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*Professional Issues*

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## Information Processing in the Context of Genetic Risk: Implications for Genetic-Risk Communication

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Communicating genetic-risk information is fraught with difficulties, and there are no universally accepted guidelines for clinical practice. In this paper, we suggest that information-processing models may offer some guidance for the communication of genetic risk. The paper reviews selected literature from health and social psychology, including defensive reactions to threatening health information, the Extended Parallel Process Model (EPPM) and Self Affirmation Theory. Ultimately, it presents the Heuristic-Systematic Model (HSM) of information processing as a useful perspective from which to view genetic-risk communication. Through our review of this literature, we identify some of the variables found to influence the systematic or heuristic processing of risk information and note their relevance to genetic counseling contexts. We suggest that systematic information processing is conducive to informed decision-making, as well as improved understanding of risk information. Clinical practice implications derived from our review of these literatures are noted.

**KEY WORDS:** genetic-risk communication; information-processing; heuristic; systematic; risk perception; genetic testing.

### INTRODUCTION

The increasing availability of predictive genetic testing provides new choices for managing health (Bell, 1998). People carrying mutations predisposing them to hereditary breast-ovarian cancer (HBOC), for example, could begin an intensive program of surveillance including breast self-exam, clinical breast exam and mammography. Women with a predisposing mutation to HBOC could also have their breasts and/or ovaries removed as a risk-reducing measure (Rebbeck *et al.*, 2002). Conversely, those

who test negative for disease-conferring mutations might be reassured and engage in screening only at recommended population levels. However, communicating genetic-risk information is fraught with difficulties (Bottorff *et al.*, 1998; Trepanier *et al.*, 2004). Numerous studies confirm that many at risk people have inaccurate or elevated perceptions of their genetic risk (Braithwaite *et al.*, 2004; Croyle and Lerman, 1999; Hallowell *et al.*, 1998; Rees *et al.*, 2001) which can persist even after genetic counseling (Croyle and Lerman, 1999; Lerman *et al.*, 1995). This paper proposes that a consideration of genetic risk-communication in an information-processing framework, particularly heuristic and systematic processing, may assist in the communication of genetic risk.

### Why is the Systematic Processing of Genetic-Risk Information Desirable?

It is generally accepted that a primary goal of offering genetic testing or screening is to enable

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people to make informed decisions about genetic risk (Marteau and Dormandy, 2001; van den Berg *et al.*, 2006). While definitions of informed decision-making vary, most include at least two components: (1) The decision is based on sufficient knowledge about various decision alternatives and outcomes; and (2) It is consistent with the decision maker's values (Marteau *et al.*, 2001; van den Berg *et al.*, 2006). Thus, informed decision-making occurs when all relevant information about the benefits and risks of all possible courses of action have been evaluated value-consistently (van den Berg *et al.*, 2006). As such, an assumption of informed decision-making is that it is represented by a systematic, deliberated decision-making process (van den Berg *et al.*, 2006).

In addition to its importance for informed decision-making, active processing of risk information was associated with improved understanding of numerical information, problem solving and information recall (Cosmides and Tooby, 1996; Natter and Berry, 2005; Wadey and Frank, 1997). In these studies, the active processing of risk information was induced by having participants answer reflective questions prior to making risk judgments (e.g., about the risk of medication side effects or treatment options; Cosmides and Tooby, 1996; Natter and Berry, 2005; Wadey and Frank, 1997) or by having them actively use a graphical display to portray the size of a health risk (Natter and Berry, 2005). Natter and Berry (2005) concluded that risk information should be presented in a manner that enables and encourages people to think about it in an active way. To this end, "reflective questions and think-points could be integrated into medical information brochures, decision aids, and informed consent forms..." (p. 133). This line of research offers suggestions such as these that enable the active and systematic processing of risk information. Such suggestions may be particularly important for the communication of genetic risk since threatening health information is often not processed in an active, systematic manner.

### How Do We Process Information?

A number of theories and empirical research in health and social psychology suggest that people do not always process information, particularly threatening health information, in a deliberate, systematic way. For example, we are frequently motivated to process threatening health information in a self-serving manner that allows us to downplay or deny

our risk of disease (Ditto and Croyle, 1995; Reed and Aspinwall, 1998).

On the other hand, a considerable body of research in persuasion suggests that when a message topic is personally relevant, people process the message more extensively or systematically (Chaiken, 1987; Eagly and Chaiken, 1993; Petty and Cacioppo, 1986), often in an objective manner (Petty and Cacioppo, 1986). How can these two lines of research be reconciled? How can they inform the communication of genetic-risk information? This paper argues that these seemingly contradictory findings can be integrated within the heuristic-systematic model of information processing (HSM, Chaiken, 1987; Eagly and Chaiken, 1993).

Briefly, the HSM differentiates several different types of motivation that can be aroused by personally relevant messages and also distinguishes biased from unbiased systematic processing (Lieberman and Chaiken, 1992). If a risk communication message is non-threatening, for example, high personal relevance should motivate a person to arrive at an accurate conclusion, thereby prompting unbiased systematic processing of the information in the message. Receipt of a threatening message that is highly personally relevant, however, may encourage people to defend their current attitude and/or reject the new undesirable one (e.g., I am at risk for a genetic disorder) (Lieberman and Chaiken, 1992). One way to achieve this goal is to engage in biased systematic processing. Here, threatening health information is processed more critically than reassuring information in an effort to disparage the message (Eagly and Chaiken, 1993; Liberman and Chaiken, 1992).

The following sections review selected literature on the processing of threatening health information, including fear appeals and self affirmation theory. Then it will present the heuristic-systematic model (HSM) in detail. In reviewing these areas of research, we highlight the variables found to increase the systematic processing of threatening health information since these empirical findings may have implications for the communication of genetic-risk information.

### DEFENSIVE PROCESSING OF THREATENING HEALTH INFORMATION

Research demonstrating the relationship between the personal relevance of health messages and defensive reactions and/or reduced message acceptance has a long history (Sherman *et al.*, 2000). In an early study, Janis and Terwilliger (1962) had

participants think aloud while listening to a message that argued that smoking causes cancer. Heavy smokers, relative to light smokers and nonsmokers, were more likely to reject the message. Similarly, Berkowitz and Cottingham (1960) had low- and high-relevance participants listen to a message about the protective advantages of seat belt usage. Participants were classified into relevance categories based on their driving habits and whether they owned cars. Low-relevance participants were more persuaded by the message arguing for the use of seat belts than were high-relevance participants; the latter participants appeared to defensively process the message and were less persuaded.

Later research used novel health issues to study the relationship between personal relevance and defensive processing of health messages. For example, Jemmott *et al.* (1986) created a fictitious enzyme deficiency and manipulated whether participants thought they possessed the deficiency. Participants who thought they had the deficiency (i.e., high-relevance participants) rated the deficiency as less serious than did low-relevance participants. Similarly, Kunda (1987) had participants read a message about an unfamiliar topic—the link between caffeine consumption and fibrocystic breast disease (FBD). Subsequent to reading the message, participants rated their own risk of developing FBD in the next 15 years and indicated how convinced they were about the link between caffeine and FBD. Finally, they rated their own caffeine consumption (from heavy to none) which was used to categorize participants into high- and low-relevance groups. As expected, heavy caffeine drinkers were less convinced of the link between caffeine and FBD than were light caffeine drinkers. Kunda (1987) suggested that women who consumed heavy amounts of caffeine were motivated to disbelieve they were at risk of cancer and evaluated the threatening health message in a self-serving way.

Replicating Kunda (1987), Liberman and Chaiken (1992) also found that female coffee drinkers were less accepting of a message linking caffeine consumption to breast cancer than non-coffee drinkers. Notably, they observed differences in cognitive processing between the high- and low-relevance groups: Coffee drinkers were more critical of aspects of the article linking caffeine consumption and breast cancer than were non-coffee drinkers (Liberman and Chaiken, 1992). Liberman and Chaiken (1992) argued that personal relevance heightened defensive processing which was induced

by the content of the message. That is, message content threatened participants' beliefs about their health and health behaviors.

To summarize, messages that contain threatening health information appear to evoke defensive cognitive processing. We may respond by downgrading the seriousness of the illness or the validity of the diagnostic test (for a review, see Ditto and Croyle, 1995; Jemmott *et al.*, 1986), scrutinize more carefully the threatening information (Liberman and Chaiken, 1992; Reed and Aspinwall, 1998), or generate counterarguments and alternative explanations to discredit it (Giner-Sorolla and Chaiken, 1997; Liberman and Chaiken, 1992). Research shows we may also selectively generate information about ourselves and others in ways that allow us to believe we are at low relative risk for illness (Reed and Aspinwall, 1998; for reviews see Gibbons and Gerrard, 1997; Klein and Weinstein, 1997). These creative ways in which we distance ourselves from threatening health information are worrisome in so far as they may interfere with preventive or protective health behaviors (Ditto and Croyle, 1995; Klein and Weinstein, 1997).

### Relevance for Genetic Counseling

In the context of genetic counseling, at risk people may hold beliefs about their own risk derived largely from the pattern of disease expression in their families. These beliefs can be used to negate or exaggerate their actual risk, and as such, may preclude the systematic processing of risk information discussed during counseling or the acceptance of risk-reducing protective behaviors. Indeed, family history of illness is a powerful influence on personal genetic-risk perception, which in turn, has been related to testing interest, testing appraisals and post-test adjustment in the context of hereditary cancers and Huntington disease (HD; d'Agincourt-Canning, 2005; McAllister, 2002; Taylor, 2004). For example, interviews with people from families with a clinical diagnosis of Hereditary Nonpolyposis Colorectal Cancer (HNPCC) revealed several family factors that either facilitated or blocked the process of engaging with cancer risk (e.g., family talk about cancer, ignorance of the family history; McAllister, 2002). Engagement was defined as, "the degree of cognitive and emotional involvement with one's increased risk of developing cancer" (p. 496). In an information-processing framework, we speculate that low levels of engagement with the family risk may also reflect less systematic processing of genetic-risk information.

Family history is also a powerful influence on risk perception in the context of HBOC and may hinder the systematic processing of genetic-risk information (d'Agincourt-Canning, 2005; Hallowell, 2006; Kenen *et al.*, 2003). Women drew on the experiences of their female relatives with cancer to construct knowledge about the illness and the course it might take in their own lives. When relatives' cancer was perceived to be unrelenting and the cause of their suffering and death, women constructed cancer as a life-threatening disease that offered little hope or possibility of control. If, however, relatives responded well to treatment, cancer was perceived to be survivable (Chalmers and Thomson, 1996; Hallowell, 2006).

Given the powerful influence of family history on personal risk-perception beliefs, what can be done to encourage more systematic processing of the risk information presented in counseling sessions?

One line of research that may be informative explored risk communication in the context of medication usage, particularly the risk of side effects. For example, several studies found that people did want to be informed about their medications' possible side effects (Berry *et al.*, 1997; Mottram and Reed, 1997). However, when people were given a written explanation about prescribed medication that contained side-effect risk information, they perceived their risk of experiencing side effects to be higher, they were less likely to comply with the medication regimen and they judged the written explanation to be less satisfactory (Berry *et al.*, 1997, 2002). Recently, Berry and colleagues explored the effects of using a personalized style of expression in risk communication regarding medication (e.g., using the words 'you' and 'yours' when appropriate; Berry *et al.*, 2003). In two studies, they found that presenting risk information in a more personalized form resulted in significantly lower ratings of likelihood of experiencing side effects and perceived risk to health, as well as significantly higher satisfaction ratings with the information provided. They also found significantly higher levels of recall for the information provided in the personalized group (Berry *et al.*, 2003; Study 2). Berry *et al.* (2003) noted that use of an individualized form of explanation (e.g., using a person's name in the communication) could have resulted in even stronger effects on measures of satisfaction, perceived risk and compliance. In the context of mass health-risk communication, however, individualized expressions are not practical (Berry *et al.*, 2003). However, it is suggested they are practical and feasi-

ble in genetic counseling contexts. There is evidence that clients favor subsequent feedback, whether in the form of a leaflet, video, CD-Rom and/or personalized letter summarizing the information given during counseling sessions (Julian-Reynier *et al.*, 2003). Complementary materials were perceived by clients to be informative; they also allowed clients to work through the materials in private, at their own pace (Julian-Reynier *et al.*, 2003). In one-on-one follow-up genetic risk communication, it is feasible to use individualized explanations, and the literature on the provision of medication information style suggests that this form of risk communication may increase patient satisfaction (Berry *et al.*, 2003).

The effects of personalized risk communication on patient satisfaction and compliance suggest that information about the self may be processed in particular ways. As such, we review self-affirmation theory and its relevance for the communication of genetic risk.

## SELF AFFIRMATION THEORY

In the context of genetic counseling, the self-image is salient and relevant. People are confronted with the reality (or possibility) that they are at risk for a genetic disorder which may threaten the view of the self as capable and healthy. Thus, "an analysis of the self-system is central to understanding why threatening health information prompts defensive responses" (Sherman *et al.*, 2000, p. 1048; see also Harris and Napper, 2005; Reed and Aspinwall, 1998). Self-affirmation theory (Steele, 1988) proposes that our thoughts and behaviors are motivated by the desire to maintain self-worth or self-integrity, which Steele defined as a global sense of being a competent, moral person who can control the outcomes in his or her life. When people receive threatening health information (Jemmott *et al.*, 1986; Kunda, 1987), they respond in a defensive manner in an effort to protect the self and maintain a positive self image (Sherman *et al.*, 2000). Importantly, however, self affirmation theory predicts that if one's self image can be affirmed through some other means (e.g., affirming important values, recalling positive experiences), the need to respond defensively to threatening health information should be reduced (Harris and Napper, 2005; Reed and Aspinwall, 1998; Sherman *et al.*, 2000). Steele (1988) explained:

Salient, self-affirming thoughts should make it easier to be objective about other, self-threatening

information; they should reduce the pressure to diminish the threat inherent in this information. In this way, self-affirming thoughts may be an effective means of reducing thought distorting defense mechanisms such as denial and rationalization (p. 290).

Thus, providing an alternative means to reduce the threat in a health-risk message via self affirmation should reduce defensive processing of the message and increase its acceptance (Reed and Aspinwall, 1998; Sherman *et al.*, 2000). Further, self-affirmed individuals may be more likely to engage in health-protective behaviors (Sherman and Cohen, 2002). Self-affirmation may be a useful technique in the context of genetic-risk communication, particularly for those disorders for which some effective intervention exists to manage the risk (e.g., colonoscopy in the context of testing for HNPCC). A large body of research confirms that engaging in self-affirming activities promotes less biased processing of threatening health information.

In two studies, for example, Sherman *et al.* (2000) found that a self-affirmation procedure increased the acceptance of a personally relevant threatening health communication. When participants were given the opportunity to affirm a central value, they were more accepting that their health behaviors (coffee drinking or unprotected sex) may have increased their risk for disease. Affirmed participants perceived a higher risk and intended to change their behavior (Study 1 – reduce caffeine consumption) and also engaged in positive health behaviors (Study 2 – bought condoms and took AIDs pamphlets) more often than non-self-affirmed participants. Sherman *et al.* (2000) argued that the self-affirmation procedure (reflecting on important values) reduced the threat in the health message, making individuals more open to the risks described in the health communication (e.g., that they were potentially at risk for diseases such as breast cancer or AIDs).

A recent study randomly assigned women to either self-affirm by writing about an important personally-held value or to a no self-affirmation control condition (Harris and Napper, 2005). All women were then asked to read a health leaflet that described the risks of developing breast cancer from excessive alcohol consumption followed by a series of questions measuring risk perception, anxiety and intention to reduce alcohol consumption. As predicted, self-affirmed participants reported greater personal risk ratings for breast cancer from their alcohol

consumption and greater intention to reduce the amount of alcohol they consumed.

Harris and Napper (2005) suggested that future applied research was needed to identify settings in which self-affirmation might be employed, and they specifically suggested settings such as one-on-one counseling contexts. Thus, the genetic counseling context could be a useful situation in which to explore the effects of self-affirmation on message acceptance. Self-affirmation could be achieved through a values exercise. Here, people were asked to reflect on and/or write about their most important value (Harris and Napper, 2005) or to complete a values scale (see Sherman *et al.*, 2000). Self-affirmation was also induced through a recollection exercise where participants were asked to remember some past positive act or experience (e.g., the recall of one's past acts of kindness; Reed and Aspinwall, 1998) prior to receiving threatening health information. In the context of genetic counseling, a values exercise is possibly already an existing component of the discussion since value-driven informed decision-making is a desired goal of counseling (Marteau *et al.*, 2001). This is encouraging since self-affirmation about core values has been shown to reduce the defensive processing of threatening health information (Sherman and Cohen, 2002).

## THE EXTENDED PARALLEL-PROCESS MODEL

Despite the considerable evidence that self-affirmation reduces the defensive processing of health information, Harris and Napper (2005) suggested that perception of efficacy could be an important moderator of the relationship (see also Renner, 2004). Indeed, perceived personal control has long been recognized as a critical variable in health-risk cognition and behavior, such that greater perceived control motivates protective health-behavior intention and change (for reviews see Armitage and Conner, 2000; Bandura, 2004). Recent theorizing from the fear appeal literature complements the literature on the relevance-defensiveness link in response to threatening health information and includes perceptions of efficacy as critical variables.

A considerable amount of research demonstrates that persuasive health messages that arouse fear (i.e., fear appeals) motivate health-behavior change (see Witte and Allen, 2000, for a review). The most recent fear appeal theory, the Extended

Parallel Process Model (EPPM; Witte, 1992; Witte and Allen, 2000), explains how people process a threatening health message, having implications for the processing of genetic-risk information.

The EPPM suggests that evaluation of a risk-communication message initiates two appraisals of the message. First, people will appraise the threat represented in the message. The more people believe they are susceptible to a serious threat (i.e., high perceived risk), the more they are motivated to initiate the second appraisal, that is, an evaluation of the efficacy of the recommended response (Witte and Allen, 2000). If the message threat is perceived to be irrelevant (i.e., low perceived risk), there is no motivation to continue processing the message, and people will simply ignore the risk communication. Immediately, this has relevance in the genetic counseling context. If people come to counseling believing they are not at risk or are at low risk for a genetic disorder, they may not be motivated to process the information provided in counseling sessions. Thus, counselors may be challenged to change clients' motivation to process information.

In contrast, if a threat is portrayed in a risk communication that is believed to be serious and personally relevant, people become scared (Witte and Allen, 2000). Fear then motivates action, any action, to reduce that fear. Perceived efficacy, composed of both self and response efficacy, determines whether people will be motivated to engage in *fear* control or *danger* control. For example, when people believe they are able to perform the recommended response against the threat (self efficacy) and that the response is reasonable and will combat the threat (response efficacy), danger control is initiated. Here, people consciously and systematically think about how to lessen or remove the health threat (e.g., being at high risk for hereditary cancer). They may think carefully about the recommended responses in the risk-communication message (e.g., colonoscopy or prophylactic surgery) and adopt these as a way to control the danger (Witte and Allen, 2000). Thus, the EPPM suggests that when efficacy perception is high, systematic processing of the risk information may be the default response.

However, if people doubt that the recommended response will combat the threat (i.e., low response efficacy) or doubt their own ability to engage in the response (i.e., low self efficacy), they are motivated instead to control their fear. As such, they focus on eliminating their fear through denial, defensive avoidance or reactance (e.g., "They're just trying

to manipulate me, I'm going to ignore them;" Witte and Allen, 2000, p. 594). Therefore, if efficacy perception is low, systematic processing of the risk communication message is not likely. Witte and Allen (2000) suggested that if no information is provided regarding what can be done about the threat, people rely on past experiences and prior beliefs to assess perceived efficacy to cope with the threat.

### Relevance for Genetic Counseling

There are notable considerations for communicating genetic risk arising from the EPPM, not least the importance of efficacy messages. Research shows, for example, that women at risk for breast cancer desire more than a numerical risk figure (Bottorff *et al.*, 1998). They might also want background information about cancer and non-genetic risk factors, as well as emotional support and help in understanding how the risk information can be used in decision-making. In their review of communicating health-risk information, Rothman and Kiviniemi (1999) noted that people's mental models about their health risks were organized around two dimensions—causes and consequences. As such, numerical probability information will have little impact on people's "ability to imagine either *what* might happen to them or *how* it might occur" (p. 45). Instead, Rothman and Kiviniemi (1999) advocated the use of a contextualized approach to communicate health-risk information. The defining feature of such an approach is that it provides information about the antecedents and the consequences of a health risk, and it often includes information on what can be done about the risk. This approach to health risk-communication corresponds to the EPPM's predictions about when danger control will be initiated, rather than fear control. Thus, genetic counselors might give recommended courses of action to lessen the risk consequences and provide additional sources of information (Trepanier *et al.*, 2004). Bottorff *et al.* (1998) concurred, and suggested that risk communication always include information about surveillance and early detection of disease. Otherwise, unnecessary anxiety and a sense of helplessness could be created.

Second, the EPPM suggests that fear control responses are inversely correlated with danger control responses, such that the more a person defensively resists a health-risk message, the less a person will adopt the health-protective behaviors recommended by the message (Witte and Allen, 2000). Thus, risk

messages appear to produce two opposing responses that interfere with each other (Witte, 1992; Witte and Allen, 2000). Notably, meta-analyses of the fear appeal literature confirm that the weaker the efficacy message, the greater the fear control responses (Witte and Allen, 2000). Presumably, fear control responses are not desirable in the context of genetic-risk communication since a goal of counseling is to encourage deliberate, systematic processing of the risk message (van den Berg *et al.*, 2006). Thus, when counselors provide recommended courses of action that might lessen the risk consequences, they may also be encouraging the systematic processing of the risk information.

Witte and Allen (2000) suggested that an interesting area for future research about fear appeals is to study them through the lens of message-processing models such as the elaboration likelihood model (ELM; Petty and Cacioppo, 1986) or the heuristic-systematic model (HSM; Chaiken, 1987; Chaiken *et al.*, 1989). We turn now to a description of the HSM, which carries implications for the processing of genetic-risk communication. As an information-processing model, the HSM also offers a framework within which the literature reviewed thus far can be integrated.

## **MULTIPLE MOTIVE HEURISTIC-SYSTEMATIC MODEL (HSM)**

The heuristic-systematic model (HSM) is relevant to communication contexts in which individuals are “exposed to information about themselves, other persons and events, and have to make decisions or formulate judgments about these entities” (Chaiken *et al.*, 1989). It is a dual-process theory, based on the assumption that “attitudes are formed and modified as people gain information about attitude objects” (Eagly and Chaiken, 1993, p. 257). Trumbo (2002) suggested it is well suited for use in studies of risk communication since it can explore linkages among the questions of where people acquire risk information, how they process it and how this might then influence risk perception and behavior (see also Griffin *et al.*, 2002).

As a dual-process theory, the HSM postulates that when faced with a judgment situation, people process information heuristically (superficially) or systematically (effortfully) or may use a combination of both heuristic and systematic strategies when processing the same information (Chaiken, 1987; Chen

and Chaiken, 1999; Eagly and Chaiken, 1993). The co-occurrence of heuristic and systematic processing distinguishes the HSM from similar dual-process models such as the ELM (Petty and Cacioppo, 1986). In the context of genetic-risk communication, which processing mode dominates may be important since people who process information systematically are thought to form attitudes that are relatively stable over time and resistant to change (Eagly and Chaiken, 1993; Petty and Cacioppo, 1986). They may also be more likely to engage in protective health behaviors (Griffin *et al.*, 1999, 2002; Kahlor *et al.*, 2003). Noted earlier, systematic processing is also assumed to underlie the process of informed decision-making (van den Berg *et al.*, 2006). As such, theories that specify the variables that promote systematic vs. heuristic processing should have considerable utility in the process of genetic-risk communication.

## **Systematic vs. Heuristic Processing**

Systematic processing requires considerable cognitive effort. Here, people carefully examine arguments contained in the message and relate those arguments to those already held. Thus, “systematic processing entails a relatively analytic and comprehensive treatment of judgment-relevant information” (Chen and Chaiken, 1999, p. 74). Decisions made on the basis of systematic processing are therefore responsive to the actual content of the communication (Chen and Chaiken, 1999). Heuristic processing, on the other hand, makes minimal cognitive demands on the decision-maker. Here, judgments are based on simple decision rules that are presumed to be stored in memory (e.g., Experts’ statements can be trusted; Chen and Chaiken, 1999). Decisions made on the basis of heuristic processing, therefore, are responsive to judgment-relevant peripheral cues such as message length, message source or emotion, rather than particular judgment-relevant information (Chen and Chaiken, 1999).

## **Heuristics in Genetic Counseling**

Heuristic processing has been observed in the context of genetic-risk communication, and other draws to heuristic thinking (e.g., how the risk information is framed) are also relevant to genetic-risk communication. Recent risk perception research suggests that most risk analysis by the layperson is handled by the experiential system, an intuitive, feeling-based, heuristic mode of thinking (Slovic *et al.*, 2004)

as opposed to the objective, probabilistic risk information provided in many risk communication contexts. “Risk as feelings” (Lowenstein *et al.*, 2001) provides people with a rapid way to determine that a risk is good or bad and allows for a simple binary decision to accept or reject a risk construct, without rationally weighing the pros and cons of a risk situation.

A large body of decision-making research identified the heuristics, or rules-of-thumb for judgment, people use when taking decisions based on probabilistic information (Tversky and Kahneman, 1974). The decision to take a predictive genetic test is a situation requiring the processing of large amounts of new and difficult information, precisely the circumstances conducive to heuristic decision-making (Kenen *et al.*, 2003). In their research with women at risk for breast cancer, Kenen *et al.* (2003) observed that heuristics did influence women’s judgments about the cancer risk they faced. For example, vivid, unpleasant images of a relative’s breast cancer were easily recalled (i.e., the availability heuristic) and tended to heighten risk perceptions and affect test decisions.

In addition to availability, Tversky and Kahneman (1974) identified a representativeness heuristic. That is, we sometimes assign an instance to a category simply because it seems representative of the category (i.e., is similar to it). For example, when estimating their child’s risk of developing an adult-onset genetic disorder, such as HD, parents referred to the degree of parental resemblance (Shiloh, 1994). Similarly, at risk families sometimes pre-select (Evers-Kiebooms and Decruyenaere, 1998) which family member will be the one to develop the genetic illness based on similarity to an affected parent and/or grandparent. The process of pre-selection might help explain why objective risk estimates provided during counseling are often incompatible with long-established family beliefs about the genetic illness in the family. As such, some at risk people appear to misunderstand genetic-risk information as it is presented in counseling (Richards, 1996). Richards has argued that counseling sessions must seriously explore clients’ lay beliefs about heredity in order to begin to understand personal risk perception. Eiser (1998) concurred, suggesting that an awareness of these heuristics may allow healthcare professionals to expose client misconceptions about their genetic risk and allow for early correction.

Studies of message framing are also relevant for genetic counseling since they demonstrate how sim-

ple framing effects can promote less effortful, heuristic processing of risk information. For example, absolute and relative risks are subject to framing bias: If a medication reduces an adverse outcome from 20% to 15%, the absolute risk reduction is 5%, while the relative risk reduction is 25%. Although these risk estimates come from the same data, patients are more strongly persuaded by the larger changes in relative risk (Gordon-Lubitz, 2003). Similarly, screening or treatment options are also influenced by framing effects. For example, patients are more likely to favor radiation over surgery when radiation is presented as having a 90% survival rate than when it is presented as having a 10% mortality rate. The latter is perceived as more dangerous (Gordon-Lubitz, 2003). Indeed, expressing the chance for a desired outcome (e.g., 99% chance that a fetus is healthy) is more reassuring to test candidates than expressing the chance for the corresponding negative outcome (e.g., a 1% chance a fetal abnormality exists). However, Abramsky and Fletcher (2002) suggested that both ways of expressing the risk should be used in genetic counseling sessions in order to be as nondirective as possible. We also suggest that both message frames are necessary in order to allow clients to systematically process all the relevant information in the judgment context, rather than heuristically process only one frame of the message.

### **What Determines Heuristic or Systematic Processing?**

The HSM postulates two general processing mode determinants, one cognitive and one motivational. The primary cognitive determinant of processing mode is an individual’s level of information-processing ability. Since systematic processing is a more demanding form of information processing than heuristic processing, “systematic processing should be more constrained or disrupted than heuristic processing by situational and individual difference factors that reduce people’s abilities for detailed information processing” (Eagly and Chaiken, 1993, p. 328). Variables such as lack of prior knowledge about the topic, time constraints, perceived inability to obtain relevant information, low personal relevance of the topic, low need for cognition and argument ambiguity have all been identified as factors that may constrain systematic processing in experimental and field research (Chaiken and Maheswaran, 1994; Chen and Chaiken, 1999; Eagly and Chaiken, 1993; Griffin *et al.*, 1999, 2002; Kahlor *et al.*, 2003;



Maheswaran and Chaiken, 1991). Some of these variables have obvious relevance in the communication of genetic-risk information: For example, some clients will attend counseling sessions knowing very little about the process of genetic inheritance, the disorder for which they are at risk or the genetic testing or screening procedure itself (Green *et al.*, 2004; Kenen *et al.*, 2003; Richards, 1996). An important component of the communication of genetic risk, therefore, will be explanations of tests, screens and disorders.

The amount of time available to clients in which to process risk information will also be important. As noted, time constraints promote less effortful, heuristic processing (Eagly and Chaiken, 1993; Chen and Chaiken, 1999). As such, follow-up sessions may be needed with some counseling clients in order to provide the time necessary for them to systematically process the risk communication.

Message ambiguity also impedes systematic processing and may draw people to rely on heuristic strategies instead (Chaiken and Maheswaran, 1994). Although this finding arose from controlled lab studies, it has practical implications for the communication of genetic risk. Message ambiguity should have particular relevance in the communication of inconclusive test results, ambiguous by their very nature. Risk communicators, including genetic counselors, should choose simple, non-technical terms whenever possible and define unavoidable jargon. For example, what exactly is meant by an inconclusive test result? Bier (2001) suggested that definitions should include both what a term means and what it does *not* mean. Dorval *et al.* (2005), for example, advocated the value of clinicians explaining to clients that inconclusive test results do not discount the possibility that clients maintain a higher risk of developing cancer. These strategies may promote clients' systematic processing of the risk information while drawing them away from heuristic processing which is normally the response to ambiguous messages (Chaiken and Maheswaran, 1994).

### Motivational Determinants of Information Processing

Beyond cognitive capacity, there are several motivational determinants of processing mode, including accuracy, defense or impression motivation, as well as information sufficiency.

### The Sufficiency Principle

The HSM assumes that perceivers are "economy-minded souls" who wish to satisfy their goal-related needs in the most efficient way possible (Chaiken, 1987; Chaiken *et al.*, 1989). The model's *least effort* and *sufficiency* principles reflect this motivational assumption (Eagly and Chaiken, 1993). The least effort principle asserts that people prefer less effortful to more effortful information-processing strategies, and as such, heuristic processing often prevails over systematic processing (Eagly and Chaiken, 1993). In other words, it is the default strategy in most judgment situations.

However, people have other motivational processing goals (e.g., the desire to make accurate judgments, the desire to defend current attitudes). The model's sufficiency principle incorporates the idea that information processors must strike a balance between satisfying their motivational goals and minimizing their processing efforts. Thus, "people will exert whatever effort is required to attain a "sufficient" degree of confidence that they have satisfactorily accomplished their processing goals" (Eagly and Chaiken, 1993, p. 330). This sufficiency threshold is defined in terms of desired judgmental confidence—the degree of confidence a person desires to have in any particular judgment situation. The sufficiency principle implies that people will engage in greater amounts of systematic processing when the less effortful heuristic mode does not allow sufficient amounts of judgmental confidence.

For any given decision situation, the sufficiency principle proposes a continuum of judgmental confidence along which lie the perceivers' *actual* confidence and their *desired* level of confidence (Chen and Chaiken, 1999). "Perceivers will exert cognitive effort until their level of actual confidence reaches (it if can) their sufficiency threshold, thereby closing the gap between actual and desired levels of confidence" (Chen and Chaiken, 1999, p. 74). Thus, when the gap between actual and desired confidence is widened, systematic processing is likely to emerge.

In the context of genetic counseling, we might expect clients' motivation for testing to affect confidence levels. A woman attending HBOC counseling in order to acquire information to make prophylactic surgery decisions, for example, may desire a high level of confidence in this judgment situation. Assuming high cognitive capacity, we would expect her to engage in high levels of systematic processing. Practically, counselors could enquire about clients'

current and desired levels of judgmental confidence in an effort to assess whether heuristic or systematic processing of genetic-risk information is likely to occur.

### The Multiple Motive Framework

The HSM originally assumed that people are motivated to hold accurate attitudes and beliefs with the goal of forming an objectively valid view of the world (Chaiken, 1987). Thus, “the accuracy-motivated perceiver assesses the validity of attitude-relevant information in the interest of achieving valid attitudes that square with relevant facts” (Eagly and Chaiken, 1993, p. 339). If motivation is low or cognitive capacity is constrained, accuracy-motivated perceivers simply base their judgments on heuristic-cue information that is seen as best suited to achieve their accuracy goals (e.g., experts can be trusted; Chen and Chaiken, 1999).

More recent formulations of the HSM propose two other motivational goals that may co-exist with, or even supplant, accuracy goals: Defense and impression motives (Eagly and Chaiken, 1993; Chen and Chaiken, 1999).

### Defense Motives

Defense motives represent the role played in social influence by variables such as ego-involvement, vested interests or personal wishes, hopes and desires (Eagly and Chaiken, 1993). These sorts of variables arouse defense motivation, the desire to form or defend particular attitudinal positions (Eagly and Chaiken, 1993). “The defense-motivated perceiver aims to preserve the self concept and associated world views, and thus processes information selectively—that is, in a way that best satisfies such defense concerns” (Chen and Chaiken, 1999). Giner-Sorolla and Chaiken (1997) suggested that attributes such as health were closely tied to the self-concept and represented a relevant situation for defense motivation (see also Liberman and Chaiken, 1992).

Under defense motivation, perceivers’ sufficiency concerns affect processing in much the same way as they do under accuracy motivation. However, “the sufficiency of a defensive processing strategy is determined, not by its ability to increase confidence in the objective accuracy of the conclusion, but by its ability to increase confidence in a preferred conclusion that is consistent with material interests

or self-defining beliefs” (Giner-Sorolla and Chaiken, 1997). As such, biased processing strategies will be used in preference to more even-handed strategies since they are more effective in attaining defensive sufficiency (Giner-Sorolla and Chaiken, 1997). These strategies might include finding fault with arguments that oppose a desired belief (e.g., “I am at high risk for breast cancer”) and supportively elaborating upon arguments that favor it (e.g., “All my female relatives had breast cancer”) (Giner-Sorolla and Chaiken, 1997).

The literature reviewed earlier about the biased processing of threatening health information accords well with the HSM’s hypotheses about biased systematic processing. While both heuristic and systematic processing strategies can achieve defensive goals, “When defense motivation is high and cognitive resources are available, defense-motivated systematic processing is likely to emerge, characterized by effortful but biased scrutiny and evaluation of judgment-relevant information” (Chen and Chaiken, 1999, p. 78).

In the context of genetic counseling, defense motivation may be high since the view of the self as healthy and capable is being threatened (cf. Steele, 1988). Thus, clients could be defensively motivated to reject genetic-risk information. Defense motivation might also be present in people who believe their risk for disease is high, usually due to the experience and expression of disease in their family (e.g., Chalmers and Thompson, 1996). These clients could be motivated to defensively reject genetic-risk information that concludes they are, in fact, at low risk for disease.

Whether they come to the clinic with low- or high-risk expectations, defense motivation might affect the processing of genetic-risk information in at risk persons. In either case, when their beliefs are threatened, they will be motivated to process the information in a biased way, one that supports their desired conclusions (Liberman and Chaiken, 1992; Giner-Sorolla and Chaiken, 1997). Defense motivation could offer an explanation as for why elevated or incorrect risk perceptions persist subsequent to counseling (e.g., Croyle and Lerman, 1999; Lerman *et al.*, 1995). Sherman and Cohen (2002) suggested that informational approaches to reduce personal risk perception (e.g., provision of information about risk factors) are often unsuccessful, particularly because they “fail to address the ego-protective motivations underlying defensive biases in response to health-risk information” (p. 121). Described earlier, a

motivational approach such as that provided by self-affirmation theory (Steele, 1988) may be more effective to reduce the defensive processing of genetic-risk information.

### Impression Motives

The final processing motive is impression motivation, the desire to express attitudes that are socially acceptable. This type of motivation is assumed to arise in situations where social relationships are important, when perceivers must communicate or justify their attitudes to others or when the identities of significant audiences are salient (Eagly and Chaiken, 1993). “Thus, impression motives elicit a consideration of the interpersonal consequences of expressing a particular judgment in a given social context” (Chen and Chaiken, 1999, p. 78). As with accuracy and defense motivations, the sufficiency principle also predicts whether heuristic or systematic (biased or unbiased) processing will occur in a given social judgment situation.

It is possible that impression motivation could be relevant in the provision of genetic-risk communication, although we are unaware of any study that explored this relationship. Certainly, genetic counseling is a context in which interpersonal relationships are highlighted, since by its very nature, genetic risk is family risk. Indeed, considerable evidence exists that decisions around genetic risk are motivated by perceptions of responsibility to other family members (see Etchegary and Fowler, 2006 for a review). We tentatively suggest that impression motivated information-processing might be revealed by clients’ references to perceptions of responsibility to others during counseling sessions. If, in fact, clients are processing risk information heuristically or in a systematic, but biased way (due to their impression motives), this suggests it is important that the *personal* implications of genetic testing or risk-management decisions be thoroughly explored prior to testing. Left unexplored, it could be that some at risk people will be unprepared for the potential distressing effects of a positive test result (Foster *et al.*, 2002).

### Evaluation of the HSM for Genetic Counseling

The HSM contains unique theoretical strengths in its postulation of multiple motives underlying information processing and its suggestion that informa-

tion processing can be heuristic, systematic or both, biased or unbiased (Eagly and Chaiken, 1993). As such, it allows predictions about when processing will be more effortful (e.g., when capacity and motivation are high), heuristic (e.g., when cognitive capacity or motivation is constrained), biased (e.g., when information is incongruent with defense or impression motives) or unbiased (e.g., when accuracy motives are most relevant; Eagly and Chaiken, 1993; Chaiken *et al.*, 1989; Chen and Chaiken, 1999; Liberman and Chaiken, 1992). It also offers a rubric in which to encompass empirical findings about the personal relevance-defensiveness link in the health psychology literature, as well as research on fear appeals (reviewed earlier).

As such, it may be useful to conceptualize genetic-risk communication in the framework of the HSM as a way to identify some of the variables that affect systematic and heuristic processing of information. If counselors want to promote clients’ ability to process genetic-risk information critically and systematically and avoid heuristic thinking, the HSM and related literature offers some guidance as to what variables might be important. For example, situational variables thought to promote systematic processing include: Personal relevance, a lack of time pressure, the perceived need to be accountable for one’s judgments, and high perceived amount of information needed for the judgment task (i.e., low judgmental confidence). Individual-difference variables such as need for cognition, self-efficacy, and clients’ processing goals, including accuracy, defense and impression motives also affect whether systematic processing is likely (Eagly and Chaiken, 1993; Chen and Chaiken, 1999; Giner-Sorolla and Chaiken, 1997; Kahlor *et al.*, 2003; Maheswaran and Chaiken, 1991; Reed and Aspinwall, 1998; Trumbo, 1999).

Findings from contexts outside the HSM are also relevant in that they suggest further variables that promote less biased systematic processing of threatening risk information: Self-affirmation opportunities (Reed and Aspinwall, 1998; Sherman *et al.*, 2000), answering reflective questions (Natter and Berry, 2005), entering risk information on a graphical display (Natter and Berry, 2005), and using personalized expressions of risk information (Berry *et al.*, 2003).

Similarly, heuristic processing is determined by capacity and motivation, as well as clients’ processing goals. Identified variables that promote less effortful processing include: Low personal relevance, low perceived capacity to process information, time

pressure, a small confidence gap between actual and desired levels of judgmental confidence, affective responses to risk such as worry, and message ambiguity (Bottorff *et al.*, 1998; Chaiken and Maheswaran, 1994; Chen and Chaiken, 1997; Eagly and Chaiken, 1993; Giner-Sorolla and Chaiken, 1997; Kahlor *et al.*, 2003). By focusing on those variables that can be modified (e.g., time pressure, judgmental confidence, message ambiguity, risk framing), genetic counselors may avoid those variables thought to promote heuristics, and instead, guide their clients to systematic processing of the genetic-risk information.

## CONCLUSION

A small number of risk communication scholars have begun to apply the HSM outside of persuasion and/or experimental contexts. These field studies have demonstrated the utility of studying risk perception and communication in a variety of health and environmental risk contexts (Griffin *et al.*, 1999, 2002; Kahlor *et al.*, 2003; Trumbo, 1999, 2002). The patterns in processing styles that have emerged in this newer survey research are consistent with earlier lab studies of the HSM (Kahlor *et al.*, 2003), and these scholars support the application of the HSM in specific risk contexts. We suggest that studies of genetic-risk communication in the context of the HSM would be particularly useful for identifying the variables that encourage systematic, deliberate processing of genetic-risk information and disable less effortful, heuristic strategies. In this way, counselors may help promote truly informed decision-making about genetic risk.

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