appraisals.

According to appraisal theories, perceptions of greater predictability of future consequences are expected with more anger, and perceptions of less predictability are expected with more fear. As a result, the impact of more fear *and* anger on predictability should cancel out. The correlation of predictability with risk perceptions of stigmatized radiation sources was quite low ($r = 0.02$, n.s.); greater predictability was associated, however, with less perceived risk for nonstigmatized sources ($r = -0.15$, $p < 0.05$). Results were similar for the relationship of predictability with our measures of stigma and negative emotion. Predictability was dropped from further analyses.

3.1. Stigma Susceptibility—Structural Equation Models

Structural equation modeling procedures were used to test the plausibility of the postulated model. The program AMOS was used for estimating parameters. Model fit was assessed using the Comparative Fit Index (CFI) and the chi-square. Although some disagreement exists as to cutoff criteria, the CFI should exceed 0.90 and the chi-squared p-value should be greater than 0.05. The sample used was 198 and included no missing data. This sample size is adequate for the proposed number of parameters (Bentler & Chou, 1987; Schumacker & Lomax, 1996).[7]

Analyses were conducted in three stages. First, a path analysis model fit the hypothesized model to the observed data. Second, Modification Indices were used to identify additional parameters to be freed that would significantly improve the model's fit to the data. Finally, an alternative model was considered in which the direction of a single causal path from Negative Emotion to Risk was reversed.

[7] The model has 42 parameters including the 11 variables. Bentler and Chou (1987) recommend five cases per parameter when the data are multivariate normal (as the present data are). In addition, in sensitivity checks the model was re-run in pieces with no more than 18 parameters at a time. The results did not change substantially from the full model, thus indicating sufficient power.

3.1.1. Overview of Model Results

As before, radiation sources that scored higher on a measure of stigma were considered in further analyses (i.e., nuclear power plants, radioactive waste from nuclear power plants, radiation from nuclear weapons testing). In general, the results of structural equation models supported the hypotheses.[8] Individual differences in negative reactivity and worldviews were associated directly with emotional appraisals of stigmatized radiation sources and only indirectly with the other variables in the model. As hypothesized, the model fit the data better with perceived risk as a function of negative emotion rather than vice versa. Finally, stigma itself was associated with negative emotion and, to a lesser extent, with risk perceptions.

The Hypothesized Model shown in Fig. 4 did not fit the data adequately, as indicated by the various fit indices (NFI = 0.90, CFI = 0.94) and the chi-square test statistics [χ^2 (37, $N = 198$) = 92.92, $p = 0.00$]. Two modifications to the Hypothesized Model were needed in order to provide an adequate fit—two paths were added, from Affect to Risk and from Affect to Stigma. Fig. 5 contains the Modified Model. The resulting model adequately fit the data, as indicated by the various fit indices (NFI = 0.96, CFI = 0.99) and the chi-square test statistics [χ^2 (35, $N = 198$) = 40.31, $p = 0.25$]. Note that adding the path from Affect to Stigma increases the explained variation of Stigma from 59% to 66% but renders the path from Risk to Stigma nonsignificant.

As can be seen in Fig. 5, individual differences in worldviews were correlated with one another. Hierarch/Fatalist scores correlated positively with Individualism scores ($r = 0.48$, $t = 6.11$,[9] $p < 0.01$) and negatively with Egalitarianism scores ($r = -0.33$, $t = -4.34$, $p < 0.01$). Individualism and Egalitarianism scores also correlated negatively ($r = -0.25$, $t = -3.37$, $p < 0.01$). This pattern of correlations is consistent with previous research (e.g., Peters & Slovic, 1996). Individual differences in Negative Reactivity did not correlate significantly with any of the worldview measures.

Because we were measuring objects that were feared and angering, Emotional Appraisals shared by fear and anger were expected to correlate. As a result, we allowed the errors of the emotional appraisal

[8] Analyses based on linear recursive modeling were similar and are available from the first author.

[9] These t-values are actually critical ratios; our analyses were conducted with AMOS, which uses an estimated standard error rather than the actual standard error in calculations.

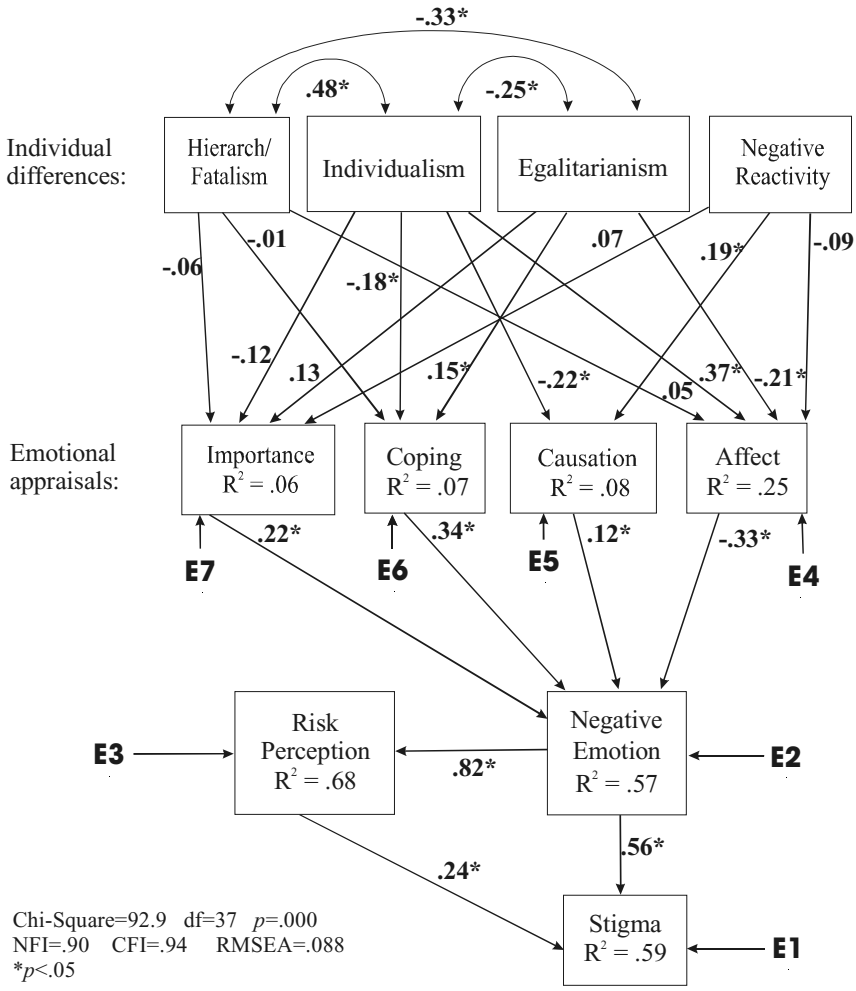

Fig. 4. Hypothesized path model.

Note: The error terms for the appraisals are covaried. Relaxing the three parameters appears to be justified due to the content of the items.

measures to covary. Table III contains the correlated errors for these measures. Because increases in anger and fear should have opposite effects on Predictability, we did not correlate it with the other measures in Fig. 5 nor did we include it in any further analyses.

The Individual Difference measures combined to explain 25% of the variation in Affect. Both Individualism ($beta = 0.37$, $t = 5.26$, $p < 0.01$) and Egalitarianism ($beta = -0.21$, $t = -3.42$, $p < 0.01$) significantly predicted Affect, while the Hierarch/Fatalist ($beta = 0.05$, $t = 0.74$, $p > 0.10$) and Negative Reactivity ($beta = -0.09$, $t = -1.50$, $p > 0.10$) measures did not.

Negative Reactivity ($beta = 0.19$, $t = 2.82$, $p < 0.01$) and Individualism ($beta = -0.22$, $t = -3.21$, $p < 0.01$) combined to explain 8% of the variance in Causation. Egalitarianism ($beta = 0.15$, $t = 2.20$, $p < 0.05$), Individualism ($beta = -0.18$, $t = -2.32$, $p < 0.05$), and Hierarch/Fatalism ($beta = -0.01$, $t = -0.18$, $p > 0.10$) scores combined to explain 7% of the variation in Coping. Although none of the paths were significant, Hierarch/Fatalism scores, Individualism, Egalitarianism, and Negative Reactivity combined to explain 6% of the variance in Importance.

The Emotional Appraisal measures combined to explain 57% of the variance in Negative Emotions. Coping ($beta = 0.34$, $t = 5.73$, $p < 0.01$) and Affect ($beta = -0.33$, $t = -5.95$, $p < 0.01$) had the strongest relationship with Negative Emotions, followed by Importance ($beta = 0.22$, $t = 3.92$, $p < 0.01$) and Causation ($beta = 0.12$, $t = 2.26$, $p < 0.05$). Negative Emotions ($beta = 0.71$, $t = 14.69$, $p < 0.01$) and Affect ($beta = -0.19$, $t = -3.84$, $p < 0.01$) combined to explain 70% of the variation in Risk. Negative Emotions

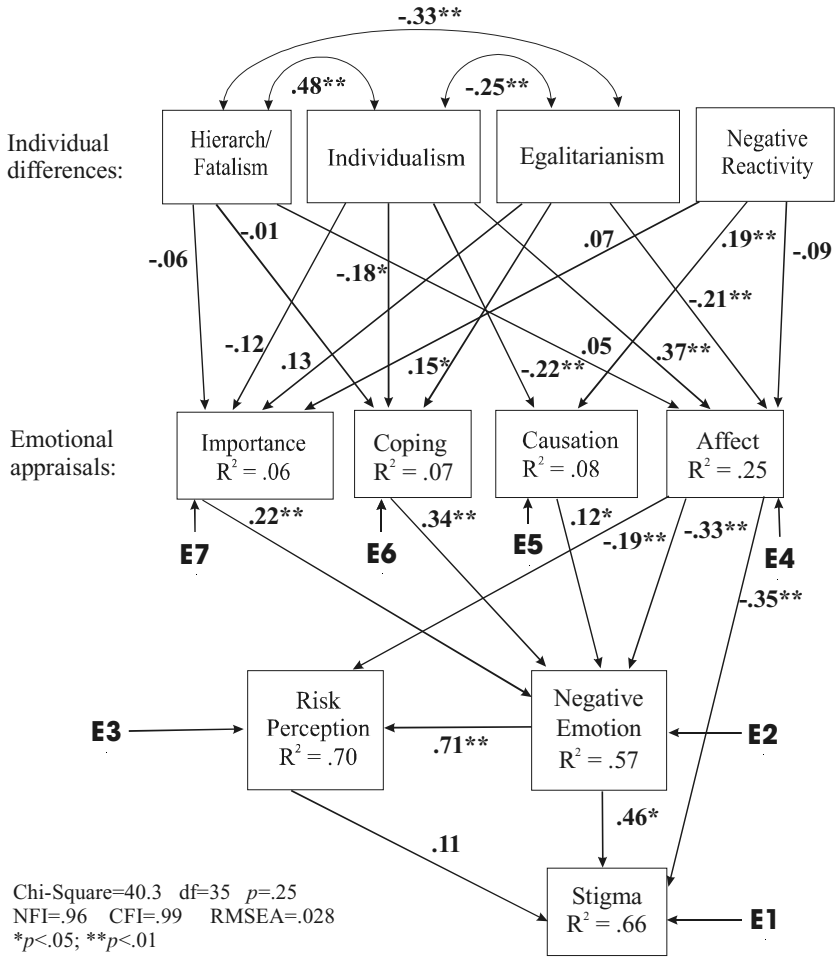

Fig. 5. Modified path model.

Note: The error terms for the appraisals are covaried. Relaxing the three parameters appears to be justified due to the content of the items.

($beta = 0.46, t = 6.11, p < 0.01$), Affect ($beta = -0.35$, $t = -6.48$, $p < 0.01$), and Risk ($beta = 0.11, t = 1.41$, $p > 0.10$) combined to explain 66% of the variation in Stigma.

3.2. Alternative Stigma Model

It is also possible, based on the long history of literature linking risk perceptions to more cognitive phenomena, that risk perceptions come first and cause negative emotional reactions. Fig. 6 is the Alternative Stigma Model and only differs from the previous model (Fig. 5) in one way; the path from Negative Emotions to Risk has been reversed so that Risk predicts Negative Emotions. The Alternative Stigma Model does not adequately fit the data, as indicated by the various fit indices (NFI = 0.92, CFI = 0.95) and the chi-square test statistics [χ^2 (35, $N = 198$) = 80.73, $p = 0.00$].

The path from Risk ($beta = 0.63, t = 13.26, p < 0.01$) to Negative Emotions is strong and increases the explained variation of Negative Emotions from 57% to 72%. The path from Risk to Stigma remains nonsignificant. In the context of Risk, the paths from Importance ($beta = 0.16, t = 3.26, p < 0.01$) and Coping ($beta = 0.19, t = 4.01, p < 0.01$) to Negative Emotions remained significant but were smaller in magnitude

Table III. Error Covariances for Modified Path Model

	e4	e5	e6	e7
e4	—			
e5	−0.33*	—		
e6	−0.39*	0.27*	—	
e7	−0.22*	0.15*	0.50*	—

*$p < 0.05$.

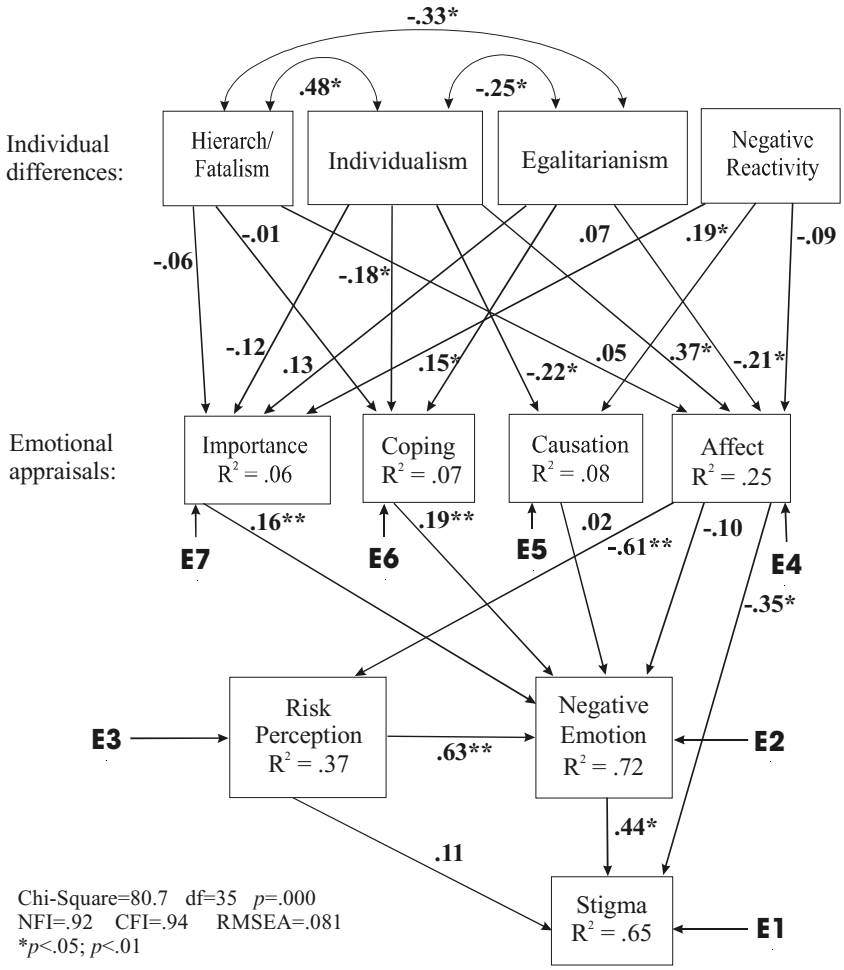

Fig. 6. Alternative stigma model.

Note: The error terms for the appraisals are covaried. Relaxing the three parameters appears to be justified due to the content of the items.

than in the previous model (Fig. 5). In the context of Risk, the paths from Affect ($beta = -0.10, t = -1.91, p < 0.10$) and Causation ($beta = 0.02, t = 0.39, p > 0.10$) to Negative Emotions became nonsignificant.

The explained variation of Risk drops from 70% (Fig. 5) to 37% (see Fig. 6). The path from Affect ($beta = -0.61, t = -10.85, p < 0.01$) to Risk was quite strong. The Modification Index indicates that adding paths from Coping and Causation to Risk would significantly improve the fit of the model to the data.

4. DISCUSSION

Results of the present study supported our general hypothesis that radiation-related stigma responses are associated with particular feelings (affective and emotional) and thoughts (worldviews and cognitive appraisals) about the stigmatized object. People were fearful of and angry about stigmatized objects and places. These fear and anger responses were associated with individual differences, emotional appraisals, and risk perceptions as hypothesized.

We proposed a new theory of stigma susceptibility in which individual differences in negative reactivity and worldviews activate cognitive predispositions so that events are experienced in systematic ways that result in particular negative emotional reactions and risk perceptions. Stigma responses emerged less from an activation of risk perceptions (of potential hazards or threats) and more from negative emotion (fear and anger). We call this process *stigma susceptibility*. Stigma susceptibilities are appraisal-based processes through which information about events are interpreted and result in the generation of an emotion and its subsequent motivations and action

tendencies. The stigma-susceptibility hypothesis asserts that emotional appraisals and the potential for stigma responses are influenced not only by events in the world around us, but also by our individual proclivities. Thus, two persons can witness the same series of events, but appraise them quite differently due to individual or cultural differences. As a result, qualitatively different emotions will be part of each person's subjective representation of the technological risk and will drive different responses. The appraisals, however constructed, will determine the quality of the emotion felt about the hazard, the perceived risks, and the stigma response.

Results of structural equation models supported these hypotheses. Radiation sources that scored higher on a measure of stigma were considered in the analyses (e.g., radioactive waste from nuclear power plants, radiation from nuclear weapons testing). Participants rated these stigmatized radiation sources as being higher in negative emotional reactions (fear and anger), greater in perceived risk, and as having more negative affect than nonstigmatized sources. Individual differences in negative reactivity and worldviews were associated with the strength of negative emotion toward stigmatized radiation sources. In an extension of appraisal theory to feelings integral to an object, the inclusion of emotional appraisals greatly increased the prediction of negative emotion and, to a lesser extent, of risk and stigma. Perceived risk was a function of negative emotion, but was only indirectly related to individual differences in affective reactivity and worldviews (direct relations were reported in past studies). Finally, stigma itself was associated with negative emotion and, to a lesser extent, with risk perceptions. When a path was added from affect to stigma, the model fit improved, but risk perceptions no longer added significant explanatory power to the perception of stigma. This last finding supports the importance of affect and the Affect Heuristic in risk domains (Slovic *et al*., 2004).

Not all of our predictions were supported. For example, we expected that higher individual-difference scores of negative reactivity would be associated with increased importance and greater negative affect, particularly because higher negative-reactivity scores were associated with fewer high-loss choices in previous experiments (Peters & Slovic, 2000). We were surprised that these relations were nonsignificant after taking into account the other variables (although the direct correlation between affect and negative reactivity was significant). Greater negative reactivity scores were associated with increased perceptions that others rather than the self were responsible for the radiation sources as hypothesized. It may be that negative reactivity leads to a more specific appraisal of "I can't control this and therefore I must avoid it" more than it does to the more general appraisal of negative affect. Further research on these issues could help to clarify the role of individual tendencies in the perception of risks.

The amount of variance in the appraisals that was predicted by the individual differences, while significant, was fairly small (ranging from 6% to 25%). Affect was explained the best by far. This finding suggests that the factors underlying and creating these emotional appraisals are influenced by individual differences but, not surprisingly, that situational differences also likely play a major role.

The appraisals themselves predicted negative emotional reactions to the hazards quite well. Fifty-seven percent of the variance in negative emotion was predicted by the four hypothesized appraisals; 70% and 66% of the variance in risk perceptions and stigma, respectively, were predicted by the model. This finding is important because it supports the extension of appraisal theory to integral emotions in general and to emotional representations of technological hazards in particular. Affect played a particularly important role. It provided significant explanatory power of negative emotion as hypothesized, but also independently, it provided additional explanatory power for risk perceptions and stigma, over and above the power provided by negative emotion. Affect appears to play a fundamental role in risk perceptions and stigma responses (Slovic *et al*., 2004). It may be that the strength of association between affect and risk-related perceptions is due in part to the presence of mixed emotions about technological risks. With mixed emotions come mixed appraisals that may cancel each other out (e.g., greater predictability with anger and less predictability with fear as in the present study), leaving that appraisal with little influence on the emotion felt. Although the present study was not designed to test this hypothesis, we speculate that the affect appraisal is more likely to be consistent (i.e., to be primarily good or bad) than other appraisals when mixed emotions are present, and, as a result, that affect may play a larger role in responses to hazards about which we have mixed feelings.

Of course, any conclusions we draw from these data must be tempered by the size and nature of our convenience sample. These concerns are alleviated somewhat for two reasons. First, our main results were replicated in our initial pilot study (see footnote 4). Second, concerns about generalizability are less in studies such as the present one where relationships

among factors are the primary focus (e.g., the dread risk—unknown risk findings; Slovic, 1987) because these relationships are less likely to vary by sample characteristics than other data (e.g., sample means). Nonetheless, it will be important to replicate this study with a more representative sample in the future.

The results suggest several important, albeit tentative, conclusions. First, stigma responses appear to have strong links with emotional reactions to technologies that can be predicted, in part, by specific appraisals of the technology. Technologies may be different in their susceptibility to these appraisals. These emotional responses are thought of as critical to how individuals value the world around them and to the efficiency and quality of decision making (e.g., Damasio, 1994). Second, some individuals appear to be more susceptible to the generation of stigma responses, due to either individual differences in affectivity or worldviews. Individual differences in appraisals such as coping (e.g., self-efficacy) are also possible but were not the focus of the present study. Risk communication about stigmatized objects may benefit from a more complete understanding of how emotional beliefs are constructed and the routes through which they affect responses and behaviors. Third, cognitive appraisals of emotion toward stigmatized objects appear to be linked to individual differences in worldviews and negative reactivity. Fourth, these appraisal theories can be extended to integral emotional reactions of specific stimuli (as opposed to being applicable only to full blown emotion states). The application of appraisal theories in this manner should help theorists to gain a greater understanding of the impact of emotion on risk perceptions. Finally, greater differentiation may exist between risk perceptions and stigma than has been suggested previously.

Fischhoff (2001) characterized stigma as a moral statement. He suggested three routes to reducing stigma: (1) moral persuasion, (2) convincing people that their general stigma rules do not apply to a specific situation, and (3) convincing people that while their general stigma rule applies in principle, it does not apply in practice.

Stigma, as an emotional response, leads us to alternative routes to changing stigma and to testing the stigma-susceptibility model. First, affect appears to be particularly important to risk perceptions and stigma responses. As a result, changing the affective associations with a specific hazard could be particularly effective. In the lab environment, changes to affect could be tested using priming or other techniques that attempt to manipulate affect without altering the content of other beliefs. In the real world, changes to affect can be (and are) attempted through advertising and other persuasion techniques that carry with them ethical questions and responsibilities. Second, our results imply that stigma responses could be altered by changing the emotional appraisals of the technology or the situation within which it is appraised. For example, by reducing the perceived extent of coping required in a situation, negative emotions, risk perceptions, and stigma responses should be reduced in turn. This hypothesis is testable experimentally; it may also be more ethically palatable because it involves educating the public about the nature of effort that may be required from them rather than attempting to directly manipulate an affective response. Because issues of trust are so important to risk perception (e.g., Slovic, 1999), educational rather than persuasion efforts may work better in the long run for changing stigma responses. Third, experimental as well as nonexperimental studies could be devised to test whether different media presentations relevant to emotional appraisals can amplify or attenuate the appraisals, thus influencing emotions, risk perceptions, and stigma. Fourth, experimental inductions of negative emotion (e.g., Lerner *et al*., 2003) could be used to test aspects of the model from appraisals to stigma responses. Finally, special interest groups, geographic areas, and cultures that differ in the individual differences or appraisals from our model should also differ predictably in terms of risk and stigma responses based on our model. Group mean differences on these variables may also provide clues as to effective routes to stigma change. Specifically, groups with different sets of mixed emotions should also differ in the appraisals important to their reactions, providing different group-specific routes to potential change.

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2003 annual meeting of the Society for Risk Analysis and received a Best Paper award.

APPENDIX A: SAMPLE ITEMS FROM EACH OF THE SCALES USED

Appraisals

AFFECT. For each situation or thing listed below, *please make a quick intuitive rating of how good or bad you feel about it* by circling a number from −2 = very bad to +2 = very good.

Very Bad				Very Good
−2	−1	0	+1	+2

PREDICTABLE/UNPREDICTABLE. Sometimes we feel like a situation or a thing will continue as expected; it is predictable. Other times, however, we feel as if we do not know what might happen; it's unpredictable. How predictable or unpredictable are the aftereffects of each of the following situations or things? For each one, *please make a quick intuitive rating of how predictable or unpredictable you feel its aftereffects are* by circling a number from 0 = very unpredictable to 4 = very predictable.

Very Unpredictable				Very Predictable
0	1	2	3	4

OWN INFLUENCE OR CONTROL. How much influence or control do you have over how much each of the following situations or things impacts your life? For each one listed below, *please indicate how much influence or control you have over its impact on your life* by circling a number from 0 = have no influence or control to 4 = have lots of influence or control.

I Have No Influence or Control				I Have Lots of Influence or Control
0	1	2	3	4

SELF-RESPONSIBLE. Overall, how responsible are you for the impact on your life of each situation or thing listed below? *Please make a quick intuitive rating of how responsible you are for the impact of each one on your life* by circling a number from 0 = not personally responsible at all to 4 = personally very responsible.

Not Personally Responsible at All				Personally Very Responsible
0	1	2	3	4

OTHERS' INFLUENCE OR CONTROL. How much influence or control do you have over how much each of the following situations or things impacts your life? For each situation or thing listed below, *please make a quick intuitive rating of the extent to which others influence or control the impact of each one on your life* by circling a number from 0 = have no influence or control to 4 = have lots of influence or control.

Others Have No Influence or Control				Others Have Lots of Influence or Control
0	1	2	3	4

OTHERS RESPONSIBLE. Overall, how responsible are others for the impact on your life of each situation or thing listed below? For each situation or thing listed below, *please make a quick intuitive rating of how much other individuals are responsible or not responsible for its impact on your life* by circling a number from 0 = others are not responsible at all to 4 = others are very responsible.

Others Not Responsible at All				Others Very Responsible
0	1	2	3	4

ADJUST TO SITUATION. How well do you think you could adjust to the aftereffects (both good and bad) of what might happen? For each situation or thing listed below, *please make a quick intuitive rating of how well you could adjust to what could happen with each one* by circling a number from 0 = could not adjust at all to 4 = could adjust very well.

Could Not Adjust at All				Could Adjust Very Well
0	1	2	3	4

FUTURE EFFORT REQUIRED. Overall, how much of your effort (mental or physical) might each situation or thing require in the future? For each one listed below, *please make a quick intuitive rating of the extent of effort each one might require from you in the future* by circling a number from 0 = very little effort to 4 = a lot of effort.

Very Little Effort				A Lot of Effort
0	1	2	3	4

IMPORTANCE. How important do you feel each situation or thing will be in your life? For each one listed below, *please make a quick intuitive rating of how important or unimportant each one will be in*

your life by circling a number from 0 = not important at all to 4 = very important.

Not Important at All				Very Important
0	1	2	3	4

Negative Emotions

ANGRY. For each situation or thing listed below, *please make a quick intuitive rating of how angry you feel about it* by circling a number from 0 = not at all angry to 4 = very angry.

Not at All Angry				Very Angry
0	1	2	3	4

AFRAID. For each situation or thing listed below, *please make a quick intuitive rating of how afraid you feel about it* by circling a number from 0 = not at all afraid to 4 = very afraid.

Not at All Afraid				Very Afraid
0	1	2	3	4

Risk Perception

RISKY. For each situation or thing listed below, *please make a quick intuitive rating of how risky you feel it is to the American public* by circling a number from 0 = not at all risky to 4 = very risky.

Not at All Risky				Very Risky
0	1	2	3	4

Measures of Stigma

DISGRACEFUL. For each situation or thing listed below, *please make a quick intuitive rating of how disgraceful you feel it is* by circling a number from 0 = not at all disgraceful to 4 = very disgraceful.

Not at All Disgraceful				Very Disgraceful
0	1	2	3	4

IMMORAL/MORAL. For each situation or thing listed below, *please make a quick intuitive rating of how moral or immoral you feel it is* by circling a number from −2 = very immoral to +2 = very moral. If the moral/immoral rating is not applicable to it, please circle "9" in the far right column.

Very Immoral				Very Moral	Not Applicable
−2	−1	0	+1	+2	9

UNACCEPTABLE/ACCEPTABLE. For each situation or thing listed below, *please make a quick intuitive rating of how acceptable or unacceptable you feel it is* by circling a number from −2 = very unacceptable to +2 = very acceptable.

Very Unacceptable				Very Acceptable
−2	−1	0	+1	+2

IMAGINE A SITUATION? For those situations or things listed below that seem unacceptable to you, can you imagine any social or economic situations under which it would become acceptable? For each situation or thing given below that you find unacceptable, *please indicate whether you can imagine some situation in which it could become acceptable to you* by circling a number from 0 = can imagine no situations to 3 = can imagine many situations. If it is acceptable already, please circle "9" in the far right column.

No Imaginable Situations			Many Imaginable Situations	Acceptable Already
0	1	2	3	9

STIGMATIZED. For each situation or thing listed below, *please make a quick intuitive rating of how stigmatized you feel it is* by circling a number from 0 = not at all stigmatized to 4 = very stigmatized.

Not at All Stigmatized				Very Stigmatized
0	1	2	3	4

APPENDIX B

Negative Reactivity (BIS)

Negative BIS reactivity items (1 = *strongly disagree* to 4 = *strongly agree*)
If I think something unpleasant is going to happen, I usually get pretty "worked up"
I worry about making mistakes
Criticism or scolding hurts me quite a bit
I feel pretty worried or upset when I think or know somebody is angry at me
Even if something bad is about to happen to me, I rarely experience fear or nervousness (r)
I feel worried when I think I have done poorly at something
I have very few fears compared to my friends (r)

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