DISSERTATION

PREDICTORS OF BEHAVIORAL INTENTION TO PURCHASE RISKY CONSUMER PRODUCTS

Submitted by

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ABSTRACT

PREDICTORS OF BEHAVIORAL INTENTION TO PURCHASE RISKY CONSUMER PRODUCTS

Two online surveys dealing with the purchase of potentially risky consumer products, sunscreen containing nanoparticles (n=373) and genetically modified foods (n=379), examined behavioral intention within the framework of the theory of reasoned action (Fishbein & Ajzen, 2010). In addition to attitude and social norms, which are subsumed under the theory, predictors examined included cognitive and affective risk perceptions, systematic versus heuristic processing, and two personality traits: need for cognition and need for affect (specifically, the avoidance and approach sub-dimensions identified by Maio & Esses, 2001).

Four hypotheses were tested and supported. High cognitive and affective risk perceptions were negatively related to attitude, adherence to social norms and purchase intent. High need for cognition was positively related to systematic processing, while negatively related to heuristic processing. High need for affect avoidance was positively related to heuristic processing, while high need for affect approach was positively related to systematic processing. Finally, higher systematic processing was positively related to both cognitive risk perception and affective risk perception, while higher heuristic processing was not.

Sex, awareness, and product use were included as explanatory variables that helped explain purchase intent. Females were more likely to purchase and more aware of both products. Level of prior product perceived knowledge (measured for GM foods only) was not significantly related to purchase intent. However, its higher level was correlated to systematic processing, while its lower level was associated with heuristic processing.

Separate hierarchical regressions examined the combined effects of the focal and explanatory variables on purchase intent. The final regression model in the sunscreen study explained 39.0% of the variance and suggested purchase intent was related to sex (being female), low product awareness, low cognitive risk perception, and positive attitude and conformity to social norms. The final regression model in the GM foods study, which explained 29.2% of the variance, suggested that purchase intention was best explained by the need for affect avoidance, low affective risk perceptions, positive attitude, and conformity to social norms.

This study proposed a framework in which personality traits based on psychological needs (need for cognition and need for affect) led to different styles of processing. Then, two forms of risk perception (cognitive and affective) together were shown to influence purchase intention of common technologically enhanced consumer goods. The study underscored the importance of looking into both affective and cognitive risk perceptions examining purchase intention for risky products. This study also illustrated the potential practical importance of the two sub-dimensions of need for affect identified in the literature, suggesting that each can possibly influence the processing of persuasive messages and risk perceptions and ultimately consumer actions.

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CHAPTER 1: INTRODUCTION

New products employing new technologies can pose actual as well as perceived risks for purchasers. Some examples of the consumer products that have been demonstrated to pose hazards include household cleaning products (e.g., pesticides, herbicides, bleach, and heavy-duty cleaners), hair dyes, and interior house paint. More recently, however, risks have been associated with artificial ingredients and chemical additives in foods and in health and beauty products. These can especially impact consumers' daily lives and safety due to the frequency of their usage and how they are being consumed.

Safety-related risks are part of life for today's consumers. This is why certain products are subject to government scrutiny or must be approved prior to being offered to public. Examples include pharmaceuticals and certain medical devices. Other products can come under regulation based on evidence of safety concerns, often in response to consumer complaints and/or organized efforts by consumer activists who have been harmed or other advocates who are concerned with consumer rights in general. As part of the identification of safety concerns, many products become the topic of controversy because early evidence is often inconclusive or government actions to regulate the product are slow in being implemented.

Activists and advocates use publicity and other tools to raise public awareness and concern, producers often refute such claims, and government agencies sometimes take intermediate steps, such as conducting hearings or asking for public comments to determine whether intervention is necessary or desirable. Not surprisingly, consumers can become aroused or concerned about product safety prior to any government action; those concerns often linger after government action is taken or not taken. Meanwhile, consumers rely on potentially risky

products to meet their wants, needs, or interests – especially when alternatives are not readily available, not convenient, not effective, or too costly.

Product safety is a particular form of risk. Risk is defined by decision theorists as "the situation where a decision maker has a priori knowledge of both the consequences of alternatives and their probabilities of occurrence" (Dowling, 1986, p. 194). Other kinds of risks to consumers include financial risk, self-identity/decision-making risk (scared of making a wrong decision based on a lack of self-confidence or self-efficacy), social risk (looking bad to others), and civic risk (diminishing the lives of others, such as a damage to the environment). Aside from risks related to consumption, people also are concerned about threats from external factors outside their loci of control. Examples include harm or losses from natural disasters, crime, terrorism, organization crises (loss of employment, etc.), and economic collapses. Unlike risks stemming from external factors, people often recognize their internal loci of control (i.e., they can make choices about the products they consume). Consumers vary in their willingness to take such risks. Risk-taking is a personality factor that has been recognized by psychologists, and thus this dissertation will discuss the psychological perspective on the conception of risk in the Literature Review.

Focus of Study

This study sought to examine how perceived cognitive and affective risks influence the purchasing of potentially risky products, as measured by purchase intention. Not surprisingly, the study predicted that perceived risks are disincentives to purchase consumer products; however, it also explored the degree to which purchase decisions were driven by cognitive risk perception, by affective risk perception, or both.

Cognitive and Affective Dimensions of Risk

Psychologists have demonstrated that decision-making in general and product decision-making in particular have cognitive and affective dimensions. Affect is defined by Slovic, Peters, Finucane, and MacGregor (2005, p. 35) as "the specific quality of goodness or badness (a) experienced as a feeling state (with or without consciousness) and (b) demarcating a positive and negative quality of a stimulus," while cognition represents "appraisal, remembering, and anticipation" (Izard, Kagan, & Zajonc, 1984, p. 2). Classical economists assume that when people possess perfect information, they will act rationally and will make choices that result in the greatest utility at the lowest cost. However, behavioral economists recognize that people are often irrational and their decisions can be biased by a variety of factors, including emotions (Rick & Loewenstein, 2008).

According to Sheeran, Harris, and Epton (2013, p. 2), “risk perceptions refer to people’s beliefs about their vulnerability to danger or harm.” Risk traditionally has been viewed from the cognitive perspective. According to Trumbo et al. (2016), approaches for cognitive risk perception measurement "extend back to the early work on the psychometric paradigm (much of which was cognitively based), to emphasize individuals' identification and assessment of objective, observable properties of a hazard" (p. 4). However, recently researchers have paid increased attention to affective aspects of risk, especially in light of the role of fear as an emotional consideration in many risky situations. The relationship between the cognitive and affective dimensions of risk has only begun to be examined, and recent research (Trumbo et al., 2016) suggests that it is advantageous to examine cognitive and affective perceptions.

Purchase Intention

Purchase intention, as a special case of behavioral intention, has been used extensively as a predictor of purchase behavior and draws heavily upon the work of Ajzen and Fishbein and their theory of reasoned action (TRA) and theory of planned behavior (TPB) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1977). The authors assert that "since much human behavior is under volitional control, most behaviors can be accurately predicted from an appropriate measure of the individual's intention to perform the behavior in question" (Fishbein & Ajzen, 1975, p. 380). Attitude, a key intermediary in the influence process in TRA and TPB, is itself a psychological construct that combines cognitive and affective elements and can be defined as a person's favorable or unfavorable predisposition toward a particular object or action. Social norms, also a critical factor in understanding intention in TRA and TPB, can be defined as the perceived social pressure as well as personal feelings of obligation or responsibility to implement or not to implement the behavior (Ajzen, 1991), and they similarly include cognitive and affective dimensions.

Antecedents of Risks Perceptions

The study also sought to investigate how cognitive and affective risk perceptions are created by drawing on two models from psychology that address the role of cognition and affect. These involve both innate individual differences or personality traits found within individuals and alternative modes of processing persuasive messages (i.e., systematic and heuristic modes).

Need for cognition and need for affect are personality traits based on the notion that individuals seek cognition-related gratifications and seek or avoid affect-related gratifications or states of being. According to Cacioppo and Petty (1982, p. 116), need for cognition (NFC) is "an individual's tendency to engage in and enjoy effortful cognitive activity." Need for affect (NFA)

is a relatively newer concept. Developed by psychologists Maio and Esses (2001), NFA measures individual differences in the motivation to approach or avoid strong emotions. Importantly, each individual possesses *both* traits at varying levels and in varying combinations.

Two models in the persuasion literature suggest that individuals engage two alternative styles of processing persuasive messages based on motivation. Specifically, the Heuristic-Systematic Model (HSM) suggests heuristic processing is relied upon by individuals with low motivation to exert cognitive resources to effortfully process a persuasive message. Individuals in general are cognitive misers who, when lacking sufficient reason to do otherwise, rely on heuristic cues in the message that often operate by tapping the message recipient's affect or emotions. By contrast, systematic processing involves the thorough, effortful cognitive processing of a message by focusing on the quality of arguments presented in the message, not simple or peripheral cues (Chaiken, 1980). Unlike its counter-part, the Elaboration Likelihood Model (Petty & Cacioppo, 1986), the HSM contends these two processes can notably co-occur. However, similar to the ELM, HSM research suggests that heuristic processing based on simple cues instead of strong arguments leads to attitude change that is "relatively weak, susceptible to counterpersuasion and less predictive of behavior" (Gawronski & Creighton, 2013, p. 285).

Figure 1.1 depicts a conceptual framework for the relationships between the major variables in this study: Purchase intention and the intermediate components of attitude and social norms, serving as the ultimate outcome of interest or criterion variables (shown at bottom). Innate personality traits include need for cognition (NFC) and need for affect (NFA). In turn people are posited to engage in either systematic or heuristic processing of persuasive messages, or both. Decisions about purchasing potentially risky products are believed to be grounded in perceptions of the product, which similarly can be either cognitive or affective in nature.

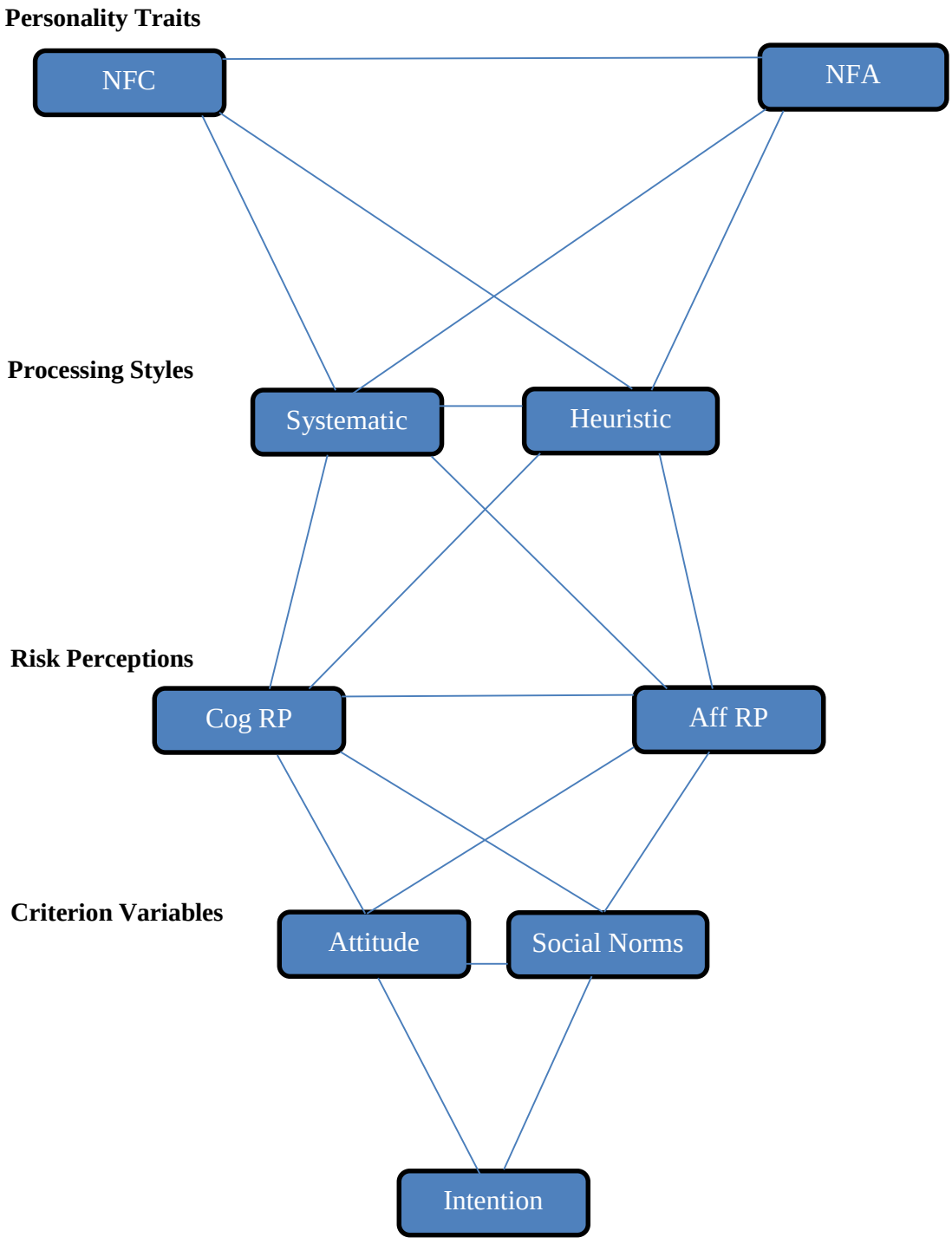

Figure 1.1: Analytical Schematic (NFA = need for affect, NFC = need for cognition, Aff RP = affective risk perception, Cog RP = cognitive risk perception).

Overview of Investigation

This study reports the findings of two online surveys dealing with the purchase of potentially risky consumer products: sunscreen containing nanoparticles (n=373; hereafter, nanoparticle sunscreen) and genetically modified foods (n=379; hereafter, GM foods). Notably, the two products varied considerably in terms of the participants' awareness of the products. Awareness was low or almost non-existent for nanoparticle sunscreen, while awareness was nearly universal for GM foods while understanding varied.

Parallel analyses using the two products were conducted to investigate the impact of cognitive and affective risk perception on purchase intent. In addition, parallel analyses examined the possible influence of the personality traits (need for cognition and need for affect), processing styles (systematic versus heuristic processing), and other possible explanatory variables for each of the products.

Sunscreen is a popular consumer product that prevents sunburn, dry and aging skin, and, most important, skin cancer. Wearing sunscreen can be risky as more and more sunscreen manufacturers are using nanoparticles, tinier versions of the chemicals regularly included, which have different properties and thus differently interact with human skin (Osmond & Mccall, 2010). The scientific community has been split over whether these particles are safe or not (Lee, Scheufele, & Lewenstein, 2005). Nanoparticle development impacts nearly all facets of daily-used products like cosmetics, sunscreens, packaging/decorating materials, and so forth (Balshaw, Philbert, & Suk, 2005). Both sides of this controversy agree that more research on the impact of nanoparticle sunscreens is needed (Fairbrother & Fairbrother, 2009).

Genetically modified foods are a matter of great interest and controversy among many consumers globally (Costa-Font, Gil, & Traill, 2008) compared to nanoparticle sunscreen. Most

farmers, agribusiness interests, and food manufacturers support the genetic modification of foods because it increases productivity, reduces pesticide use, improves preservability and shelf-life, and reduces costs of foods to consumers. On the other hand, other people may object to the use of genetic modification in food production due to potential harmful effects on the human body as well as its ethical implications.

In summary, both nanoparticle sunscreen usage and GM food consumption involve risks that are not yet fully researched. This dissertation was undertaken to more fully understand the linkages between cognitive and affective risk perceptions and their antecedents and purchase behavior using these two potentially risky products.

This dissertation is organized in five chapters. Chapter One has introduced the study. Chapter Two provides a literature review of the relevant constructs and theories. Chapter Three outlines the methodology used to conduct the two surveys and to analyze the results. Chapter Four reports the findings. Chapter Five provides a discussion that summarizes the findings and their implication and discusses limitations and possible directions for future research.

CHAPTER 2: REVIEW OF LITERATURE

This chapter provides the conceptualization and literature review for this study. It begins by reviewing the two focal variables of interest in the study: risk perceptions and their impact on purchase intent. It also reviews two sets of potential explanatory variables for risk perceptions that form a basis for the study: needs for cognition versus affect and systematic versus heuristic processing.

Risk Perceptions: Cognitive vs. Affective

The distinction between different types of risk perceptions that served as predictor variables in this study are cogently summarized by Slovic and Peters (2006):

> Risk in the modern world is perceived and acted upon in two fundamental ways. *Risk as feelings* refers to our instinctive and intuitive reactions to danger. *Risk as analysis* brings logic, reason, and scientific deliberation to bear on risk assessment and decision making. (p. 322)

Of these two approaches, researchers initially focused on the cognitive dimensions of risk and undertook extensive investigations. More recently, however, researchers have recognized the importance of affect, both because of its impact on risk perception covering cognitive factors and as a distinct dimension with effects that operate independently of cognition.

This section, therefore, is divided into three sub-sections: 1) Risk Perception Covering Cognitive Factors, 2) Risk Perception Covering Affective Factors, and 3) Analyzing Cognitive and Affective Risk Perception Together.

Cognitive Risk Perceptions

Cognitive risk perception is grounded in the psychological constructs of cognition, cognitive processing and learning, and decision-making. According to Neisser (1976, p.1), "cognition is the activity of knowing: the acquisition, organization, and use of knowledge." By contrast, affect is "the specific quality of goodness or badness a) experienced as a feeling state (with or without consciousness) and b) demarcating a positive or negative quality of a stimulus" (Slovic et al., 2005, p. 35).

Cognitive processing involves a series of processes that include perception, followed by comprehension, understanding, elaboration, and the selective storage of new information in memory (Christen & Hallahan, 2013). Memory is believed to be organized into schemas, which are cognitive structures that provide linkages between attributes and relationships among people, objects and events. Retrieval of stored knowledge can be biased by the availability and accessibility of schemas, as well as by people's desire for to avoid cognitive dissonance or discomfort resulting from inconsistent information. However, thinking also can be triggered by heuristics, or "rules of thumb" that people use as cognitive shortcuts (Christen & Hallahan, 2013, p. 705).

Most recently, Trumbo et al. (2016, p. 4) used the term "risk perception tapping cognitive factors" in their hurricane risk perception study. Those factors included "the degree to which the individual perceives personal control over hurricane risk, thinks the risk of hurricanes is increasing or believes scientists understand hurricane risk."

Cognitive risk perceptions involve the processing of information and subsequent decision-making about situations, people, objects, or events based on people's recognition of their vulnerability to potential hazards, losses, danger or harm. Sheeran, Harris and Epton (2013)

further noted that "characteristic measures of risk perception capture cognitive evaluations of the hazard (i.e., beliefs about the possibility of harm) but underestimate affective reactions (i.e., feelings about the possibility of harm)" (p. 2). Recognition of riskiness can be triggered by observation or cues found in messages, which people compare to their past experiences and extant knowledge. In general, people are more likely to perceive a situation is risky if they have experienced or been exposed to similar conditions that resulted in negative outcomes. Their fundamental decision involves involvement or avoidance.

Probabilistic models. The earliest cognitive risk perception research took a probabilistic approach, i.e. focusing on the how both experts (starting with Starr, 1969) and ordinary people analyzed particular risks. For example, Sjoberg, Moen, and Rudmo (2004) argued that risk perception is "the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences. To perceive risk includes evaluations of probability as well as the consequences of a negative outcome" (p. 8).

According to Hendricks, Vlek, and Oppelwal (1989), consistent with information processing theory, which compared human reasoning to how a computer logically analyzes data, scholars have investigated probability approximations of humans and have suggested categorizations of cognitive phenomena behind probability of risk. The authors suggest several cognitive strategies, based on different types of information, and identified the following three-fold distinction: logical risk judgment, frequentistic risk judgment, and scenario-based risk judgment.

Probabilistic theorizing was informed further by with the introduction of the ideas of cognitive biases, errors, and heuristics (Kahneman and Tversky, 1979, 1982; Tversky & Kahneman, 1974). For example, prospect theory addressed the often asymmetric or illogical

evaluation of the prospects for gains and losses when people confront risks. According to Kahneman and Tversky (1979), people are more likely to be risk averse, to keep potential gains, when a message is framed positively than when a message is framed negatively. Prospect theory further suggests that individuals are less likely to take risks when considering gains since the perceived subjective value of gains is fairly low, while individuals will take risks to avoid losses since the subjective value of losses is relatively high (Tversky & Kahneman, 1981). Other researchers suggest loss frames are more effective for changing behaviors deemed risky, while gain frames are more adequate for behaviors deemed safe (Banks et al., 1995; Edwards, Elwyn, Covey, Elaine, & Pill, 2001).

Psychometric paradigm. In contrast to the probabilistic model, later cognitive approaches to risk perceptions have focused on characterizing people's knowledge, evaluations or opinions about a variety of potential risks. The psychometric paradigm was developed by Fischhoff, Slovic, Lichtenstein, Read, and Combs (1978; see also Slovic, Fischoff, & Lichtenstein, 1982) and posits that cognitively based risk perceptions involve more than a simple calculus related to morbidity and mortality and the potential benefits of a particular risk to society. Instead, multiple factors shape risk perceptions, which can be measured using psychophysical scaling and multivariate analysis techniques.

Notably, although the psychometric model has evolved to recognize the importance of affect, the initial conceptualization was quite cognitively based. An early goal of the psychometric model was to develop a taxonomy for hazards that could be used to understand and predict responses to risks and "to produce quantitative representations or cognitive maps of risk attitudes and perceptions" (Slovic, Fischhoff & Lichtenstein, 1986, p. 4). Two decades after its

inception, Sjöberg (2000, p. 9) argued that the psychometric model remained "cognitive in its conception and flavor" and remained grounded in the perceptions about the hazards analyzed.

Fischhoff and his colleagues (1978) initially conducted a psychometric study of attitudes towards technological risks and benefits. Most notably, they identified 18 risk characteristics that could be associated with different hazards. These characteristics were then arrayed into two factors: 1) whether the risk was understood (observable, known to those exposed, immediate effect, old risk and risks known to science), and 2) evoked a feeling of dread (controllable, global catastrophic impact, consequences fatal, not equitable, catastrophic, high risk to future generations, not easily reduce, risk increasing, involuntary and affects individual directly) (Slovic et al., 1986). Other scholars have further investigated topics such as the impact of sex, race, perceived risk, and new-age beliefs (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Sjöberg & Wåhlberg, 2002). Later, both earlier scholars (Slovic, Fischhoff, & Lichtenstein, 1985) and other researchers (Finucane et al., 2000) confirmed the previous findings and further introduced the three significant dimensions of the risks: number of people affected, dread, and knowledge of the threat.

Affective Risk Perceptions

Recognition of the importance of affect. The "cognitive revolution" in the 1960s was initially described as an openly acknowledged lack of interest in affect (Hilgard, 1980). However, Bruner (1990) took a new stance in studies of social perception and contended that feelings and preferences indispensably impact all perceptual judgments. Eventually, evolving interest in real-life cognition showed that affect plays a major role in how human beings deal with social information (Bruner, 1990; Neisser, 1982).

According to Tomkins (1962, 1963), there are nine basic affects in three categories: positive affect, consisting of interest/excitement and enjoyment/joy; neutral affects, consisting of surprise/startle; and negative affect, consisting of anger/rage, fear/terror, distress/anguish, shame, and disgust. These affects have been used in social and cognitive studies of decision making, with research suggesting that these affective states have an influence on memory recall, judgments or decisions, and categorization of stimuli (Cohen & Areni, 1991).

Lerner, Vladesolo, and Kassam (2015) noted an explosion in the number of scholarly publications devoted toaffect. Indeed, many scholars assert that emotions (versus cognitions) are the significant motivational force in decision making processes of people's daily lives (e.g., Ekman, 2007; Frijda, 1988; Gilbert, 2006; Keltner et al., 2014; Keltner & Lerner, 2010; Lazarus, 1991; Loewenstein et al., 2001; Scherer & Ekman, 1984).

Within the context of risk, affect can be either positively or negatively valenced. Positive affect can include general arousal or attraction to an idea or situation, which at its extreme can result in thrill-seeking and purposeful risk taking. Negative affect typically results in avoidance and is most commonly associated with dread, which can be defined as "to fear greatly or to feel extreme reluctance to meet or face a situation" (Merriam-Webster.Com, n.d.). Alternative synonyms for dread include "alarming, frightening, awe-inspiring, awful, creepy, dire, frightful, shuddersome and terrible" (Dictionary.Com, n.d.). In general and in the context of this study, affective risk perception connotes negative affect.

Affect's direct impact on decision-making: The affect heuristic. Other research has also looked into the direct influence of affect on how people evaluate certain situations. For example, Lerner and Keltner (2001) examined the impact of discrete emotions on people's

perceptions and discovered fear and anger, both negatively valenced emotions, to have opposite effects.

Consistent with other dual processing models, affect is also believed to operate heuristically as a shortcut that predicts and explains numerous aspects of perceived risk. Slovic, Finucane, Peters and MacGregor (2002, 2007) explain that idea of affect draws from early theorizing about the role of affect by Zajonc (1980) as well as Damasio's (1994) idea of somatic markers wherein:

> Representations of objects and events in people's minds are tagged to varying degrees with affect. In the process of making a judgment or decision, people consult or refer to an ''affect pool'' containing all the positive and negative tags consciously or unconsciously associated with the representations. Just as imaginability, memorability, and similarity serve as cues for probability judgments (e.g., the availability and representativeness heuristics), affect may serve as a cue for many important judgments. Using an overall, readily available affective impression can be far easier—more efficient—than weighing the pros and cons or retrieving from memory many relevant examples, especially when the required judgment or decision is complex or mental resources are limited. This characterization of a mental short-cut leads to labeling the use of affect a 'heuristic.' (Slovic, Finucane, Peters & MacGregor, 2007, pp. 1335-1336)

Slovic and Peters (2006, p. 324) explained that the affect heuristic, relies on positive and negative feelings and that it predicts and explains numerous aspects of perceived risk. They explained this concept by suggesting the reason that the general population considers nuclear

power plants' radiation exposure (highly dreaded) as a lot riskier compared to medical X-rays radiation, which is an evaluation not agreed to by risk specialists. They further asserted that feelings of dread were the primary reason for the public's risk perception as well as admittance of risk for a variety of hazards.

To illustrate, consider how people make summary judgments about topics where it is possible to focus on specific information to make a judgment versus judgments people might be asked to make about broader topics where they might not have specific information. According to Andrews and Withey (1976), it is well established that when someone is asked how satisfied they are with some aspect of their life, their response will be driven by two components: their pre-existing affective states and cognitions that come to mind when processing this question. Satisfaction is, therefore, a composite of these two factors: cognition and affect. The degree that these two factors influence our judgments of satisfaction depends on the degree of the specificity of the satisfaction question (Andrews & Withey, 1976). If someone asked, "How satisfied are you with your mobile phone?" there is only a limited amount of information that is relevant to the question. As a result, it is easy to derive a reasonably accurate judgment on the level of satisfaction with this target. Such specific satisfaction questions are, thus, prominently driven by cognition (Levine, Wyer, & Schwarz, 1994; Schwarz & Strack, 1999).

On the other hand, if someone asked, "How satisfied are you with your whole life?" there is too much relevant information to effectively process. Consequently, it would be impossible to make an accurate, completely cognitive-driven judgment. Actually doing this would take a lot of time and effort, weighing the variety of things in one's life that may or may not be going well. The fact that the majority of people can answer this question quite fast demonstrates that they are not processing this question in the type of detailed, deliberate way that

would be essential for cognitive processing (Schwarz & Strack, 1999). Instead, these judgments are not based on effortful cognition, but are instead made quite quickly based on the person's affective state at the time of questioning.

The impact of affect was evidenced in a study by Davern, Cummins, and Stokes (2007 wherein participants were asked to rate the degree that they generally experienced certain affective states (e.g., happy, content, excited, etc.). With the use of regression analyses, the authors found that six affective terms accounted for 64% of the variance in the question, "How satisfied are you with your whole life?" With affect explaining such a large amount of the variance in this question, it demonstrates that affect is the driving force behind the broad question of satisfaction with "life as a whole." As the last step to fully understand affective and cognitive risk perceptions, the next section examines how dual-process risk perception has emerged.

Analyzing Cognitive and Affective Risk Perceptions Together

A pivotal question addressed in this study is how cognitive risk perceptions and affective risk perceptions operate (i.e., whether their influence is independent or whether they operate interdependently).

The potential interaction between cognition and affect has been recognized in dual-process theories of information processing (Chaiken & Trope, 1999; Epstein, 1994, Gawronski & Creighton, 2013). In terms of the interplay of cognition and affect on risk perceptions, Fischhoff et al. (1978) compiled nine elements from the literature and asked individuals to evaluate the "risk" of a variety of activities using those nine elements; they included both affective and cognitive questions. What they found was that perceived risk was well illustrated by dread (i.e., fear of the risks). Later, and more generally, many scholars have emphasized the

significance of evaluating both cognitive and affective factors of risk perceptions (e.g., Janssen, van Osch, De Vries, & Lechner, 2011; Klein, Zajac, & Monin, 2009; Linville, Fischer, & Fischhoff, 1993; Loewenstein, Weber, Hsee, & Welch, 2001; McCaul & Mullins, 2003; Ruiter, Abraham, & Kok, 2001; Sheeeran, Harris, & Epton,2013; Slovic & Peters, 2006).

Notably, researchers have recognized that much of the decision-making process about risks is still implicitly cognitive as people strive to predict the events; however, people also strive to predict the nature and strength of their future emotions in response to possible decision outcomes and then weigh them according to their probability of occurring (Loewenstein, Weber, Hsee, & Welch, 2001, p. 268). Thus, the psychometric model discussed previously has evolved to incorporate both cognitive and affective risk perceptions. In recent research pertaining to hurricane preparedness and evacuation intention, the psychometric model was described as a framework in which risk perception is defined as "a function of the individual's cognitive and affective estimations of the probability of harm from a given hazard" (Trumbo et al., 2016, p. 3).

Separate measurement of cognitive versus affective risk perceptions as distinct constructs began quite recently. For example, Västfjäll et al. (2008, p. 66) came up with a six-item emotion scale that consisted of the adjectives *sad, depressed, anxious, worried, afraid*, and *angry*. This approach was adapted by Trumbo et al. (2016), who used two separate 6-item scales to measure cognition (such as the degree to which the individual perceives personal control) and affect (such as the degree to which individuals dread various outcomes).

In summary, this study posits that cognitive and affective risk perceptions are distinct concepts that impact people's behavior. Cognitive risk perceptions are grounded in knowledge and perceptions of the risk itself, including but not limited to a probabilistic analysis of the likelihood and severity of a potential danger, hazard or loss. Affective risk perceptions can

influence cognition and also operate directly or heuristically by serving as a mental shortcut used by people (when deciding to engage in or avoid particular risky behaviors wherein they anticipate not only events but also their emotional response to such events).

Dependent Variable: Purchase Intention

While positive attitude toward the brand represents a predisposition to purchase, *purchase intention* is defined as the self-reported probability that such a purchase activity will be undertaken. Purchase intention is a special case of behavioral intent and represents a likelihood statement that combines elements of both affect and action. According to Spears and Singh (2004, p. 56), purchase intention can be defined as "an individual's conscious plan to make an effort to purchase a brand." Earlier conceptualizations suggested that purchase intent involved personal action tendencies relating to a brand (Bagozzi et al., 1979; Ostrom, 1969) and as "the person's motivation in the sense of his or her conscious plan to exert effort to carry out a behavior" (Eagly & Chaiken, 1993, p. 168).

Purchase intention has been used over the past several decades as a dependent or criterion variable (along with attitude toward the product or attitude toward the brand) in a wide range of studies that have tested advertising and marketing communication strategies as well as acceptance and adoption of new or unusual product categories and brands. Although several authors examined conceptual and methodological issues in the 1970s and 1980s (see Spears & Singh, 2004; Kalwawni & Silk, 1982), the construct has been generally accepted as a standard measure in more recent research without much discussion. Measures of purchase intention have ranged from single items on surveys and in experimental questionnaires to short 3- to 5-item indexes that have demonstrated exceptionally high reliability (Cronbach alphas typically >.90). Examples include a battery of questions on a 5- or 7-point scale that ask study respondents whether they *want to, need to, wish to,*

plan to, intend to, or *feel obligated to* purchase a specified product. Alternatively, study participants have been asked whether they plan or intend to purchase a particular product and then asked to respond on 5- or 7-point scales featuring antonymic pairs such *as never/definitely, probably not/probably, definitely intend/definitely do not intend, will/will not,* and/or *very low interest/very high interest.*

Behavioral Intention in Theory of Reasoned Action

Behavioral intention, as the more general case of purchase intention models plays a central role in Ajzen and Fishbein's theory of reasoned action (1977, 1980), a seminal theory used to examine persuasion and explain human behavior more generally. Behavioral intention plays a similar role in Azjen's (1985, 1987) extended theory of planned behavior (TPB) and reasoned action approach, which also addresses the extent to which people believe they can exert control over their behavior. Ajzen (2012) describes TPB as "dominant conceptual framework for predicting, explaining, and changing human social behavior" (p. 11). This dissertation is not using TPB because people's sense of being able to exert control is not a focal interest of the researcher and thus not included in this study. Behavioral intent is also found in lesser known models such as Miniard and Cohen's (1983) alternative model that distinguishes between personal and normative reasons for taking action (See also Netemeyer, Andrews and Durvasula, 1993).

As part of their theory of reasoned action, Ajzen and Fishbein (1977, 1980) posits that a behavioral intention measure will predict performance of any voluntary act unless intention changes prior to performance, or unless the intention measure does not correspond to the behavior criterion in terms of action, target, context, time-frame and or specificity. It is the best proxy available to measure impact of promotional messages prior to the targeted behavior. In short, behavioral intention is a good predictor if 1) the individual's plans do not change, and 2) the individual is

not impeded from taking action (Fishbein & Ajzen, 1975). According to an early meta-analysis by Sheppard, Hartwick, and Warshaw (1988, p. 325), "not only does the model appear to predict consumer intentions and behavior quite well, it also provides a relatively simple basis for identifying where and how to target consumers' behavioral change attempts" (For discussions, also see Fazio, Powell and Williams, 1989; Miniard and Cohen, 1979, 1981).

According to TRA, behavioral intent is a function of two factors: *attitudes toward acts* and *subjective norms*. In their comprehensive review published three decades following the introduction of the theory, Fishbein and Ajzen (2010) explain:

> First, people hold beliefs about the positive or negative consequences they experience if they performed the behavior. These outcome expectancies or behavioral beliefs are assumed to determine people's attitude toward personally performing the behavior—that is, their positive or negative evaluation of their performing the behavior in question…. Second, people form beliefs that important individuals or groups in their lives would approve or disapprove of their performing the behavior as well as beliefs that these referents themselves perform or don't perform the behavior in question. (p. 20)

Attitudes. In defining attitudes, it has been widely acknowledged that "early theoretical developments emphasized the complexity" of the concept (Fishbein & Ajzen, 2010, p. 76). For example, according to Allport (1935), "an attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (p. 810). In a similar manner, Krech and Crutchfield (1948) defined attitudes as "an enduring organization of motivational,

emotional, perceptual, and cognitive processes with respect to some aspect of the individual's world" (p. 152). Such broad interpretations of attitude were commonly investigated by researchers who frequently borrowed Allport's definition in their studies (Fishbein & Ajzen, 2010).

Most scholars who conduct research on attitudes agree that an attitude's fundamental trait is in its dimension of bipolar evaluation (i.e. its directionality from positive to negative) (Ajzen & Fishbein, 2005; Eagly & Chaiken, 1993; Fazio, 1990; Fishbein & Ajzen, 1975; Krosnick, Judd, & Wittenbrink, 2005; Petty & Cacioppo, 1986). In addition, some scholars assert that attitude can be defined with the hypothetical characteristic (Eagly & Chaiken, 2005) and "assume that evaluative responses of various kinds can be used to infer it" (Fishbein & Ajzen, 2010, p. 76). In the present investigation, the latter disposition of the concept was applied when this study came up with attitude items for nanoparticle sunscreen, while the former characteristic of the concept was used when it formulated attitude items for GM sunscreen (see Table 4.2 and Table 4.3). The reason this research changed the attitude questions from evaluative responses of various kinds to the bipolar evaluative dimension is because more scholars have more commonly used the dimension of bipolar evaluation when they measure individuals' attitudes (Ajzen, 2011).

Social norms. Fishbein and Ajzen (2010) explained the definitions of social norms in the following manner:

> There is general agreement that the social environment can exert strong influence on people's intentions and actions. This influence is captured most frequently in the concept of social norm, a central construct in the theorizing of sociologists and other social scientists. Generally speaking, social norms refer to what is acceptable or permissible

> behavior in a group or society…. In our reasoned action framework, norms are more narrowly defined and are focused on the performance of a particular behavior. That is, we view norms as perceived social pressure to perform (or not to perform) a given behavior. (pp. 129-130)

A sociologist would contend that social norms can be described as informal comprehensions that control the behaviors of individuals in society (Oxford Dictionary of Sociology, n.d.). On the other hand, a social psychologist would recognize "smaller group units, such as a team or an office, may also endorse norms separately or in addition to cultural or societal expectations" (Jackson, 1965, p. 301). Namely, not only are norms treated as collective expressions of group of people's conduct, but norms are also regarded as each person's perceptions of certain group of people's conduct (Lapinski & Rimal, 2005). Such ideas have been recognized by scholars since the 1930s, such as the work of Sherif (1936). In particular, it was noted that social norms can be interpreted as cultural entities such as values, customs, and traditions (Sherif, 1936), which symbolize people's fundamental understanding of how other individuals behave and their speculation on how they ought to behave (Cialdini, 2003).

Outside the TRA, social norms have been used as evidence in social marketing campaigns where people overestimate the levels people engage in activities that might be hazardous (Burchell, Rettie, & Patel, 2013). For example, college students misjudging the amount of alcohol consumed or the incidence of sexual activity engaged in by other students. Evidence about actual behavior (which disconfirm beliefs about the popularity of particular, tempting activities) is presented to discourage excessive or risky behaviors.

Previous researchers have utilized the theory of reasoned action and its attendant measures of behavioral intention, attitudes, and perceived social norms, to examine decision making in a variety of contexts. Early examples include the following: health, support of pro-social causes, personal self-improvement, willingness for religious practice/sports activity, viewers' media selection, and consumer choice on necessities (Sheppard et al., 1988). One study closely related to this study, employed the TRA to better understand sunscreen usage among children and found "direct and indirect relationships among study variables that confirmed those predicted by the TRA" (Martin, Jacobsen, Lucas, Branch, & Ferron, 1999, p. 37). Silk, Weiner, and Parrott (2005) similarly studied attitudes and subjective norms relevant to genetically modified foods as a theoretical strategy for audience segmentation.

Risk, purchase behavior, and purchase intention. Fill (2009) explains that various factors are associated with the purchase decision process, including but not limited to utility of the product, personality traits and other individual differences variables, and the level of risk perceived by the consumer. Fill defines risk as "the uncertainty of a proposed purchase and the outcomes that will result from the decision to purchase" (p. 170). In this vein, Jacoby & Kaplan (1972) identified five types of perceived purchasing risks including performance, financial, social, ego and physical risks. The latter could include damage to other belongs (such as other equipment) or endangerment of personal safety.

Product safety, where potential harm might exceed potential benefits, has been a concern among from marketing and social responsibility perspectives since the 1970s. For instance, Chandran, Lowenhar, and Stanton (1979) provided an overview of the role of advertising in product safety and showed some guidelines for product advertising policies. In the 1990s, Stoltman and Morgan (1995) investigated the behavioral elements that can impact the efficacy of

information provision program. More recently, Kim and Chung (2011) examined consumer purchase intention for organic personal care products.

Not surprisingly, studies have demonstrated that there was a negative relationship between risk perception (perceived risk) and consumers' new product purchase attitude/intention (Choi, Lee, & Ok, 2013; Lee, 2009; Michaelidou & Christodoulides, 2011). Perceived risk means, in the area of consumer behavior, an individual's level of belief that some negative outcomes might be caused by consuming certain products (Michaelidou & Christodoulides, 2011). In their review of a number of studies, Yang, Sarathy, and Lee (2016), noted "if a consumer perceives more risks from the purchasing of products, their attitude toward this purchasing behavior is less favorable and vice versa" (p. 68). For instance, there were statistically significant negative impact on consumers' attitudes when they purchase products such as street food (Choi et al., 2013) and computer games (Michaelidou & Christodoulides, 2011). Consumer researchers suggest an indirect role for risk beliefs, which are mediated by attitudes (Yang, Sarathy, and Lee, 2016). As a good example, Lee (2009) demonstrated that consumers' attitudes about online transactions impacted their intention to conduct their stock trading online. Lee's research showed that risk beliefs had a detrimental effect in that process.

Antecedents to Risk Perception: Personality Traits and Information Processing

Although the primary focus of this dissertation is to examine the impact of risk perceptions on purchase intent, the study also sought to consider how relevant personality traits and information processing might impact these variables. The following section reviews need for cognition and need for affect as personality traits as well differences that might accrue from reliance on systematic versus heuristic processing or information pertaining to potentially risky products.

Need for Cognition versus Need for Affect as Personality Traits

Growing bodies of literature demonstrate potentially powerful influence of different levels of need for affect and need for cognition as personality traits. This section introduces each of these concepts and how they have evolved.

Need for cognition. According to Cacioppo and Petty (1982), the most important dispositional factor that influences processing strategies is an individual's innate motivation to engage in effortful cognitive-based processing. This innate motivation, called need for cognition (NFC), seems to be a stable construct, with individuals ranging on a continuum from low to high levels. Research dealing with this construct has mainly taken place in the area of persuasion using the widely adopted elaboration likelihood model (ELM, Cacioppo & Petty, 1982) and suggests people with high levels of NFC tend to make judgments based on the quality of information in a persuasive message and exert more cognitive effort when processing information (Cacioppo & Petty, 1982).

High NFC is presumed to encourage central route processing under the ELM and contribute to making people's attitude change occur more frequently (Harrington, Lane, Donohew, & Zimmerman, 2006). Moreover, high-NFC individuals excel at challenging cognitive tasks.

By contrast, people with low levels of NFC seek to make a correct judgment but do so by focusing on peripheral and heuristic cues found in the message that not require effortful processing. Examples include the attractiveness of presenter, graphical appeal of the message, or the sheer number of arguments presented (regardless of quality). Stated another way, low NFC reduces people's "likelihood of message elaboration," i.e. whether not they critically investigate

messages and “add something of their own to the specific information provided in the communication” (Petty & Wegener, 1999, p. 46).

The initial scale used to measure need for cognition (Cacioppo & Petty, 1982) contained 34 items, and after several revisions, a more efficient, abridged NFC scale was created that included only 18 items (Cacioppo, Petty, & Kao, 1984). Then, Perse (1992) measured NFC with an even shorter 10-item scale, while and Sherrard and Czaja (1999) created yet another NFC scale with 9 items that maintained equivalently sound reliability and convergent validity, compared to the 18-item version. Later Hawkins et al. (2001) utilized a five-item index of the highest loading items from Cacioppo and Petty’s NFC scale (1982).

Need for affect measures differences among people in the motivation to approach or avoid strong emotions. Maio and Esses(2001) explain the concept in the following manner:

> We define the need for affect as the general motivation of people to approach or avoid situations and activities that are emotion inducing for themselves and others. Because emotions are an ubiquitous part of life, we expect that this need is a pan-cultural necessity. It includes the desire to experience and understand the emotions of oneself and others, and it includes the belief that emotions are useful for shaping judgments and behavior. People would not attempt to experience and understand others’ emotions if they found emotions uncomfortable, and they would not approach emotions if they regarded emotions as unproductive. (p. 585)

In their conceptualization, need for affect (NFA) encompasses “both a motivation to approach emotions and a motivation to avoid them” (Maio & Esses, 2001, p. 587). Uniquely

separate impacts of approach and avoidance motivations have been revealed in several research studies; for example, research has uncovered that approaching success as well as avoiding failure have uniquely separate impacts on intrinsic motivation (Elliot & Harackiewicz, 1996) and subjective well-being (Elliot, Sheldon, & Church, 1997). Furthermore, research in neuropsychology has differentiated approach and avoidance motivations (e.g., Gray 1972, 1990). Maio and Esses (2001, p. 588) also explained that "approach motivations are closely linked to the experience of positive affect and avoidance motivations are closely linked to the experience of negative affect" (e.g., Davidson, 1998; Heubeck, Wilkinson, & Cologon, 1998; Lang, 1995). In addition, Maio and Esses (2001) asserted that "the motivation to avoid emotion might be uniquely predictive of behavior when one anticipates or is currently experiencing emotions that are intense and involving" (p. 588). Carver (2006) expands upon this conceptualization of the two dimensions of need for affect:

> Psychology sometimes returns to old ideas in new forms. One old idea…. is that behavior is built from two distinct kinds of action tendencies. Sometimes these are discussed simply as action tendencies: approach and avoidance (withdrawal). Sometimes they are discussed in terms of motivations: appetitive and aversive. In either case, the argument is that these two classes of motives or actions are the fundamental building blocks that underlie the complexity of human behavior. (p. 105)

More recent research on stimuli or message type has found that individuals high in NFA are likely to be influenced and persuaded more by an emotional message rather than a cognitive

message (nonemotion inducing), and have better memory recognition for the information from the affective message (Haddock, Maio, Arnold, & Huskinson, 2008).

In its original measure, the 26-item NFA scale accessed an individual's motivation to engage in or refrain from emotional stimuli with questions such as "I feel that I need to experience strong emotions regularly" and "I would prefer not to experience either the lows or highs of emotion" (Maio & Esses, 2001). More recently, Appel, Gnambs, and Maio (2012) developed a 10-item measure of NFA while demonstrating empirically its validity and reliability. The original 26-item NFA scale, included 13 approach items and 13 avoidance items; while the 10-item version of NFA has five items of each type.

Relationship Between NFC and NFA

Maio and Esses (2001) argue that NFA and NFA are distinct processes, explaining one is holistic and one is analytical based on rules of reasoning but allow for interaction between the two processes. They suggest, for example that cognitive tasks involve a moderate amount of emotion, such as frustration or joy.

Indeed, Maio and Esses (2001) discovered that these two concepts are correlated positively. They elaborated that this positive relation "indicates that people who seek emotions also tend to seek and enjoy effortful cognitive endeavors, contradicting some common assumptions" (p. 597). They further argued that it would be fruitful to investigate the *total* need for affect as well as its two components, emotion approach and emotion avoidance, to most fully grasp emotion-related processes (p. 609). As a good example, Rosenbaum and Johnson (2016) examined whether personality traits influence the relationship between spoilers (e.g. revealing the outcome of a story) and enjoyment and found that "individuals with a high need for affect enjoyed unspoiled stories more," compared to individuals with a low NFA (p. 273).

Need for Cognition, Need for Affect, and Risk Perceptions

Recent research has pointed out that it would be quite useful to utilize both need for affect and need for cognition (Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Haddock et al., 2008), but also in risk perception and decision making, supporting the applicability of these constructs to be combined with the dual-process risk perception approach introduced earlier (Arceneaux & Vander Wielen, 2013; Keer, van den Putte, & Neijens, 2012; Steinhart, Kamins, Mazursky, & Noy, 2013; van Gelder, de Vries, & van der Pligt, 2009). More recently, Haddock et al. (2008) tested experimentally the effects of conditions of high NFC/low NFA and low NFC/high NFA, and found that the former group is more likely to be persuaded by a cognitive message, while the latter group is more likely to be persuaded by an affective message.

When designing public information campaigns, targeting and segmenting audiences are critical. In these cases, the message creators hold important information about their audiences that facilitate effective communication outcomes. If researchers can identify people with high need for cognition/low need for affect as well as people with low need for cognition/high need for affect among the audience, they can then more effectively utilize either a cognitive message (for the former) or an affective message (for the latter). This can be quite feasible since previous researchers (Cacioppo & Petty, 1982; Maio & Esses, 2001) have already established reliable scales for both need for cognition (NFC) and need for affect (NFA). In addition, for those who have high NFC and NFA, researchers can utilize a high cognitive and affective message while, for those who have low NFC and NFA, they can utilize a low cognitive and affective message. The segmentation strategy is more likely to be achieved by deploying messages that are HNFC/LNFA in media that lend themselves to presentation of arguments in that format (such as

opinion magazines), while LNFC/HNFA messages need to be developed for media that appeal to personalities with these characteristics (such as popular magazines or television).

Systematic and Heuristic Processing as Antecedents of Risk Perception

Under the Heuristic-Systematic Model's conceptualization, individuals can engage in systematic and heuristic processing at the same time. According to Smith and DeCoster (2000):

> People go beyond heuristic processing when circumstances 1) make them feel an unusually great need to be accurate, defend an attitude, or create a positive impression; and 2) offer enough time and cognitive capacity to permit more effortful processing. When both of these conditions hold, people will perform systematic processing…. Systematic processing is assumed to take place in addition to, and simultaneously with, heuristic processing rather than replace it. The two types of processing may have additive or offsetting effects on judgment, depending on the circumstances. (p. 119)

In understanding the inner workings of heuristic and systematic model, topic and personal involvement and situational factors play an important role. According to Branscombe and Cohen (1991), the traits of the judgment itself will affect whether someone is going to engage in systematic processing. If a judgment is personally relevant, such as when a person perceives a possible personal risk, the need to make a judgment will (1) increase motivation towards processing the information in a careful, deliberate manner in an individual's ongoing life (enduring involvement), and (2) increase the person's ability to engage in systematic processing (issue involvement) because there will be an increased amount of accessible information relevant to the issue (Branscombe & Cohen, 1991; Forgas, 1994). For instance, if someone is asked,

"How satisfied are you with the current government's environmental policy?" this may be personally relevant for the person (e.g., if an individual is passionate about climate change or environmental issues), which might make the question quite important and motivate the person to process the information carefully. This circumstance may also cause some information relevant to the question to be more salient, and thus, there would be sufficient information from which to form a judgment that is predominantly cognition-based.

On the other hand, if climate change or any current environmental issue is not a personally relevant issue for someone, then he/she would not be motivated to process this question in greater detail, and there may be a lack of accessible information that is particularly relevant to this question. Therefore, low personal relevance increases the likelihood that the easier, non-cognitive processing strategy will be employed (i.e., heuristic processing).

Typically, judgments formed through systematic processing are more stable and more tied to subsequent behavior than judgments formed through heuristic processing. How typical or complex the judgment is also affects the processing that is engaged (Branscombe & Cohen, 1991; Forgas, 1994). For example, if someone were asked a very common question that is simple and requires very little processing, then time and effort would not be spent processing the question systematically. Rather, the easier option of heuristic processing would be taken. On the other hand, if the question was extremely low in personal relevance, the motivation to cognitively process information relevant to the question would also be low and people would be more likely to process information through heuristic processing.

Systematic-Heuristic Processing and Risk Perceptions

Some risk perceptions are based on deliberate and analytic considerations and some are based on intuition (e.g., Kahneman, 2003; Kahneman & Frederick, 2002; Slovic et al., 2005). For

instance, if an individual is passionate about environmental issues, generally, that person might be driven to process messages through a need to more thoroughly understand environmental messages while at the same time greatly enjoying this apprehension process.

In a study of heuristic-systematic information processing, Trumbo (1999) found that systematic processing is likely to lead people to greater motivation, while heuristic processing is likely to lead people to a judgment of less risk. He later explained that across a series of studies involving communities concerned about cancer rates as well as electronic cigarettes among college students, "that heuristic processing is consistently linked to lower risk evaluations" (Trumbo, 2002, p. 381).

Similar observations can be also found in other research pertaining to personal decision-making involving risk (Gaspar et al., 2016; Smith et al., 2017). Gaspar and his colleagues hypothesized that information avoidance of red meat risks would be negatively related to systematic and heuristic processing of information. This hypothesis was only partially supported that it was only affirmative with regard to systematic processing (Gaspar et al., 2016). Smith and her colleagues presented findings at two literacy levels about perfluorooctanoic acid (PFOA), a possible environmental contributor to breast cancer. They discovered heuristic processing cues, when operationalized as perceived message quality and source credibility, were positively associated with risk beliefs. In turn these predicted negative attitudes about PFOA. More knowledge and lower literacy message led to lower perceived risk, while greater involvement and ratings of heuristic cues led to greater risk-perceptions (Smith et al., 2017, p. 279).

Summing up, people can engage in both systematic and heuristic processing of messages that might contain risk elements. Although one or the other might be dominant, the two can co-occur in the formation of risk perceptions. In risk management and communication, relatively

few researchers have utilized the HSM to examine the public's processing of and decisions to risk-related information (but see Griffin, Dunwoody, & Neuwirth, 1999; Griffin, Neuwirth, Dunwoody, & Giese, 2004; Kahlor, Dunwoody, Griffin, Neuwirth, & Giese, 2003; Trumbo, 1999, 2002). It would be appropriate to include information processing style in this study because the concept so closely aligns with the o the cognitive (or rational) and affective (or experiential) modes of risk perception as discussed in the previous section, but also because the two styles of information processing can occur at the same time (as most risk judgments are made that way).

Possible Explanatory Variables

Beyond personality traits and type of information processing, this study recognizes that various other factors might influence a consumer's decision to purchase potentially risky products such as sunscreen containing nanoparticles or genetically modified foods. This research included five control variables that might help explain risk perceptions and their impact on purchase intention. These included: sex, awareness of and prior perceived knowledge of the products, actual prior use of the product, exposure to controversies related to the product, and prior attitudes. Each of these explanatory variables is reviewed briefly below.

Sex

Research suggests that the sex of respondents, i.e., whether the individual self-identifies as male or female, can influence their interest in particular product category, style of cognitive processing, openness to innovation, and aversion to risk. Sex is used here as a biological concept that differentiates people and is used interchangeably with sex of respondent. Past research shows that females and males have different information processing styles when they process claims in advertising messages (Meyers-Levy, 1989). Specifically, women demonstrated much

more sensitivity to the details of the information when making decisions, compared to men (Farina, 1982; Lenney, 1977; Meyers-Levy & Sternthal, 1991). Furthermore, Darley and Smith (1995) assert the following:

> Males often do not engage in comprehensive processing of all available information as a basis for judgement but instead are selective. Indeed, males tend to employ various heuristics devices that serve as surrogate for more detailed processing…. In contrast, females tend to use a 'comprehensive strategy' and attempt to assimilate all available cues. Though capacity restrictions in active memory may prevent women from accomplishing this goal, they usually attempt to engage in effortful, comprehensive, itemized analysis of all available information (p. 43).

Similarly, according to Cho and Workman (2014), "… is a significant factor influencing tolerance for risk-taking, indicating that women tend to have greater tolerance for risk-taking than men; that is, women, compared to men, are more willing to try new or unusual products and also enjoy the stimulation of the newness" (p. 476). Such findings are in accordance with research that demonstrate females are more likely to, compared to males, become early adopters in fashion. i.e., willing to take risk in demonstrating such potentially risky consumer behavior (Workman & Johnson, 1993).

Awareness/Prior Perceived Knowledge

Product class knowledge is an *ability* (versus motivational) factor, and was used in the study because individuals would not be expected to be equally familiar or experienced with all

products used in a multiple-product study and because overall knowledge about products might vary across individuals.

Sujan (1985) and Rao and Sieben (1992) define *prior product knowledge*, in general, as encompassing the amount of accurate information held in memory (objective knowledge) as well as self-perceptions of product knowledge about what they think they know (subjective knowledge). Alba and Hutchinson (1987) point out that consumer product knowledge has two components: *familiarity* (based on purchase, use, or vicarious experience) and *expertise* (based on the ability to perform product-related tasks). While *direct experience* is useful, it is not necessary (Hoch & Deighton, 1989). Johnson and Russo (1984) suggest that existing knowledge facilitates learning, provides better understanding of alternatives and relationships among elements in a product class, and allows individuals to focus attention on *product attributes* (Jaccard, Brinberg, & Ackerman, 1986; MacKenzie, 1986; Yi, 1990).

Expertness in product *class* knowledge similarly has been shown to be instrumental in learning new product information (Alba, 1983), and thus results in enhanced ability to process product-related information (Maclnnis & Jaworski, 1989; Petty & Cacioppo, 1986). On the other hand, audience members with less familiarity (*novices* versus *experts*) can be expected to exert less cognitive effort and engage in lower levels of cognitive processing. Sujan demonstrated novices tend to use category-based processing more extensively than experts, who engaged in more piecemeal (attribute-by-attribute) evaluations (Sujan, 1985; Sujan and Bettman, 1989; Sujan and Dekleva, 1987).

Prior Use

People can obtain knowledge about a particular product category or brand in a variety of ways, including observation, media reports, conversations with others, and direct experience.

Although not required to possess product knowledge (Hoch & Deighton, 1989), individuals who have personal experience in having purchased and then used a product can be assumed to be more familiar with and to have a greater knowledge of a product, although they might remain a novice and not an expert. Individuals who have previously used a product also can be expected to be more interested and involved with a product because of possible personal relevance or consequences in their lives. When processing information about a potentially risky product, people who have used a product previously inevitably compare new information with their own experience as they elaborate and store new information in memory.

Exposure to Controversy

Perceived riskiness of a product or service can be based on personal experience when an individual encounters and remembers a negative consequence. However, people also come to recognize the riskiness of particular activities through communication involving the experience of others or claims about risk in the public arena. Social amplification of risk plays a critical role in people's perceptions of risk. Slovic (1987) discovered that familiarity of the risk is one of the critical elements of risk amplification. As a good example, he also found that "unknown or unfamiliar risk such as nuclear accidents can potentially upset people enough to take social or political actions" (Chung & Yun, 2013, p. 149).

In the case of sunscreen containing nanoparticles, public's knowledge is limited and relatively little controversy has existed. However, the genetic modification of foods has become a major public issue (e.g., Bawa & Anilakumar, 2013; Lang & Heasman, 2015; Malyska, Bolla, & Twardowski, 2016). Many more people have taken social or political actions on the issue of GM foods compared to the issue of sunscreen with nanoparticles.

Prior Attitudes

Participants in a study typically bring some prior predispositions about a product to a research study. Prior attitudes can moderate exposure, attention, elaboration and storage of information in memory. Thus common practice is to measure extant knowledge and attitudes prior to any intervention that might be introduced as part of an information campaign or experimental study. Where appropriate, a common goal is to measure the impact of an intervention by comparing pre-invention and post-intervention attitude scores. For instance, Frewer, Howard, and Shepherd (1998) discovered that people with a more positive attitude on genetic engineering interpreted the benefits of this technology with much more favor. In addition, they found that people perceived the information sources as more intelligent and reliable compared to individuals with negative attitudes.

Hypotheses

The main purpose of this study is to investigate the impact of cognitive and affective risk perception on purchase intent. In addition, parallel analyses examine the possible influence of the personality traits (need for cognition and need for affect) and processing styles (systematic versus heuristic processing) for each of the products.

The personality traits of need of cognition and need for affect are conceptualized as inherent trait variables found within individuals. These are posited to have a direct effect on the processing styles of individuals, i.e., whether they engage in systematic v. heuristic processing in the context of considering prospective (risky) products. Sex of respondent is an individual difference that influences both need for cognition and for affect, while several explanatory variables moderate processing based on the individual's motivation and/or ability

(awareness/prior perceived knowledge, prior use, exposure to product-related controversies about the riskiness of the product and prior attitudes).

Engagement in systematic and/or heuristic processing is conceptualized as having a direct effect on both cognitive and affective risk perceptions, which, in turn, affect both attitudes and judgments about social norms pertaining to the advisability of purchasing the product. In turn, as posited in the reasoned action framework (Fishbein & Ajzen, 2010), attitudes and social norms influence purchase intention, although it is conceptually feasible other components might have a direct effect.

To test these ideas, model and investigate the underlying questions behind it, this study aimed to test five main hypotheses.

Effects of Risk Perceptions

Based on this review, when risk is included in the terms such as cognitive risk perception and affective risk perception, the connotation is negative in terms of expected consequences for actions. As several studies suggested (Choi et al., 2013; Lee, 2009; Michaelidou & Christodoulides, 2011), purchase intent can be expected to be lower when perceived risk is high. Considering the other side of the coin, the absence of risks can be considered inconsequential or even used as an argument by product promoters to encourage purchases.

As suggested by the theory of reasoned action framework, purchase intention is invariably driven by attitudes, which suggests that perceived risks lead to negative predispositions to purchase. This is especially the case when an individual perceives social norms expressed or exhibited by family or friends do not support a positive decision and might actually discourage purchasing. When risk perceptions increase, it is reasonable to assume that attitudes toward the action become negative and that social norms might also play an increased

role. Thus, the first hypothesis addresses the relationships between cognitive and affective risk perceptions and three key components found in the reasoned action framework:

H1: High cognitive and affective risk perceptions are negatively related to a) attitude, b) social norm, and c) purchase intent.

Effects of Personality Traits

Considering the fact that an individual can demonstrate different levels of need for affect and need for cognition, it is important to understand how these personality traits might influence processing. Maio and Esses (2001) explained the relationship between cognition and affect as such that the notions of affect and cognition are distinct processes. They further noted that "one system is holistic and based on affective experience, whereas the other system is analytical and based on rules of reasoning" (p. 584). More important, they asserted that these perspectives grant interaction between emotional and cognitive processes.

Based on such observations, a natural follow-up question is whether the motivation to approach cognitive tasks and emotions is empirically related, as suggested by Maio and Esses (2001) or unrelated as concluded by Rosenbaum and Johnson (2016). In dealing with the experience products that might potentially generate negative affect (such as nanoparticle sunscreen and GM foods), Maio and Esses (2001) argued that "separately examining emotion approach and emotion avoidance is a valuable goal because motivations might occasionally have distinct correlates" (p. 587). No previous studies have investigated the avoidance concept in tandem with risk yet. In a similar manner, Carver (2006) also introduced the existence of "two bipolar dimensions of affective experiences: one is generated by affect looks linked to approach

behavior, the other is generated by those linked to avoidance" (p. 106). The idea might be that risk avoidance is not merely a rational cognitive decision, but might be grounded in a personality trait.

Maio and Esses (2001) further concluded that that need for affect avoidance becomes more significant as the strength of an emotional experience builds. Because nanoparticle sunscreen and GM foods issues involve potential negative risks and the controversies surrounding both are getting more and more intensified, in light of the support that Carver (2006) provides about avoidance and approach co-occuring, it would be logical to pay particular attention to how the motivations to avoid and approach emotions (hereafter, need for affect avoidance and need for affect approach, respectively) play a role in purchase intention toward nanoparticle sunscreen and GM foods.

Consequently, the following hypotheses will test the relationship between need for cognition and need for affect avoidance/approach and types of processing:

H2: High need for cognition is positively related to a) systematic processing, and b) negatively related to heuristic processing.

H3a: High need for affect avoidance is positively related to heuristic processing.

H3b: High need for affect approach is positively related to systematic processing.

Effects of Systematic vs. Heuristic Processing

According to Branscombe and Cohen (1991), the traits of the judgment itself (e.g., purchase decisions about risky products) will influence whether someone is going to engage in

systematic processing. If a judgment is personally relevant, such as when an individual perceives a possible personal risk, that personal relevance will increase motivation towards processing the information in a careful, deliberate manner (Branscombe & Cohen, 1991; Forgas, 1994).

If risk perceptions impact purchase intention, it is valuable to understand how risk perceptions are influenced based on information processing style or mode. Specifically whether, as suggested by Smith and DeCoster (2000), cognitive risk perceptions are the results of systematic, cognitive-drive processing. Another aspect to understand is whether heuristic processing contributes to heuristic processing or not. In the event that the affective and cognitive processes are interrelated, it is important to examine how both cognitive and affective risk perceptions might be influenced by less rigorous cognitive and less rigorous heuristic processing, and vice versa. Theoretically, elaborative cognitive processing clearly can contribute to both, but the possible consequences of heuristic processing are less clear. Consequently, the fourth hypothesis addresses the relationships between systematic/heuristic processing and cognitive/affective risk perceptions:

H4: Higher systematic processing is positively related to a) cognitive risk perception and b) affective risk perception, while higher heuristic processing is not.

Effects of Personality Traits, Processing Styles, Explanatory Variables

As suggested above, other factors identified in this study possibly have an effect on purchase intent. For example, different patterns are possible among males and females based on the nature of the product. Similarly, this study is predicated on the assumption that crystallized (cognitive and affective) risk perceptions are antecedents to product attitudes, assessments of

social norms, and purchase intent. It would be important to confirm this assumption, and explore the possibility that personality traits (need for cognition and need for affect) or reliance on systematic versus heuristic processing somehow has a direct effect on the criterion variables in the study. It is also essential to determine to what extent, if any, the other explanatory variables identified in the study (product perceived knowledge, prior usage, awareness of controversy, etc.) moderate attitude, social norms, and product intention. To consider these possibilities, no formal research questions are proposed, but secondary post-hoc multi-variate analysis will be performed to identify the possible explanation for purchase intent.

CHAPTER 3: METHODOLOGY

This chapter details the methods employed to conduct the two studies, including recruitment of participants, instrumentation, operationalization of constructs, and data analysis.

Sunscreen Study

The first study was devoted to risk perceptions about sunscreen containing nanoparticles and was conducted in March 2014.

Sample

Following IRB approval, 535 undergraduates enrolled in Professional Communication and Composition classes at Colorado State University were invited to participate in an online survey, which was conducted using QuestionPro. The researcher visited each classroom to recruit participants. Instruction sheets with the online survey URL (see Appendix 1) were distributed in class, and students had a week to participate to receive extra credit points. Those who chose not to participate in the survey were given an alternative opportunity to earn the extra credit points.

In the end, 391 out of enrolled 535 students completed the survey. After eliminating those who carelessly or randomly put the same answer for most questionnaire items (e.g., checking "uncertain" for almost all items without much deliberate effort to choose his/her answer choice), 373 usable surveys were obtained, resulting in a 70% participation rate.

Instrument and Operationalization

Unless otherwise noted, scaled variables were measured using a 5-point Likert-type scale, where a positively valenced response=1 and a negatively valenced response=5. Values were labeled: 1) strongly agree, 2) agree, 3) uncertain, 4) disagree, and 5) strongly disagree.

All participants were given the following basic information on nanoparticle sunscreen prior to answering the survey questions (IARC, 2007).

> Next, we will be asking you to answer questions about your view of nano sunscreen. In advance, please make sure you read the following statements regarding nanoparticles and nano sunscreen:
>
> Nanomaterials are engineered on the scale of a billionth of a meter, about one ten-thousandth the width of a human hair. These tiny substances have moved into the marketplace over the last decade, in products as varied as cosmetics, clothing and paint. Nanoscale forms of substances like silver, carbon, zinc and aluminum have many useful properties. Nano zinc oxide sunscreen goes on smoothly, for example, and nano carbon is lighter and stronger than its everyday or "bulk" form. Also, various food companies have said they are interested in nanotechnology, which can help make products creamier without additional fat, intensify and improve flavors and brighten colors. So nanomaterials are starting to enter the food chain through well-known food products and their packaging. But some scientists think that not enough is known about their potential health and environmental risks. Their small size allows nanoparticles to go places in the body where larger particles cannot and enter cells. They have been found in the blood stream after ingestion and inhalation, and while research on their health effects is limited, studies have shown them to have deleterious effects on mice and cells. And they can seep into the environment during manufacturing or disposal. Because the nanotechnology market is expanding — it represented $225 billion in product sales in 2009 and is expected to grow rapidly in the next decade — "today's exposure scenarios may not resemble those of the future," one report says. In particular, looking at the potential harmful impact of nano sunscreen, the International Agency of Research on Cancer (IARC) categorized titanium dioxide (TiO_2) as a possible human carcinogen - in group 2B - while the hazards of nano-sized TiO_2 in sunscreen applications were fiercely debated. Yet, the IARC recognized that TiO_2 particles are being used in various sizes (nano and fine-sized particles), though the agency does not make this size distinction for the given categorization. Although, it is still unclear how much evidence is needed to give a final and credible answer to these environmental and safety issues, it seems evident that most parties in the debate ask for more research on the real impact of nanoparticles in sunscreens.

Cognitive risk perception was measured by asking participants to rate their cognitive risk perception using four statements: *People understand risk in different ways. In thinking about the nature of nano sunscreen, how strongly would you disagree or agree with the following*: *1) I think it is difficult to understand the risks associated with nano sunscreen, 2) I think that nano*

sunscreen may cause big health problems, 3) I think the risks from nano sunscreen are very unpredictable, and 4) I think using nano sunscreen could pose a health-related financial risk. These items were adapted from a study by Trumbo et al. (2016) that explored a cognitive-affective scale for hurricane risk perceptions.

Affective risk perception was measured by asking participants to rate their affective risk perception by responding to the following six statements: *People have different kinds of emotional responses when they think about risk. How might these factors figure into your thinking about the possible risks that might be associated with consuming nano sunscreen? 1) makes me feel alarming, 2) makes me feel sad, 3) makes me feel depressed, 4) makes me feel anxious, 5) makes me feel worried, 6) makes me feel unhappy.* These items were also adapted from a hurricane risk perception study by Trumbo et al. (2016).

Intention was measured using a three-item scale developed by Ajzen (2011). Participants were asked to respond to following statement: *If nano sunscreens were labeled, I intend to seek out and purchase nano sunscreens during my regular trips to the grocery.* Participants could respond based on three bipolar antonymic pairs where *1=true and 5=false, where 1=likely and 5=unlikely, and where 1=probably and 5=probably not.*

Attitude was measured by adopting a three-item scale developed by Ajzen (2011). Participants were asked to indicate whether they agreed or disagreed with the following statements: 1) *I think the use of nano sunscreen is appropriate for consumers*, 2) *I think nano sunscreen is a big step forward*, 3) *I think nano sunscreen is the more modern way of using sunscreen now.*

Social norms conformity was measured using a six-item scale developed by Ajzen (2011). Participants were asked to indicate whether they agreed or disagreed with the following statements that indicated their degree of adherence to the opinions of others: *1a) It would be acceptable to my closest friends if I used nano sunscreen, 1b) When it comes to things like using nano sunscreen, it is important to me to follow the wishes of my closest friends, 2a) It would be acceptable to most people I know if I used nano sunscreen, 2b) When it comes to things like using nano sunscreen, it is important to me to follow the wishes of most people I know, 3a) It would be acceptable to my closest family members if I used nano sunscreen, and 3b) When it comes to things like using nano sunscreen, it is important to me to follow the wishes of my closest family members.*

Need for cognition was measured by asking participants to rate their interest in engaging in thinking using nine items adapted from Sherrard and Czaja (1999). The nine statements to which participants were asked to agree or disagree were ("R" indicates a reversed item to reduce possible demand effects): *1) I like to have the responsibility of handling a situation that requires a lot of thinking, 2) Thinking is not my idea of fun (R), 3) I find satisfaction in deliberating hard and for long hours. 4) I only think as hard as I have to (R), 5) I really enjoy a task that involves coming up with new solutions to problems, 6) Learning new ways to think does not excite me very much (R), 7) I prefer life to be filled with puzzles that I must solve. 8) The notion of thinking abstractly is appealing to me. 9) I would rather do something that requires little thought than something that is sure to challenge my thinking abilities (R).*

Need for affect was measured by asking participants to indicate the extent to which they agreed or disagreed with 10 statements used to measure need for affect avoidance and need for

affect approach (five statements for each dimension) contained in the indexes created by Appel, Gnambs, & Maio (2012): Avoidance: *1) If I reflect on my past, I see that I tend to be afraid of feeling emotions, 2) I find strong emotions overwhelming and therefore try to avoid them, 3) I would prefer not to experience either the lows or highs of emotion, 4) I do not know how to handle my emotions, so I avoid them, 5) Emotions are dangerous—they tend to get me into situations that I would rather avoid*. Approach: *1) I feel that I need to experience strong emotions regularly, 2) Emotions help people get along in life, 3) I think that it is important to explore my feelings, 4) It is important for me to be in touch with my feelings, 5) It is important for me to know how others are feeling.*

Systematic processing was measured using a four-item scale developed by Smerecnik et al. (2012). Participants were asked the degree to which they agreed or disagreed with the following statements: *1) I think about what actions I myself might take based on what I read, 2) I found myself making connections between the story and what I've read or heard about elsewhere, 3) I tried to think about the importance of the information for my daily life, 4) I thought about how the story related to other things I know.*

Heuristic processing was measured using a four-item scale also developed by Smerecnik et al. (2012) where participants were asked the degree to which they agreed or disagreed with these statements: *1) I skimmed through the story, 2) While reading the story, I focused on only a few points, 3) I did not spend much time thinking about the story, 4) The scenario contained more information than I personally needed.*

Explanatory variables. Participants also were asked about explanatory variables. They are elaborated in the next several paragraphs.

Awareness of product was measured by asking a simple yes/no question, *Have you heard of sunscreen with nanoparticles?*

Prior Use was measured by asking the following question: *Have you ever used nano sunscreen?* Participants answered yes or no.

Exposure to Controversy was measured by asking, *How many times have you heard about the debate regarding 'benefit vs. risks' associated with nanotechnology*? where choices were the following: *1) I have heard or read about the debate often (more than 5 times), 2) I have heard or read about the debate several times (3-5 times), 3) I have heard or read about the debate once or twice, 4) I have not heard or read about the debate*.

Prior Attitude was measured by asking whether participants agreed or disagreed with the following statements (same as Attitude): *1) I think the use of nano sunscreen is appropriate for consumers, 2) I think nano sunscreen is a big step forward, 3) I think nano sunscreen is the more modern way of using sunscreen now.*

Finally, Concern about Safety was measured by asking *How concerned are you currently about the safety of nano sunscreen? where choices were the following: 1) Extremely, 2) Quite a lot, 3) Somewhat, 4) Just a little, 5) Not at all.*

At the conclusion of the survey, participants were also asked to check whether they were male or female, to type in their age (in years) and to check their class level (freshman, sophomore, junior or senior).

Pilot Testing

The sunscreen study reported here was preceded by a full-scale pretest, for which the results are described and summarized in Appendix B. Following IRB approval, the pilot test involved 318 undergraduates enrolled in Professional Communication and Composition classes

at Colorado State. Participants were recruited for the online survey via QuestionPro. The procedures for the pilot test were the same as for the study reported here. Through the process of conducting this pilot study and modifying the wording of the questionnaire before the main sunscreen study, Cronbach alpha values of several variables were significantly improved (e.g., heuristic: .40 → .72; affective risk perception: .59 → .89; cognitive risk perception: .33 → .66).

Genetically Modified Foods Study

The second study, which was conducted in March 2015, was devoted to risk perceptions about genetically modified foods. In general, the procedures for this study were the same as for the nanoparticle sunscreen survey, but varied in the following details

Sample

A total of 454 undergraduates were invited to participate from the same two clusters of courses using the same procedures as in the nanoparticle sunscreen study. In all, 387 students completed the survey, but 8 surveys were eliminated because it appeared that participants carelessly or randomly put the same answer for most questionnaire items. In the end, usable responses were obtained from 379 students, representing an 83% participation rate.

Instrument and Operationalization

Unlike the sunscreen study, which relied on 5-point scales, scaled measures in the GM study relied upon 7-point Likert-type scale, where 1 = strongly agree and 7 = strongly disagree. Also similar to the sunscreen study, participants were first asked basic questions pertaining to prior use and awareness of product, exposure to the controversy about genetically modified foods, prior attitude about GM foods, and concern about the safety of GM foods. An additional measure was Perceived Level of Prior Perceived Knowledge of GMOs: *How well informed you*

would say you are currently about GMO. Respondents could self-report using a 7-point Likert scale where *1=very informed and 7=not informed at all.*

> Next, we will be asking you to answer questions about your view of genetically modified organisms (GMOs). In advance, please make sure you read the following statements regarding nanoparticles and nano sunscreen:
>
> Potential risks associated with GM foods include: 1) Accidental contamination between genetically modified and non-genetically modified foods, 2) Adversely changing the nutrient content of a crop, and 3) Creation of super weeds and other environmental risks. Potential benefits associated with GM foods include: 1) Increased pest and disease resistance, 2) Drought tolerance, and 3) Increased food supply. According to the Food and Agriculture of the United Nations, genetically modified crops can reduce some environmental risks associated with conventional agriculture, but will also introduce new challenges that must be addressed. Society will have to decide when and where genetic engineering is safe enough.

After reading this brief description (Poortinga & Pidgeon, 2006), participants were again asked *How well informed you would say you are about GMOs after reading the statements.* This also permitted measuring changes in perceived knowledge level from before to after reading the statements about GMOs by computing the mean differences in before and after scores (See Change in Perceived Knowledge in Table 4.1).

Although several wording changes were made in measurements between the pilot test and main study for nanoparticle sunscreen (see Appendix B), the only change in measurements between the sunscreen and GMO study involve the measure of attitudes. For the GMO study, a simple 3-item, 7-point semantic differential index was employed, consistent with more common attitudinal measures (Ajzen, 2012). Participants were asked to respond to the statement: *If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be…* by indicating the degree to which the experience would be *pleasant/unpleasant, nice/awful* or *fun/not fun.*

Pilot Testing

Unlike the nanoparticle sunscreen study, there was no separate pilot or pretest for the GM foods study.

Data Analysis

After all survey questionnaires were collected for the separate studies, data cleaning procedures was employed to ensure each answer was valid for coding. The data sets were edited in Excel and then downloaded into SPSS for analysis. Scale items reversed in the questionnaire were recoded so that all scale items were consistent in direction. Demographic information was reported and analyzed using frequencies or descriptive statistics in the form of means and standard deviations. In order to determine reliability, factor and reliability analyses of each of the scaled indexes were conducted.

After satisfactory Cronbach alpha (α) values were calculated for each, indices for the scaled variables in each study were created by computing sums or means and standard deviations. Hypotheses were tested using correlational analyses. Linear regressions were then performed to explore combined effects of the focal and explanatory (control) explanatory variables on the hypothesized results. Finally, separate hierarchical regressions were used to examine the cumulative effects of predictor and explanatory variables on the primary criterion variables in the studies, purchase intent, for each product.

For most data, a lower numerical score indicates a positively valenced score (e.g., 2=agree), while a higher score indicates a negatively result (e.g., 4=disagree). Mean scores and standard deviations are reported based on sums, not the computed mean scores for key variables. In following the custom in social science research, findings were deemed statistically significant if there was less than a 1 in 20 probability that the results were obtained by chance ($p \leq .05$).

CHAPTER 4: RESULTS

This chapter presents findings for the two studies. It begins with a profile of the participants in each study, along with a comparison of the possible explanatory variables in both studies. It provides a descriptive summary and analysis of the nine scales, including reliability of indexes created and the correlations and covariances between the final indexes. Because key results were strikingly similar for both products, the major hypothesis tests are then reported together, and the differences in results are explained. These are followed by an analysis of possible direct effects of explanatory variables intended to help inform the hypothesis findings. A secondary analysis using hierarchical regression follows.

Participants and Possible Explanatory Variables

Participants in the study and differences in possible explanatory variables are summarized in Table 4.1. Most notably, as suspected, the participants demonstrated marked differences in their awareness of the two products. Only 64 participants out of total 373 (17%) reported being aware of the nanoparticle sunscreen before reading the informational statement provided in the survey, and only 11 (3%) reported actually using the product. By contrast, almost all participants (350 out of total 379; 92% of sample) were aware of GM foods; 345 (91%) reported having heard about the controversy at least once; and 261 (69%) reported they had actually consumed genetically modified foods (or believed they had consumed them). Of the 373 sunscreen study participants, 208 (55%) were female and 165 (45%) were male, while among the 379 GM foods participants, 226 (59%) were female and 153 (41%) were male. Additionally, the mean age among sunscreen study participants was 19.5 and the median was 19.0, while the mean age for GM foods study was 20.3 and median was 20.0. No significant correlations were found between age and any of the major variables in the study. Participants' years in college were as

follows: 125 freshmen, 89 sophomores, 107 juniors, and 52 seniors for nanoparticle sunscreen study; 195 freshmen, 79 sophomores, 59 juniors, and 46 seniors for GM foods study.

Nanoparticle Sunscreen

Only 137 respondents (36%) reported being exposed to prior information about the controversy related to nanotechnology (versus any controversy about sunscreen itself). Among 132 respondents (after eliminating 5 who responded inconsistently), prior attitudes about nanotechnology were relatively mixed (*M*=6.91 out of 15) based on the 3-item attitudes index where 1=positive and 15=negative. Males showed slightly more positive attitudes (*M*=6.70) towards nanotechnology than females (*M*=7.23), but the difference was not statistically significant. Concern about nanotechnology was relatively low (3.83 based on a 5-point scale where 1=not concerned and 5=not concerned); females were slightly more concerned (*M*=3.74) than males (*M*=3.94), but the difference was not statistically significant. Based on a chi-square analysis, the only significant difference on the counts between males versus females was for exposure to the controversy (χ^2=21.41, *df*=373, p<.001).

GM Foods

Prior perceived knowledge (prior to reading the basic information provided) was moderate (*M*=4.31, *SD*=1.58, where 1=very informed and 7=not informed at all), with men claiming greater perceived knowledge than women but not at a statistically significant level. Not surprisingly, after reading information, the participants showed greater perceived knowledge on the subject (*M*=3.58, *SD*=1.37, $t(378)$=53.17, $p\leq.000$). In terms of the difference between before and after reading GMO information, no sex effects were detected (males *M*=-.72, *SD*=1.59; females *M*=-.73, *SD*=1.67, n.s.). Prior attitudes were measured using 3-item index such as commonly used for a consumer product (pleasant/unpleasant, nice/not nice, fun/not fun) and

varied widely (*M*=12.18, *SD*=3.87 where 1=positive and 15=negative) with no statistically significant differences between males and females. Concern about GM foods was moderate (*M*=3.97 *SD*=1.72, with 1=very concerned and 7=not concerned at all) with males somewhat less concerned than females but not at a statistically significant level. Based on a chi-square analysis, the only significant difference between males versus females was found for awareness (χ^2=6.14, *df*=379, $p \leq .013$).

Table 4.1 Profile of Participants and Their Involvement with Two Products

	Nanoparticle Sunscreen (*n*=373)			**Genetically Modified Foods (*n*=379)**		
Counts and percentages except for scale items as noted	Males (*n*=165)	Females (*n*=208)	**Total**	Males (*n*=153)	Females (*n*=226)	**Total**
Awareness: *Number aware of product* Have you heard of sunscreen with nanoparticles (hereafter nano sunscreen)? [of genetically modified foods (hereafter GM foods)?]	25 (6.7%)	39 (10.5%)	64 (17.2%)	135*** (35.6%)	215*** (56.7%)	350 (92.3%)
Use of Product *Number who use/consume* Have you ever used nano sunscreen? Have you ever consumed GM foods?	6 (1.6%)	5 (1.3%)	11 (2.9%)	101 (26.7%)	160 (42.2%)	261 (68.9%)
Exposure to Controversy: *Number who recall hearing about debate at least once* How many times have you heard about the debate regarding "benefits vs. risks" associated with nanotechnology? [regarding GM foods?]	82*** (22.0%)	55*** (14.7%)	137 (36.7%)	136 (35.9%)	209 (55.1%)	345 (91.0%)
Prior Perceived Knowledge About GMOs *Self-report before reading GMO information (Likert 7-point scale where 1 = very informed, 7 = not informed*	---	---	---	4.24 (1.68)	4.36 (1.51)	4.31 (1.58)

at all) How well informed you would say you are currently about GMOs?						
Change in Perceived Knowledge						
Self-report after reading GMO Information based on same question as prior perceived knowledge	---	---	---	3.52 (1.33)	3.63 (1.39)	3.58 (1.37)
Difference between before and after reading GMO information (Means, SD)	---	---	---	-.72 (1.59)	-.73 (1.67)	-.73 (1.64)
Concern About Safety **Nano Sunscreen:** How concerned are you currently about the safety of nano sunscreen? (Likert 5-point scale where 1: extremely, 5: not at all) **GM Foods**: Currently, how concerned are you about the safety of GM foods? (Likert 7-point scale where 1 = very concerned, 7 = not concerned at all)	3.94 (1.14)	3.74 (1.10)	3.83 (1.12) (n=373)	4.16 (1.73)	3.84 (1.70)	3.97 (1.72) (n=379)

*** $p<.001$

A chi-square analysis of frequencies based on sex and the three dichotomous variables in Table 4.1 found significant differences only for awareness of GM foods and for exposure to the controversy surrounding the use of nanotechnology in general. All other sex differences for these three variables were not significant (all $\chi^2<1$).

For awareness of GM Foods, the 135 aware males were fewer than expected the 141.3 value, while the 215 aware females exceeded the 208.7 expected value. Meanwhile, the 18 males not aware of the controversy exceeded the expected values of 11.7, while the 11 females were

fewer than the 17.3 expected value. This suggests that females in the study were aware of GM foods than males overall (χ^2=6.143, *df*=379, $p \leq .017$).

For exposure to the controversy about nanotechnology in general, males were about equally split in number. However, the 82 aware males exceeded the 60 expected value, while the 83 not exposed to the controversy were fewer than the 104.4 expected value. By contrast, the 55 females exposed to the controversy were fewer than the 76.4 expected value, while the 153 females not exposed to the controversy exceeded the 131.6 expected value. This suggests that males were more familiar with the nanotechnology controversy and potentially influenced by it compared to the females in the study (χ^2=21.411, *df*=373, $p \leq .000$).

Notably, mean scores for concern about safety (based on a 5-point scale were 1=not concerned and 5=concerned) revealed no statistically significant difference between males and females (Sunscreen Males *M*=3.94, *SD*=1.143; Females *M*=3.74, *SD*=1.09, *t*(371) =1.708, $p \leq .088$; GM Foods Males *M*=4.16, *SD*=1.734; Females *M*=3.84, *SD*=1.704; *t*(377)=1.823, $p \leq .069$).

Descriptive Statistics for Index Variables

The means and standard deviations for all the indexes and variables in the two studies are provided in Table 4.2 (nanoparticle sunscreen) and Table 4.3 (GM foods).

Nanoparticle Sunscreen

As noted previously noted, the sunscreen study used all 5-point scales where 1=positively valenced and 5=negatively valenced responses. One notable observation in the responses reported in Table 4.2 was the fact that attitudes are more positive than purchase intention, which is typical in marketing studies because people can like a product but do not necessarily plan to purchase it. The mean value of intention for nanoparticle sunscreen was 3.39,

while its mean value for attitude was 2.71. Another interesting observation was that the standard deviation value for intention was higher than attitude, which means that there were more varied responses among the survey participants when it comes to actual behavioral intention.

Table 4.2 Measures and Scales for Key Variables in Nanoparticle Sunscreen Study

	Measures	Mean (*SD*)
Behavioral Intention (α=.89) *(1-5 scales; 1=strongly agree; 5=strongly disagree*	1. If nano sunscreens were labeled, I intend to seek out and purchase nano sunscreens during my regular trips to the grocery: (where 1 = true, 5 = false)	3.35 (.95)
	2. If nano sunscreens were labeled, I intend to seek out and purchase nano sunscreens during my regular trips to the grocery: (where 1 = likely, 5 = unlikely)	3.27 (1.00)
	3. If nano sunscreens were labeled, I intend to seek out and purchase nano sunscreens during my regular trips to the grocery: (where 1 = probably, 5 = probably not)	3.54 (.98)
	Source: Ajzen (2011)	
Attitude toward Act (α=.81) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	1. I think the use of nano sunscreen is appropriate for consumers.	2.88 (.76)
	2. I think nano sunscreen is a big step forward.	2.62 (.79)
	3. I think nano sunscreen is the more modern way of using sunscreen now.	2.64 (.83)
	Source: Ajzen (2011)	
Social Norm (α=.82) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	1a) It would be acceptable to my closest friends if I consumed nano sunscreen.	2.61 (.84)
	1b) When it comes to things like consuming nano sunscreens, it is important to me to follow the wishes of my closest friends.	3.63 (1.10)
	2a) It would be acceptable to most people I know if I consumed nano sunscreens.	2.58 (.86)
	2b) When it comes to things like consuming nano sunscreens, it is important to me to follow the wishes of most people I know.	3.52 (1.12)
	3a) It would be acceptable to my closest family members if I consumed nano sunscreens.	2.74 (.88)
	3b) When it comes to things like consuming nano sunscreens, it is important to me to follow the wishes of my closest family members.	2.94 (1.15)
	Source: Ajzen (2011)	

Risk Perception-Affective (α=.89) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	People have different kinds of *emotional responses* when they think about risk. How might these factors figure into your thinking about the possible risks that might be associated with consuming nano sunscreen? 1) makes me feel alarming. 2) makes me feel sad. 3) makes me feel depressed. 4) makes me feel anxious. 5) makes me feel worried. 6) makes me feel unhappy. Source: Trumbo et al. (2011)	 2.87 (1.06) 3.78 (.92) 3.98 (.87) 3.35 (1.07) 3.09 (1.12) 3.72 (.96)
Risk Perception-Cognitive (α=.66) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	People *understand* risk in different ways. In thinking about the nature of nano sunscreen, how strongly would you disagree or agree with the following? 1) I think that nano sunscreen may cause big health problems. 2) I think it is difficult to understand the risks associated with nano sunscreen. 3) I think the risks from nano sunscreen are very unpredictable. 4) I think consuming nano sunscreen could eventually pose a health-related financial risk. Items deleted to improve α through "if deleted" function in SPSS: 1) I am not knowledgeable about nano sunscreen. 2) I cannot control being harmed by nano sunscreen. Source: Trumbo et al. (2011)	 2.88 (.75) 2.39 (.90) 2.51 (.84) 2.70 (.74)
Heuristic Processing (α=.72) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	1) I skimmed through the story 2) While reading the story, I focused on only a few points. 3) I did not spend much time thinking about the story. 4) The statements contained more information than I personally needed. 5) While reading the statements, I did not think about the arguments presented in the story. Source: Smerecnik et al. (2012)	3.20 (1.13) 2.80 (1.03) 3.12 (1.05) 3.15 (1.00) 3.62 (.89)
Systematic Processing (α=.71) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	1) I think about what actions I myself might take based on what I read. 2) I found myself making connections between the story and what I've read or heard about elsewhere. 3) I tried to think about the importance of the information for my daily life. 4) I thought about how the story related to other things I know. 5) I tried to relate the ideas in the statements to my own personal experiences. Source: Smerecnik et al. (2012)	2.21 (.76) 2.91 (1.02) 2.26 (.85) 2.33 (.87) 2.41 (.91)

Need for Affect (α=.78) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	Avoidance (α=.82): 1) If I reflect on my past, I see that I tend to be afraid of feeling emotions. 2) I find strong emotions overwhelming and therefore try to avoid them. 3) I would prefer not to experience either the lows or highs of emotion. 4) I do not know how to handle my emotions, so I avoid them. 5) Emotions are dangerous—they tend to get me into situations that I would rather avoid. Approach (α=.70): 1) I feel that I need to experience strong emotions regularly. 2) Emotions help people get along in life. 3) I think that it is important to explore my feelings. 4) It is important for me to be in touch with my feelings. 5) It is important for me to know how others are feeling.	 3.43 (1.09) 3.27 (1.09) 3.53 (.99) 3.76 (.94) 3.61 (1.00) 3.21 (1.05) 2.14 (.76) 2.15 (.85) 2.18 (.83) 1.93 (.80)
	Source: Appel et al. (2012)	
Need for Cognition (α=.81) *(1-5 scales; 1=strongly agree; 5=strongly disagree)*	1) I like to have the responsibility of handling a situation that requires a lot of thinking. 2) Thinking is not my idea of fun. (R) 3) I find satisfaction in deliberating hard and for long hours. 4) I only think as hard as I have to. (R) 5) I really enjoy a task that involves coming up with new solutions to problems. 6) Learning new ways to think does not excite me very much. (R) 7) I prefer life to be filled with puzzles that I must solve. 8) The notion of thinking abstractly is appealing to me. 9) I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)	2.21 (.90) 3.58 (1.00) 3.01 (1.04) 3.27 (1.09) 2.16 (.84) 3.64 (1.02) 2.54 (.94) 2.27 (.87) 3.54 (.97)
	Source: Sherrard and Czaja (1999)	

(R) indicates reverse-coded items

GM Foods

From the GM foods study, in which all the responses were based on 7-point scales, one notable finding in the responses reported in Table 4.3 was once again the fact that attitudes are more positive than purchase intention. The mean value of intention for GM food study was 5.47, while its mean value for attitude was 3.89. The standard deviation for intention also varied more widely than for attitude, similar to the results in the sunscreen study.

Table 4.3 Measures and Scales for Key Variables in GM Foods Study

	Measures	Mean (*SD*)
Behavioral Intention (α=.93) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1. If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery: (where 1 = true, 7 = false)	5.02 (1.63)
	2. If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery: (where 1 = likely, 7 = unlikely)	5.01 (1.65)
	3. If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery: (where 1 = probably, 7 = probably not)	5.12 (1.68)
	Source: Ajzen (2011)	
Attitude toward Act (α=.89) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1. If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (where 1 = pleasant, 7 = unpleasant)	3.83 (1.51)
	2. If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (where 1 = nice, 7 = awful)	3.76 (1.50)
	3. If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (where 1 = fun, 7 = not fun)	4.09 (1.43)
	Source: Ajzen (2012)	
Social Norm (α=.84) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1a) It would be acceptable to my closest friends if I consumed GM foods.	3.03 (1.52)
	1b) When it comes to things like consuming GM foods, it is important to me to follow the wishes of my closest friends.	4.88 (1.68)
	2a) It would be acceptable to most people I know if I consumed GM foods.	2.98 (1.41)
	2b) When it comes to things like consuming GM foods, it is important to me to follow the wishes of most people I know.	4.72 (1.63)
	3a) It would be acceptable to my closest family members if I consumed GM foods.	3.17 (1.57)
	3b) When it comes to things like consuming GM foods, it is important to me to follow the wishes of my closest family members.	4.13 (1.67)
	Source: Ajzen (2011)	
Risk Perception-Affective (α=.93) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	People have different kinds of *emotional responses* when they think about risk. How might these factors figure into your thinking about the possible risks that might be associated with consuming GM foods?	
	1) makes me feel alarming.	3.68 (1.78)
	2) makes me feel sad.	4.22 (1.86)
	3) makes me feel depressed.	5.02 (1.69)
	4) makes me feel anxious.	4.28 (1.75)
	5) makes me feel worried.	3.89 (1.83)
	6) makes me feel unhappy.	4.44 (1.74)
	Source: Trumbo et al. (2011)	

Risk Perception-Cognitive (α=.62) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	People *understand* risk in different ways. In thinking about the nature of GM foods, how strongly would you disagree or agree with the following? 1) I think that genetically modified foods may cause big health problems. 2) I think it is difficult to understand the risks associated with genetically modified foods. 3) I think the risks from genetically modified foods are very unpredictable. 4) I think consuming GM foods could eventually pose a health-related financial risk. Items deleted to improve α through "if deleted" function in SPSS: 1) I am not knowledgeable about genetically modified foods. 2) I cannot control being harmed by genetically modified foods. Source: Trumbo et al. (2011)	3.49 (1.60) 3.65 (1.47) 3.46 (1.43) 3.49 (1.50)
Heuristic Processing (α=.70) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1) I skimmed through the story 2) While reading the story, I focused on only a few points. 3) I did not spend much time thinking about the story. 4) The statements contained more information than I personally needed. 5) While reading the statements, I did not think about the arguments presented in the story. Source: Smerecnik et al. (2012)	4.18 (1.75) 3.78 (1.56) 4.26 (1.49) 4.34 (1.47) 4.82 (1.37)
Systematic Processing (α=.83) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1) I think about what actions I myself might take based on what I read. 2) I found myself making connections between the story and what I've read or heard about elsewhere. 3) I tried to think about the importance of the information for my daily life. 4) I thought about how the story related to other things I know. 5) I tried to relate the ideas in the statements to my own personal experiences. Source: Smerecnik et al. (2012)	2.79 (1.27) 2.93 (1.32) 2.78 (1.43) 3.01 (1.38) 2.87 (1.37)
Need for Affect (α=.79) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	Avoidance (α=.81): 1) If I reflect on my past, I see that I tend to be afraid of feeling emotions. 2) I find strong emotions overwhelming and therefore try to avoid them. 3) I would prefer not to experience either the lows or highs of emotion. 4) I do not know how to handle my emotions, so I avoid them. 5) Emotions are dangerous—they tend to get me into situations that I would rather avoid. Approach (α=.73): 1) I feel that I need to experience strong emotions regularly. 2) Emotions help people get along in life. 3) I think that it is important to explore my feelings. 4) It is important for me to be in touch with my feelings. 5) It is important for me to know how others are feeling. Source: Appel et al. (2012)	3.43 (1.09) 3.27 (1.09) 3.53 (.99) 3.76 (.94) 3.61 (1.00) 3.21 (1.05) 2.14 (.76) 2.15 (.85) 2.18 (.83) 1.93 (.80)

Need for Cognition (α=.83) *(1-7 scales; 1=strongly agree; 7=strongly disagree)*	1) I like to have the responsibility of handling a situation that requires a lot of thinking.	2.78 (1.23)
	2) Thinking is not my idea of fun. (R)	4.91 (1.49)
	3) I find satisfaction in deliberating hard and for long hours.	3.99 (1.58)
	4) I only think as hard as I have to. (R)	4.21 (1.65)
	5) I really enjoy a task that involves coming up with new solutions to problems.	2.85 (1.27)
	6) Learning new ways to think does not excite me very much. (R)	4.96 (1.53)
	7) I prefer life to be filled with puzzles that I must solve.	3.41 (1.37)
	8) The notion of thinking abstractly is appealing to me.	2.87 (1.36)
	9) I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)	4.58 (1.53)
	Source: Sherrard and Czaja (1999)	

(R) indicates reverse-coded items

Scale Validity and Reliability

To assess the validity and reliability of key indices used to test the hypothesis, each measure was subjected to confirmatory factor analysis using principal component analysis with Varimax rotation (Field, 2013) and reliability testing based on Cronbach alpha (Cronbach, 1951). With the arguable exception of cognitive risk perception (see next paragraph), all met satisfactory levels of reliability.

Cognitive and Affective Risk Perceptions

For both the sunscreen and GM factor analyses, two factors emerged when all combined items for cognitive and affective risk perceptions (six and four respectively) were examined. This result was as anticipated. Cronbach alpha (α) for cognitive risk perception was .66, and the α value for affective risk perception was .90 for nanoparticle sunscreen. For the GM foods study, the Cronbach alpha (α) for cognitive risk perception was .62, and the α value for affective risk perception was .93. Nunnally (1967) noted that "even modest reliabilities of .60 or .50 may be acceptable" in theoretical studies (p. 265). To back this argument, Hair, Black, Babin, Anderson, & Tatham (2006) indicated that even though "generally agreed" lower limit for α value is .70, "it may decrease to .60 and still be acceptable, especially in exploratory studies and in research in

the Social Sciences" (p. 7). Moreover, Aron and Aron (1999) suggested that "in research in psychology, Cronbach's α of .60 or even lower could be adequate; however, values exceeding .7 are preferable" (p. 650).

Behavioral Intent

Only one factor emerged when all three items for behavioral intent were examined in both the sunscreen and GM factor analyses. This outcome was as it was expected. The Cronbach alpha for behavioral intent was .89 for the nanoparticle sunscreen study. For GM foods study, Cronbach alpha for behavioral intent was .93.

Attitudes

One dimension emerged when the different items used to measure attitudes were factor analyzed for both the sunscreen and GM foods studies. This result was as it was anticipated. Cronbach alpha for attitudes was .81 in the nanoparticle sunscreen study. For GM foods study, the Cronbach alpha for attitudes was .89.

Social Norms

For both the sunscreen and GM factor analyses, two factors emerged when all combined items for social norms (with three and three items respectively) were examined. One factor was acceptability to others, and the other factor was importance of following the wishes of others (see Table 4.2 and Table 4.3). This outcome was expected in keeping with Ajzen's (2011) recommendation to use this scale having two dimensions for social norms: 1) the strength of each normative belief from each referent, 2) the motivation to comply with the referent. For the sunscreen study, the Cronbach alpha for social norms was .82. For the GM foods study, the Cronbach alpha for social norms was .84.

Need for Cognition and Need for Affect

To check whether need for cognition and need for affect are distinct concepts, all items for both variables were entered into separate factor analyses for each study. For both products, three factors emerged; specifically, one factor was need for cognition, nine items, and other two factors were five approach items and five avoidance items respectively. This dissertation therefore reports both two 5-item scales for approach and for avoidance. In the sunscreen study, the Cronbach alpha (α) for need for cognition was .81, and the α values for need for affect avoidance and need for affect approach were .82 and .70, respectively. For the GM foods study, the Cronbach alphas (α) for need for cognition was .83, while the α values for need for affect avoidance and need for affect approach were .81 and .73.

Systematic and Heuristic Processing

For both the sunscreen and GMO studies, as expected, two factors emerged when all 10 items measuring systematic processing (5 items) and heuristic processing (5 items) were factor analyzed. In the sunscreen study, the Cronbach alphas (α) were .71 for systematic processing and for heuristic processing. For the GM foods study, Cronbach alpha for systematic processing was .83, and for heuristic processing was .70.

Correlational and Covariance Analyses for Key Variables in Studies

The index variables were analyzed by creating correlations and covariance matrices as shown in Table 4.4 and Table 4.5. Covariance values represent how much two variables change together, while correlation values show a standardized score between -1 and +1 (i.e., correlation can be interpreted as the normalized value of covariance). Note: The correlations shown are for total need for affect; the correlations for need for affect avoidance and for approach will be addressed as part of H2.

Table 4.4
Correlation and Covariance Matrix for Nanoparticle Sunscreen Main Study

Cronbach α reliability indicated	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Behavioral Intention α = .89 1-15 low values more likely to use	10.16 (2.66)	.52**	.39**	-.18**	-.29**	.19**	.16**	-.07	-.05
2. Attitude toward Act α = .81 1-15 low values more positive	2.80	8.14 (2.02)	.32**	-.42**	-.37**	.24**	.08	-.09	.02
3. Social Norm α = .82 1-75 low values more pressure	10.69	6.55	26.28 (10.27)	-.04	-.04	.14**	. 24**	-.02	.04
4. Risk Affect α = .89 1-30 low values more affect. risk	-2.29	-4.08	-2.15	20.79 (4.84)	.49**	-.15**	.21**	-.04	-.08
5. Risk Cognitive α = .66 1-20 low values more cog. risk	-1.74	-1.71	-.88	5.46	10.48 (2.84)	-.09	.10*	.10*	.05
6. Heuristic Mode α = .72 1-20 low values more HEU mode	1.77	1.72	5.02	-2.63	-.72	15.88 (3.52)	-.15**	-.18**	-.15**
7. Systematic Mode α = .71 1-30 low values more SYS mode	1.27	.47	7.47	3.05	.71	-1.60	12.12 (3.03)	.10*	.27**
8. Need for Affect α = .78 1-50 low values more NFA	-.96	-.99	-1.33	-.96	1.28	-3.52	1.71	24.02 (5.44)	.28**
9. Need for Cognition α = .81 1-45 low values more NFC	-.77	.22	2.24	-2.02	.61	-2.84	4.38	8.23	22.16 (5.46)

* $p < .05$; ** $p < .01$ [correlations above diagonal, covariances below, Sum(*SD*) on diagonal (n = 373)]

Table 4.5
Correlation and Covariance Matrix for GM Foods Study

Cronbach α reliability indicated	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Behavioral Intention α = .93 1-21 low values more likely to use	15.15 (4.64)	.35**	.22**	-.30**	-.29**	.12*	-.09	-.27**	-.08
2. Attitude toward Act α = .89 1-21 low values more positive	6.53	11.67 (4.02)	.20**	-.14**	-.15**	.06	.01	-.03	-.03
3. Social Norm α = .84 1-147 low values more pressure	19.55	15.12	40.11 (18.91)	-.24**	-.12*	.05	.04	.00	-.01
4. Risk Affect α = .93 1-42 low values more affect. risk	-12.59	-4.98	-42.33	25.52 (9.15)	.58**	-.07	.22**	-.07	-.10*
5. Risk Cognitive α = .62 1-35 low values more cog. risk	-5.46	-2.45	-8.87	21.68	14.09 (4.09)	-.06	.30**	.11	-.05
6. Heuristic Mode α = .70 1-35 low values more HEU mode	2.80	1.22	4.86	-3.07	-1.33	21.37 (5.17)	-.32**	-.22**	-.19**

7. Systematic Mode α = .83 1-35 low values more SYS mode	-2.26	.29	3.82	10.34	6.33	-8.76	14.39 (5.24)	.15**	.22**
8. Need for Affect α = .79 1-70 low values more NFA	-11.12	-1.05	.38	-5.90	4.11	-9.92	6.94	31.23 (8.90)	.25**
9. Need for Cognition α = .83 1-63 low values more NFC	-3.05	-.90	-1.41	-7.87	-1.74	-8.09	9.85	19.14	29.24 (8.46)

* $p < .05$; ** $p < .01$ [correlations above diagonal, covariances below, Sum(*SD*) on diagonal ($n = 379$)]

All the statistically significant zero-order Pearson product-moment correlations are also depicted in Figure 4.1. Some of the key notable findings not addressed in the hypothesis tests that follow are as follows: First, need for cognition is negatively related to need for affect avoidance (*r*=-.23 for sunscreen, *r*=-.22 for GM foods), and positively related to need for affect approach/attraction (*r*=.22 for sunscreen, *r*=.15 for GM foods). Second, systematic processing and heuristic processing are negatively related (*r*=-.15 for sunscreen, *r*=-.22 for GM foods). Third, although distinct constructs (based on factor analysis), cognitive risk perceptions and affective risk perceptions are highly correlated (*r*=.49 for sunscreen, *r*=.59 for GM foods), so knowing one can explain 24% of the variance in the other for sunscreen, and 34% of the variance in the other for GM foods. Fourth, attitude toward the action and social norms are correlated (*r*=.32 for sunscreen; *r*=.20, for GM foods), but explain only small amounts of the variance in the other – only 10% and 4% for nanoparticle sunscreen and GM foods, respectively.

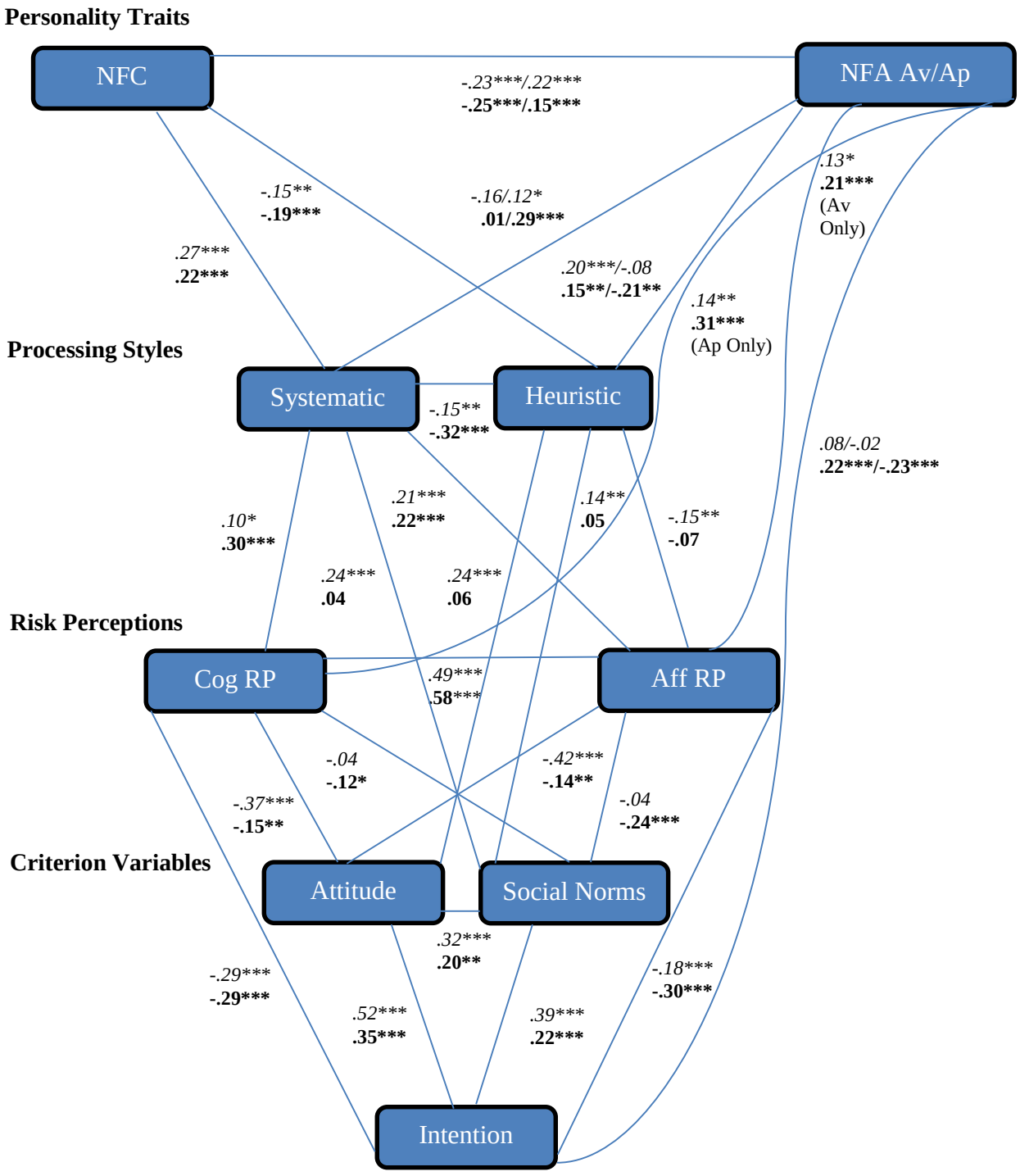

Figure 4.1: Summary of statistically significant Pearson r correlations for key variables (* $p < .05$; ** $p < .01$; *** $p < .001$). Italic (top value) indicates results from sunscreen study. Bold (bottom value) indicates results of GM foods study. Av indicates avoidance, and Ap indicates approach.

Hypotheses Test Results

Based on this study's findings, this section examines whether the hypotheses and research questions proposed in Chapter 2 were supported.

Effects of Risk Perceptions

Hypothesis 1 stated that (high) cognitive and affective risk perceptions were negatively related to attitude, adherence to social norms and purchase intent. H1 was supported. Cognitive risk perception was negatively correlated to purchase intent for both products (r=. -29, p≤.000 for sunscreen; r=-29, p≤.000 for GM foods). Affective risk perception also was negatively correlated to purchase intent for both products (r=-.18, p≤.000 for sunscreen; r=-.30, p≤.000 for GM foods).

Notably, the predicted roles of attitudes and social norms specified in the Theory of Reasoned Action were evidenced at work. The two intermediary steps (attitude and social norms) were themselves correlated (r=.32, p≤.000 for sunscreen; r=.20, p≤.000 for GM foods). Attitudes were correlated to purchase intent for both products (r=.52, p≤.000 for sunscreen; r=.35, p≤.000 for GM foods). Social norms were also correlated (r=.39, p≤.000 for sunscreen; r=.22, p≤.000 for GM foods).

Not surprisingly, attitudes were negatively correlated to both cognitive risk perception (r=-.37, p≤.000 for sunscreen; r=-.15, p≤.004 for GM foods) and affective risk perception (r=-.42, p≤.000 for sunscreen; r=-.14, p≤.008 for GM foods).

An intriguing finding involves the relationship between social norms and risk perceptions. For GM foods only, social norms were negatively related to both cognitive risk perception (r=-.12, p≤.026) and affective risk perception (r=-.24, p≤ .000). However, no relationship was found for sunscreen: Conformity to social norms appeared not to be influenced

by either cognitive risk perception (r=-.04, p≤.440) or affective risk perception (r=-.04, p≤.405). This might be explained because, in contrast to GM foods, the number of people who reported having heard about nanoparticles in sunscreen products was low (approximately 17% for sunscreen versus 92% for participants having heard of GM foods). Since many of the sunscreen survey participants did not know about the existence of nanoparticles, they probably were not able to answer confidently about social norm items (e.g., it would be acceptable to my closest friends or family members if I consumed nanoparticle sunscreen).

Purchase intention was not directly related to either systematic or heuristic processing, or need for cognition (all correlations were not significant). Similarly, purchase intention was unrelated to either form of need for affect in the case of nanoparticle sunscreen, but statistically significant correlations were found for both in the case of GM foods. This will be addressed as part of the secondary analysis of the data.

Effects of Personality Traits

Hypothesis 2 stated that need for cognition was positively related to systematic processing and negatively related to heuristic processing. H2 was supported. Need for cognition was positively correlated to systematic processing for both products (r=. 27, p≤.000 for sunscreen; r=.22, p≤.000 for GM foods). On the other hand, need for cognition was negatively correlated to heuristic processing for both products (r=-.15, p≤.004 for sunscreen; r=-.19, p≤.000 for GM foods). This suggests that people who are high in need for cognition are more likely to process information in a deliberate manner, while people who are low in need for cognition are more likely to process information via mental shortcuts. In terms of explanatory variables in the sunscreen study, NFC was only related to exposure to the controversy (r=.124, p<.050). In the GM foods study, NFC also was related to exposure to the controversy surrounding that product

(r=.193, p<.001) but also to level of prior perceived knowledge (r=178, p<.001). This suggests high-NFC respondents were in fact motivated for whatever reason to learn more about these products.

Hypothesis 3a stated that need for affect avoidance was positively related to heuristic processing. H3a was supported. Need for affect avoidance was positively correlated to heuristic processing for both products (r=.20, p≤.000 for sunscreen; r=.15, p≤.003 for GM foods). Meanwhile, H3b stated that need for affect approach was positively related to systematic processing. H3b was supported with Pearson r=.12, p<.050 for sunscreen and r=.29, p≤.000 for GM foods. These results suggest that people who are high in need for affect approach are more likely to process information in a deliberate manner while people who are high in need for affect avoidance are more likely to process information via mental shortcuts.

Effects of Systematic vs. Heuristic Processing

Hypothesis 4 stated that systematic processing was positively related to a) cognitive risk perception and b) affective risk perception, while heuristic processing was not. H4 was supported. Systematic processing was positively correlated to cognitive risk perception for both products (r=.10, p≤.047 for sunscreen; r=.30, p≤.000 for GM foods). Furthermore, systematic processing was positively correlated to affective risk perception for both products (r=.21, p≤.000 for sunscreen; r=.22, p≤.000 for GM foods). The only significant relationship was between heuristic processing and affective risk perception for sunscreen, which was a negative relationship (r=-.15, p≤.003). These results' implications will be discussed in the Discussion chapter.

Possible Direct Effects of Explanatory Variables on Purchase Intent

In examining the results of this investigation, four variables were found that could explain purchase intent beyond cognitive and affective risk perceptions. These included two dichotomous variables – sex (male or female), awareness (whether participants responded "yes" or "no" to the screening questions about whether they were aware of nanoparticles in sunscreen or genetically modified foods), and product use for sunscreen only (whether participants responded "yes" or "no" to the screening question about whether they knowingly used the product). The other measured, interval-level variable that proved to be statistically significant (but dubious) was concern about safety.

Effects of Sex

Sex effects were found in 5 of the 10 key variables in both studies, as reported in Table 4.6. For the sunscreen study, mean differences between males and females were statistically significant for intention, affective and cognitive risk perceptions, systematic processing, and need for affect approach while, for GM foods study, mean differences were significant for affective and cognitive risk perceptions, systematic processing, need for affect approach, and need for cognition.

Table 4.6
Effects of Sex on Key Variables on Study
Sums of indexes based on 5-point scale for sunscreen and 7-point scale for GM foods. Sums are not comparable across products based on the different scales used.

	Sunscreen with Nanoparticles			**Genetically Modified Foods**		
	Males (*n*=165)	Females (*n*=208)	**Total (*n*=373)**	Males (*n*=153)	Females (*n*=226)	**Total (*n*=379)**
Intention	*10.53** *(2.73)*	*9.88** *(2.56)*	*10.17* *(2.66)*	14.71 (4.69)	15.45 (4.58)	15.15 (4.63)

Attitude	*8.18 (1.97)*	*8.12 (2.07)*	*8.14 (2.02)*	11.53 (4.01)	11.77 (4.03)	11.67 (4.02)
Social Norm	*26.18 (10.24)*	*26.36 (10.31)*	*26.28 (10.27)*	37.93 (18.08)	41.58 (19.36)	40.11 (18.91)
Risk Perception-Affective	*21.81*** (4.79)*	*19.97*** (4.73)*	*20.79 (4.84)*	27.22** (9.05)	24.37** (9.07)	25.52 (9.15)
Risk Perception-Cognitive	*10.86** (2.34)*	*10.17** (2.20)*	*10.48 (2.28)*	14.59* (4.34)	13.75* (3.89)	14.09 (4.09)
Heuristic Processing	*16.16 (3.28)*	*15.65 (3.70)*	*15.88 (3.52)*	21.37 (5.31)	21.38 (5.08)	21.37 (5.17)
Systematic Processing	*12.52* (3.11)*	*11.81* (2.93)*	*12.12 (3.02)*	15.19* (6.18)	13.85* (4.51)	14.39 (5.24)
Need for Affect	*24.43 (5.53)*	*23.69 (5.36)*	*24.02 (5.44)*	31.80 (8.54)	30.84 (9.14)	31.23 (8.90)
Avoidance	*17.78 (3.91)*	*17.44 (3.88)*	*17.60 (3.89)*	23.36 (5.85)	22.91 (6.50)	23.09 (6.24)
Approach	*12.21*** (2.86)*	*11.14*** (2.86)*	*11.62 (2.90)*	15.16** (4.97)	13.75** (4.31)	14.32 (4.64)
Need for Cognition	*21.61 (5.41)*	*22.58 (5.47)*	*22.16 (5.46)*	28.20* (8.42)	29.95* (8.42)	29.24 (8.46)

*p<.05; **p<.01; ***p<.001

Nanoparticle Sunscreen. Females demonstrated greater intention toward purchasing the product (M=9.88, SD=2.56) than males (M=10.53, SD=2.73, t(371)=.2.39, $p\leq$.017). Females showed much higher affective risk perception (M=19.97, SD=4.73) than males (M=21.81, SD=4.79, t(371)=3.71, $p\leq$.000). In a similar pattern, females demonstrated greater cognitive risk perception (M=10.17, SD=2.20) than males (M=10.86, SD=2.34, t(371)=2.92, $p\leq$.004). In addition, females showed greater systematic processing (M=11.81, SD=2.93) than males

(*M*=12.52, *SD*=3.11, *t*(371)=2.73, *p*≤.024). Finally, females demonstrated more need for affect approach (*M*=11.14, *SD*=2.85) than males (*M*=12.21, *SD*=2.86, *t*(371)=3.89, *p*≤.000).

GM Foods. Females showed higher affective risk perception (*M*=24.37, *SD*=9.07) than males (*M*=27.22, *SD*=9.05, *t*(377)=3.00, *p*≤.003). In a similar manner, females demonstrated greater cognitive risk perception (*M*=24.37, *SD*=9.07) than males (*M*=27.22, *SD*=9.05, *t*(377)=1.97, *p*≤.049). As it was the case for the sunscreen study, females showed greater systematic processing (*M*=13.85, *SD*=4.51) than males (*M*=15.19, *SD*=6.18, *t*(377)=2.46, *p*≤.014). Additionally, females demonstrated more need for affect approach (*M*=13.75, *SD*=4.31) than males (*M*=15.16, *SD*=4.97, *t*(377)=2.94, *p*≤.004). Finally, males demonstrated greater need for cognition (*M*=38.20, *SD*=8.42) than females (*M*=29.95, *SD*=8.42, *t*(377)=-2.00, *p*≤.047).

Effects of Awareness

Awareness effects were found in three of the 10 key variables in both studies. For the sunscreen study, statistically significant mean differences between people who reported being aware versus not aware were found for intention, systematic processing, and need for affect avoidance. Similarly, mean differences were also statistically significant for intention, systematic processing, and need for affect avoidance (including total need for affect) for GM foods study.

Table 4.7
Awareness Effects for Two Products
Sums of indexes based on 5-point scale for sunscreen and 7-point scale for GM foods.

	Sunscreen with Nanoparticles			**Genetically Modified Foods**		
	No (*n*=309)	Yes (*n*=64)	**Total (*n*=373)**	No (*n*=29)	Yes (*n*=350)	**Total (*n*=379)**
Intention	*10.37*** (2.65)*	*9.16*** (2.48)*	*10.17 (2.66)*	13.52* (4.27)	15.28* (4.64)	15.15 (4.63)
Attitude	*8.20 (2.02)*	*7.88 (2.03)*	*8.14 (2.02)*	11.97 (3.25)	11.65 (4.08)	11.67 (4.02)

Social Norm	*26.69 (10.47)*	*24.29 (9.05)*	*26.28 (10.27)*	44.00 (20.81)	39.79 (18.74)	40.11 (18.91)
Risk Perception-Affective	*20.84 (4.88)*	*20.50 (4.65)*	*20.79 (4.84)*	24.79 (7.51)	25.58 (9.28)	25.52 (9.15)
Risk Perception-Cognitive	*10.52 (2.45)*	*10.26 (2.46)*	*10.48 (2.28)*	14.69 (2.88)	14.04 (4.18)	14.09 (4.09)
Heuristic Processing	*15.79 (3.51)*	*16.31 (3.56)*	*15.88 (3.52)*	20.28 (3.63)	21.46 (5.27)	21.37 (5.17)
Systematic Processing	*12.31** (3.03)*	*11.20** (2.87)*	*12.12 (3.02)*	17.69*** (6.16)	14.12*** (5.07)	14.39 (5.24)
Need for Affect (Total)	*23.82 (5.06)*	*24.95 (6.97)*	*24.02 (5.44)*	34.41* (8.14)	30.97* (8.92)	31.23 (8.90)
Avoidance	*17.82* (3.70)*	*16.50* (4.58)*	*17.60 (3.89)*	20.31* (6.51)	23.32* (6.17)	23.09 (6.24)
Approach	*11.65 (2.68)*	*11.45 (3.83)*	*11.62 (2.90)*	14.72 (3.91)	14.29 (4.70)	14.32 (4.64)
Need for Cognition	*22.36 (5.47)*	*21.17 (5.30)*	*22.16 (5.46)*	31.34 (8.41)	29.06 (8.45)	29.24 (8.46)

*p<.05; **p<.01; ***p<.001

Nanoparticle Sunscreen. Among those who were aware of nanoparticle sunscreen, intention to try the product (M=9.16, SD=2.48) was higher compared to those who were not aware of nanoparticle sunscreen (M=10.37, SD=2.65, t(371)=3.39, p<.001). In addition, among those who were aware of nanoparticle sunscreen, systematic processing was greater (M=11.20, SD=2.87) compared to those who were not aware of nanoparticle sunscreen (M=12.31, SD=3.03, t(371)=2.69, p≤.007). Finally, those who were aware of nanoparticle sunscreen demonstrated greater need for affect avoidance (M=16.50, SD=4.58) compared to those who were not aware of the product (M=17.82, SD=3.70, t(371)=2.17, p≤.033).

GM Foods. Among those who were not aware of GM foods, intention to try the product (*M*=13.52, *SD*=4.27) was higher compared to those who were aware of GM foods (*M*=15.28, *SD*=4.64, *t*(377)=-1.98, *p*≤.048). Plus, among those who were aware of GM foods, systematic processing was greater (*M*=14.12, *SD*=5.07) compared to those who were not aware of GM foods (*M*=17.69, *SD*=6.16, *t*(377)=3.59, *p*≤.000). Additionally, unlike the sunscreen study, those who were *not* aware of GM foods demonstrated greater need for affect avoidance (*M*=20.31, *SD*=6.51) compared to those who were aware of the product (*M*=23.32, *SD*=6.17, *t*(377)=-2.52, *p*≤.012).

Effects of Product Use for Sunscreen

Product use, as a specific form of awareness, had a significant effect on intention to purchase nanoparticle sunscreen, but not GM foods. The 11 participants who reported being users exhibited far greater purchase intention compared to nonusers (Users: *M*=7.72, SD=2.18; Nonusers: *M*=10.23, *SD*=2.62, *t*(371)=3.129. *p*≤.002). This might be explained, at least in part, by the fact that the 11 users (*M*=6.63, *SD*=8.19) also exhibited more positive attitudes than the nonusers (*M*=8.19, *SD*=1.98; *t*(371)=2.53, *p*≤.012). Product use also had a positive impact on adherence to social norms (Users *M*=37.20, *SD*=17.67; Nonusers *M*=46.53, *SD*=20.03; *t*(377)=4.56, *p*<.001). Users (*M*=13.78, *SD*=4.92) reported engaging in higher levels of systematic processing compared to non-users (*M*=15,73; *SD*=5.66; overall *M*=14.39, *SD*=5.23; *t*(377)=3.41, *p*<.001). Although systematic and heuristic processing were negatively correlated (*r*=-.15, *p*<.01), no significant effect was found for heuristic processing based on prior use of product (Users: *M*=21.55, *SD*=5.27; Nonusers: *M*=20.95, *SD*=4.90; *F*(1,377)=1.103, *p*≤.294).

By contrast to the results in the sunscreen study, product use did not affect purchase intent in the case of GM foods. Users indicated they were no more likely than nonusers to

consume GM foods (Users *M*=15.076, *SD*=4.54, Nonusers *M*=15.183, *SD*=4.68; *t*=-.209, *p*≤.834). However, both attitude and conformity with social norms were impacted by product use in the GM foods study, where users (*M*=11.37, *SD*=4.18) expressed more positive attitudes than nonusers (*M*=12.33, *SD*=3.92; *t*(377)=2.18, *p*≤.030). Users also were more conforming to social norms (Users *M*=37.21, *SD*=17.67, Nonusers *M*=46.52, *SD*=26.03; *t*(377)=4.556, *p*≤.000). When participants in the GM foods study were asked to self-report their levels of prior perceived knowledge (not measured for sunscreen), no significant effects were detected for intention, nor for attitudes or social norms, or for cognitive or affective risk perceptions (see Table 4.8 below). However, not surprisingly, self-reported level of prior perceived knowledge was positively related to systematic processing (*r*=.245, *p*<.001) and negatively related to heuristic processing (*r*=-.152, *p*<.001), suggesting those who enjoy cognitive activities might have been motivated to become more knowledgeable, while others did not.

Table 4.8
Correlations of Explanatory Index Variables and Major Variables in Two Studies
Pearson r

	Processing		**Risk Perceptions**		**TRA Predictors**		**Intention**
	Syste-matic	Heur-istic	Cogni-tive.	Affective	Attitude	Social Norms	
Level of Prior Knowledge	--[1] .245***	 -.152***	-- -.041	-- .009	-- .100	-- .046	-- -.036
Concern About Safety	.208*** .254***	.013 -.136**	.189*** .507***	.288*** .708***	-.007 -.137***	.106* -.236**	.067 -.343***

*p<.05; **p<.01; ***p<.001.
[1] Data about level of prior perceived knowledge (beyond awareness) was not collected in the sunscreen study. Top values indicate Pearson r for sunscreen. Bottom are for GM foods study.

Effects of Concern about Safety

A final possible explanation for the differences in purchase intention is found in the single-item measure of concern about safety (see Table 4.1 and Table 4.8 above). Concern about safety was positively correlated to purchase intension for GM foods (r=.343, p<.001) but not nanoparticle sunscreen (r=.067, n.s.). Participants in the GM foods study, of whom 92% were aware of GM foods, demonstrated comparatively greater concern for safety (M=.3.97, representing the 56th percentile of possible scores on a 7-point scale where 1=not concerned and 7=concerned). This compares to the participants in the sunscreen study, of whom only 8% were aware of the product (M=3.83, representing the 76th percentile of possible scores, on a 5-point scale where 1=not concerned and 5=concerned). Concern about safety was positively related to level of prior perceived knowledge (r=.120, $p\leq$.02) and negatively correlated to purchase intention for GM foods (r=-.343, p<.001, explaining 13.9% of the variance). By contrast, concern for safety itself did not impact purchase intention in the sunscreen study (r=.067, n.s.).

Concern about safety was included as an explanatory variable by simply asking participants how concerned they were about the safety of each product. Some people might argue that safety concern merely is a specific form of risk perception and measures the same construct. A better question to ask might have been how *important* the issue was to the participant or if it had *personal consequences* for the participant. The duplication (and therefore the lack of independence) between the two measures is readily evidenced in high correlations for both GM foods and sunscreen reported in Table 4.8, particularly the r=.708 correlation for concern about safety and affective risk perception in the case of GM foods. The Pearson r=.708 indicates that fully 85% of the variance of one variable is explained by the other. The possible duplication in measurement was corroborated in a correlational analysis that showed concern about safety was

correlated with *each* of the underlying items to measure affective risk perception for both products. Similarly, a simple linear regression was performed that excluded other significant predictors of purchase intent wherein purchase intent was regressed on concern about safety, cognitive risk perception, affective risk perception and attitude. The result showed positive attitude (β=-.220) was significantly related to intention, while the crude measure of concern about safety (β=.299) wiped out the effects of both cognitive risk perception and affective risk perception. Although a single-item measure of the construct might be valid and useful in other investigations, the measure of concern about safety in this study was discarded as a possible explanatory measure because it was clearly not independent of risk perception and thus might confound the analysis.

Secondary Analyses of Combined Effects of Variables

To more fully understand the factors that would possibly contribute to participants' purchases of these two products, hierarchical regressions were employed that incorporated each of the variables that were found to be positively related to purchase intention for each of these two products. The rationale for employing hierarchical regression is two-fold. First, to understand the effect of each of the independent variables (or groups of similar variables) on the dependent variable by entering them into the regression equation in a logical sequence based on their (intrinsic versus extrinsic) characteristics and thus understand their incremental contribution to the variance explained at each step (Field, 2013). This is measured in the change in variance explained (delta) at each step and its statistical significance (R^2 Δ). Second, similar to standard linear regression, to understand the effect of each independent variable, net of other variables, in the final step of the regression model. Only variables previously found statistically significant were included.

Procedures

The use of hierarchical regression requires that the residuals be normally distributed such that researchers would expect 95% of the cases to have standardized residuals within about ±2 (Field, 2013, p. 248). By examining a histogram of the regression analysis, the distributions in the two studies were found to be roughly normal. These results ensured that assumption of "no collinearity" had been properly checked since its tolerance statistics were all more than .2 and all VIFs were less than 10 and not substantially greater than 1. As a result, there was no major reason for concern in terms of standardized residuals within this study's sample. Upon verifying these requirements were met, hierarchical regression analyses were performed to examine how the key variables in the two studies (nanoparticle sunscreen and GM foods) predicted behavioral intention. These are reported in Tables 4.9 and 4.10.

Sunscreen Study. In all, seven variables had been found to be correlated at statistically significant levels with purchase intent of nanoparticle sunscreen: sex, awareness, use of product, affective risk perceptions, cognitive risk perceptions, attitude, and conformity to social norms. In conducting the hierarchical regression analysis, sex was entered first because it is the most innate trait among participants. Then, awareness and use of product were entered in the next step. Thereafter affective and cognitive risk perceptions. In the last step, attitude and social norm conformity was entered as they deemed the most direct predictors of intention based on the theory of reasoned action (TRA).

When sex was entered as the predictor variable, it significantly predicted intention to purchase nanoparticle sunscreen (β=-.123, $p<.05$; $R^2=.015$, $p<.05$). In Step 2, the addition of awareness and use of product were both significant (β=-.139, $p<.01$ and β=-.135, $p<.01$). Further, Step 2 accounted for 6.1% of the variance ($R^2=.061$, $p<.001$). The R^2 change (R^2 Δ=.045, $p<.001$)

explained an additional 4.5% percent of the variance. When affective and cognitive risk perceptions were added in Step 3, only cognitive risk perception significantly predicted intention (β=-.286, p<.001). The addition of these two variables in Step 3 increased the variance accounted for by 10.4% (R^2 Δ=.104, p<.001), while sex (β=-.178, p<.001), awareness (β=-.150, p<.01), and use of product (β=-.136, p<.01) all remained significant. In the last step, both attitude (β=.254, p<.001) and social norms (β=.254, p<.001), also significantly predicted intention as posited in the TRA. The addition of these two variables in Step 4 increased the variance accounted for by 22.5% (R^2 Δ=.225, p<.001). Notably, the effects of product use became non-significant (β=.072). In the final model, five variables proved to contribute to purchase intent (being female, lower awareness, lower cognitive risk perception, positive attitude, and greater conformity to social norms). Together these explained 39% of the variance in the final model.

Table 4.9
Hierarchical Multiple Regression Model for Intention to Purchase Nanoparticle Sunscreen

Step and predictor variable	*B*	*SE B*	β	R^2	Δ R^2
Step 1:				.015*	.015*
Sex	-.658	.275	-.123*		
Step 2:				.061***	.045***
Sex	-.649	.270	-.122*		
Awareness	-.975	.364	-.139**		
Use of Product	-2.115	.811	-.135**		
Step 3:				.165***	.104***
Sex	-.948	.261	-.178***		
Awareness	-1.054	.344	-.150**		
Use of Product	-2.125	.767	-.136**		
Affective Risk Perception	-.039	.030	-.072		
Cognitive Risk Perception	-.332	.064	-.286***		
Step 4:				.390***	.225***
Sex	-.725	.225	-.136***		
Awareness	-.786	.296	-.112**		
Use of Product	-1.200	.663	-.077		
Affective Risk Perception	.031	.027	.057		
Cognitive Risk Perception	-.223	.056	-.192***		
Attitude	.494	.065	.376***		
Social Norm	.066	.011	.254***		

*p<.05; **p<.01; ***p<.001

GM Foods Study. Seven variables had been found to be statistically significant predictors for purchase intent of GM foods based on prior correlation analyses: awareness, need for affect avoidance, need for affect approach, affective risk perception, cognitive risk perceptions, attitude, and conformity with social norms. Similar to the hierarchical regression analysis for sunscreen, awareness was entered first because it is the most intrinsic characteristic (i.e., one needs to know about the issue to have a concern or form an attitude). Then, NFA avoidance and approach were entered in the second step. The next additions were affective and cognitive risk perceptions. In the last step, attitude and conformity to social norms were entered as the direct antecedents to intention as specified in TRA.

For the GM foods study, awareness was first entered as a predictor variable, and it was significant (β=.102, $p<.05$). NFA avoidance and approach were entered in Step 2, and both variables maintained their statistically significant relationships with intention (β=.150, $p<.01$ and β=-.174, $p<.05$ respectively). The addition of NFA avoidance and NFA approach in Step 2 increased the variance accounted for by 7% (R^2 Δ=.070, $p<.001$). In this step, awareness became non-significant (β=.078, n.s.). When the two measures of risk perceptions were added in Step 3, both affective risk perception and cognitive risk perception significantly predicted intention (β=-.267, $p<.001$ and β=-.128, $p<.05$ respectively). The addition of these two variables in Step 3 increased the variance accounted for by 11.2% (R^2 Δ=.112, $p<.001$), and NFA avoidance (β=.251, $p<.001$) continued to be a significant predictor of purchase intention. At this step, awareness continued to be non-significant, while need for affect approach had no effect. In Step 5, with the addition of attitude and social norms, both significantly predicted intention (β=.283, $p<.001$ β=.112, $p<.05$, respectively). The addition of these two variables in Step 5 accounted for an additional 10% of the variance explained in the model (R^2 Δ=.100, $p<.001$). To summarize, in

the final model (which accounted for 29% of the variance), only four variables -- NFA avoidance (β=.242), positive attitude (β=.283), conformity to social norms (β=.112) and lower affective risk perception (β=-.214) -- contributed to purchase intent for genetically modified foods. Meanwhile, awareness, NFA approach, and cognitive risk perception were not significant as predictors of purchase intent among participants in this study. More detailed implications of these results will be discussed in the next chapter.

Table 4.10

Hierarchical Regression Model for Intention to Purchase GM Foods

Step and predictor variable	*B*	*SE B*	β	R^2	Δ R^2
Step 1:				.010*	.010*
Awareness	1.768	.892	.102*		
Step 2:				.080***	.070***
Awareness	1.356	.870	.078		
NFA Avoidance	.112	.039	.150**		
NFA Approach	-.174	.052	-.174*		
Step 3:				.192***	.112***
Awareness	1.190	.819	.068		
NFA Avoidance	.187	.038	.251***		
NFA Approach	-.065	.053	-.065		
Affective Risk Perception	-.135	.030	-.267***		
Cognitive Risk Perception	-.145	.068	-.128*		
Step 4:				.292***	.100***
Awareness	1.428	.770	.082		
NFA Avoidance	.180	.036	.242***		
NFA Approach	-.062	.049	-.062		
Affective Risk Perception	-.109	.028	-.214***		
Cognitive Risk Perception	-.117	.064	-.104		
Attitude	.326	.052	.283***		
Social Norm	.027	.011	.112*		

*p<.05; **p<.01; ***p<.001

CHAPTER 5: DISCUSSION

This chapter concludes the study by summarizing the results, discussing its implications, comparing the results of the two surveys, reviewing the strengths and limitations of the study, and identifying possible directions for further research.

Summary of Findings

As outlined in Chapter 4, all four of the research hypotheses were supported. Both higher cognitive perceptions and affective perceptions of risk negatively influenced attitude, conformity to social norms, and purchase intention for nanoparticle sunscreen and for genetically modified foods (H1). Need for cognition was positively correlated to systematic processing (H2), while the avoidance dimension of need for affect was positively related to heuristic processing (H3a). Meanwhile, need for affect approach was positively correlated to systematic processing (H3b). Systematic processing was positively related to cognitive risk perception and affective risk perception, while heuristic processing was not (H4).

Then, a series of analyses of possible direct effects of explanatory variables were conducted to help inform the hypothesis findings. Sex of the participant, awareness, product use, and prior perceived knowledge (measured for GM foods only) were included as explanatory variables that helped explain purchase intent. Sex (being female), awareness, and product use all proved significant for sunscreen while awareness (which was higher among females compared to males but not at a statistically significant level) was related to intention to purchase GM foods when the effects of other variables were not taken into consideration.

Separate hierarchical regressions further examined the combined effects of the key and explanatory variables on purchase intent. In the sunscreen study, the final regression model explained 39.0% of the variance and suggested purchase intent was related to being female, low

awareness of nanotechnology, low cognitive risk perceptions, and positive attitudes and adherence to social norms. In the GM foods study, the final regression model, which explained 29.2% of the variance, suggested that purchase intention was best explained by the need for affect avoidance, low affective risk perceptions, positive attitudes and adherence to social norms.

Implications for Theory

Risk and Purchase Intent

Most marketers do not address risk when promoting a new product or service. Often times risks are not known, especially for new categories of products or when materials or production systems are used to create products for the first time. When risks are suspected but not necessarily confirmed, marketers often opt to ignore or minimize them when promoting a new product because of the uncertainty that often exists about the nature and level of the risk. At the same time, consumers do not expect risks to be directly addressed in promotional messages such as advertising. Such an approach violates the audience's mental expectation that all promotional messages will be uniformly positive in valence; messages that feature extensive commentary about risks can be suspect. In the United States, a notable exception is direct-to-consumer (DTC) pharmaceutical advertising wherein advertisers are mandated by regulators to include the same kind of contraindications required in drug labels. Notably, however, considerable research suggests such disclaimers specifying possible risks or side-effects are ignored by audiences, especially those who desperately seek relief from health maladies (Green & Armstrong, 2012).

Not surprisingly, in both surveys, attitudes and purchase intention were negatively correlated to both cognitive and affective risk perceptions. These results were consistent with previous studies. Several scholars have demonstrated that there is a negative relationship

between risk perception (perceived risk) and consumers' new product purchase attitude/intention (Choi et al., 2013; Lee, 2009; Michaelidou & Christodoulides, 2011).

Risk was not central to the early work of Ajzen and Fishbein upon which this study was based, namely the theory of reasoned action. However, later work by the authors (Fishbein, 2008) have specified *perceived risk* as an individual differences variable among several background influences identified in their reasoned action approach. In both the sunscreen and GM foods studies, the evidence suggests that risk is not merely mediated by attitude, or moderated by conformity to social norms, but can have a direct effect on intention (evidenced in the strong positive correlations between all three of the variables (perceived risk, attitude or social norms, and intention). This idea merits further research to clarify how perceived risk actually operates in purchase intention, where it is possible for individuals to actually have a positive attitude toward a product despite its perceived risks.

Cognitive vs. Affective Risk Perceptions

This study provides further insights into the differentiation between cognitive risk perceptions and affective risk perceptions (Trumbo et.al., 2016). As suggested in the literature review, risk-taking has traditionally been viewed as a rational, cognitive-based activity in which a person confronting a potentially risky situation thoughtfully considers the potential benefits versus costs of a decision based on hazards or potential losses.

Separate measurement of cognitive and affective risk perceptions as distinct constructs began quite recently. For example, Västfjäll, Peters and Slovic (2008, p. 66) came up with a six-item emotion scale that consisted of the adjectives *sad, depressed, anxious, worried, afraid*, and *angry*. This approach was adapted by Trumbo et al. (2016), who used two separate 6-item scales

to measure cognition (such as the degree to which the individual perceives personal control) and affect (such as the degree to which individuals dread various outcomes).

The present study posited that cognitive and affective risk perceptions would be distinct concepts that impact people's behavioral intention in unique ways. Two of this study's related findings suggest this study's assumption that cognitive and affective risk perceptions function separately: 1) only need for affect approach was positively related to cognitive risk perception and 2) only need for affect avoidance was positively related to affective risk perception. This assumption is further supported by the fact that affective and cognitive risk perceptions maintained significantly negative relationships with purchase intent for both products (See Figure 4.1).

Cognitive risk perceptions were grounded in knowledge and perceptions of the risk itself, including but not limited to a probabilistic analysis of the likelihood and severity of a potential danger, hazard or loss. As stressed previously, affective risk perceptions can influence cognition and also operate directly or heuristically by serving as a mental shortcut used by people (when deciding to engage in or avoid particular risky behaviors wherein they anticipate not only events but also their emotional response to such events). However, cognitive risk and affective risk perceptions were also highly correlated, suggesting that they might operate in tandem, which is the reason that this study analyzed these two variables together.

Another intriguing aspect of the results from the two studies is how cognitive and affective risk perceptions contribute to purchase intention differently. When the product awareness level was low (i.e., nanoparticle sunscreen study), low cognitive risk perception was a significant factor for purchase intention. On the other hand, low affective risk perception contributed to purchase intention when the product awareness level was high (i.e., GM foods

study). These findings show that it is more difficult for individuals with low awareness on the issue to be emotionally engaged, compared to individuals with high awareness, exposure or experience within a product. In other words, it would be rather difficult for any human being to have emotionally charged feeling even before they get to know the very issue itself.

Effects of Personality Traits: Need for Cognition and Affect

As hypothesized, need for cognition was positively related to systematic processing, while it was negatively related to heuristic processing for both products. This finding indicates that people who are high in need for cognition (NFC) are more likely to process information deliberately, while people who are low in need for cognition are more likely to process information via mental shortcuts. In the sunscreen study, NFC was only related to exposure to the controversy (r=.124, p<.050). In the GM foods study, NFC also was related to exposure to the controversy surrounding that product (r=.193, p<.001) but also to level of prior self-reported perceived knowledge (r=178, p<.001). These findings demonstrate that high-NFC people were actually motivated to learn more about these two risky consumer products.

More interestingly, need for affect (NFA) avoidance was positively related to heuristic processing (r=.20, $p\leq$.000 for sunscreen; r=.15, $p\leq$.003 for GM foods), while need for affect approach was positively related to systematic processing for both products (r=.12, p<.050 for sunscreen and r=.29, $p\leq$.000 for GM foods). Once again, these findings suggest that people who are high in NFA approach are more likely to process information deliberately, while people who are high in NFA avoidance are more likely to process information via mental shortcuts. More related implications will be discussed in the next section.

NFA, at minimum, is a bi-dimensional construct involving *approach* and *avoidance*. This study advanced the call by psychologists Maio and Esses (2001) for further exploration of

these two sub-dimensions of need for affect. NFA could have quite different effects on processing, potentially positive or potentially negative. The positive (attraction) impact of affect as a motivation has been generally recognized in a variety of contexts ranging from *sensation-seeking* as a personality trait and varies among all individuals to the short-term desire to seek *hedonistic pleasure* that can be used a rationale or argument for making a cognitive decision, such as choosing to engage in a particular activity because it would be fun or pleasurable. Affect also can interact with or confound rational decision making. Uniquely separate impacts of approach and avoidance motivations have been discovered in several other research studies. For example, research has uncovered that approaching success as well as avoiding failure have uniquely separate impacts on intrinsic motivation (Elliot & Harackiewicz, 1996) and subjective well-being (Elliot, Sheldon, & Church, 1997). Furthermore, research in neuropsychology has differentiated approach and avoidance motivations (e.g., Gray 1972, 1990).

Based on Figure 4.1, NFA approach was positively related to cognitive risk perception and NFA avoidance was positively related to affective risk perception. Another way to interpret this, people with low NFA approach maintained low cognitive risk perception and thus had greater intention; also, people with low NFA avoidance showed low affective risk perception and therefore maintained greater intention. In the sunscreen study's hierarchical regression model (see Table 4.10), cognitive affective risk perception, not affective risk perception, was a significant factor in Step 4. This can support the idea about being more curious and engaging in cognitive processing due to lack of awareness level on the topic. On the other hand, affective risk perception was a significant factor in Step 4 for the GM foods study (see Table 4.10). Once again, it is less difficult for individuals with high awareness of an issue (i.e., GM foods) to be

emotionally engaged, compared to individuals with low awareness on the topic (i.e., nanoparticle sunscreen).

Comparing Results of Two Surveys

A limitation of this investigation is that the two surveys were conducted independently, not necessarily with the intention of comparing the results. Yet, both validated the importance of attitudes and social norms in predicting purchase intention, in keeping with the theory of reasoned action and illustrated the negative impact of perceived risk on intention.

Comparing the results of the two studies is largely limited to conjecture, but it appears that the differences in the results obtained can be attributed to gender, differences in awareness, and possibly the nature of the stimulant materials that the participants were asked to read.

As suggested earlier, women were more intent on purchasing sunscreen than men, and somewhat more intent than men to purchase genetically foods (although not at a statistically significant level as in the sunscreen study). In fact, females are acknowledged as bigger users of sunscreen products and more concerned about sun protection than males (U.S. Center for Disease Control, 2008, 2015) – in addition to be being more concerned about skin appearance and care in general. Thus, women could be expected to have been more involved in the products and thus motivated and able to learn more. What is more women, as suggested in the literature review, are also more integrative processors and engage in less schematic (heuristic) processing than males (Meyers-Levy, 1989), are most sensitive to the details of information (Darley and Smith, 1995) and are more than willing to try new or unusual products (Cho & Workman, 2015).

Awareness also appeared to be an important factor – that operated in opposite ways in the two surveys. Those who were aware of sunscreen with nanoparticles (M=9.16, SD=2.48) showed more intention to try the product, compared to those who were not aware of nanoparticle

sunscreen (M=10.37, SD=2.65, t(371)=3.39, p<.001). There could be several reasons for this: 1) information on nanotechnology has been positively framed in many other areas of consumer products, and 2) the majority of the survey participants (82.8%) were not aware of nanoparticles being present in the sunscreen products they might use. If they did not know and only found out about potential risks of the product for the first time in the study, then they would not show much intention to try it.

By contrast, those who were *unaware* of GM foods (M=13.52, SD=4.27) showed more intention to try the product, compared to those who were aware of GM foods (M=15.28, SD=4.64, t(377)=-1.98, $p\leq$.048). There could be several possible reasons for this: 1) information about the genetic modification of foods has been negatively framed in many instances, and 2) a large portion of the survey participants (92.3%) had not heard of GM foods before and might have established opinions about genetic modification based on personal experience, media reports and/or conversations with family or friends. Notably, women have demonstrated consistently negative attitudes toward GM foods compared to males (Funk & Kennedy, 2016).

Regrettably, interpreting the difference in results is also potentially complicated by the difference in the complexity of information provided for participants to read. The information about nanoparticle sunscreen was longer and more detailed, requiring more cognitive effort. By comparison, the information about GM foods was a cogent summary that did not require the same level of cognitive effort and included some unintended heuristic cues, such as the numbering of talking points.

In the sunscreen study, a possible explanation for the correlations presented in Figure 4.1 might suggest that the negative cognitive risk perceptions that adversely affected attitudes and intention (but were not significant for social norms) stemmed from some combination of

systematic processing (r=.10) and/or NFA for affect approach (r=.14). To examine this possibility, linear regression was employed in which cognitive risk perception was regressed on both of these as well as gender. Cognitive risk perceptions appeared to be explained by being female (β=-.121, p≤.035) and need for affect approach (β=.110, p≤.021), but not systematic processing (β=.076, p≤.141; F(3,369)=5.320, p<.001). In turn, to better understand the relationship between key variables, the same linear regression procedure was employed to regress systematic processing on gender, awareness, use of product, and the two personality traits, NFC and NFA approach (r=.27 and r=-.12, respectively). The regression suggested that systematic processing in the sunscreen study was related to being female (β=-.126, p≤.013), being aware (β=-.116, p≤.020) and especially need for cognition (β=.261, p≤.000), but not NFA approach (β=.026, p≤.613) or product use (β=-.054, p≤.280; F(5,367)=8.893, p≤.000). As indicated in Table 4.6, there is also a gender-based difference in need for affect approach for the sunscreen study, with females (M=11.14) being more interested in exploring their feelings than males (M=12.21, p<.001). This suggests that wanting to be in touch with one's feelings (need for affect approach) impacted cognitive risk perceptions independently of systematic processing.

A somewhat different scenario appears to have been at work in the case of genetically modified foods, where need for affect avoidance was positively related to intention (r=.22) along with attitudes and social norms. Conversely, need for affect approach was negatively related to purchase intent (r=-.23, Figure 4.1). Linear regression was employed to understand the variables associated with affective risk perception, which was regressed on gender, awareness, product use, need for affect avoidance, and systematic processing. Systematic processing was included because it was positively related to affective risk perceptions (r=.23), but heuristic processing was excluded because the r=.07 was not significant. Although sex had no significant

effect on purchase intent for GM foods (as it had for sunscreen), being female appears to have led to greater affective risk perceptions (β=-.125, $p \leq .012$). Awareness and product use had no effect (β=.028, $p \leq .597$ and β=.132, $p \leq .132$) and no interactions with sex were found based on a chi-square analysis. Importantly the largest betas explaining greater affective risk perception were for systematic processing (β=.220, $p \leq .000$) and need for affect avoidance (β=.188, $p \leq .000$; $F(5,373)=9.280$, $p \leq .000$), which both appeared to lead to *greater* affective risk perceptions. Affective risk perception can be contrasted with cognitive risk perceptions, where there were no effects for gender, awareness or product use (β=-.016, β=-.017 and β=-.058, respectively, all n.s.). However, less cognitive risk perception was related to need for cognition (β=-.141, $p \leq .004$), while *greater c*ognitive risk perception was related to need for affect approach (β=257, $p \leq .000$) and systematic processing (β=.258, $p \leq .000$; $F(6,372)=12.333$, $p \leq .000$).

Whereas systematic processing appeared to have no effects on the cognitive risk perceptions for sunscreen (which was explained by need for affect approach), a somewhat different picture emerges when examining the role of systematic processing in the case of GM foods. A linear regression found that systemic processing was positively related to need for cognition (β=.176, $p \leq .000$) and need for affect approach (β=.247, $p \leq .000$) as well as awareness (β =-.103, $p \leq .042$) but negatively related to familiarity with the product through product use (β=.142, $p \leq .005$). Although females engaged in more systematic processing than males (M=13.85 versus M=15.19, Figure 4.6), but sex of participant fell short of statistical significance in the linear regression (β=-089, p=.068; $F(5,373)=15.33$, $p \leq .000$). However, the effect of sex of participant cannot be ignored completely in light of the fact that females exhibited greater need for affect approach (M=13.75) than males (M=15.16, Figure 4.6). These results suggest that although systematic processing appeared be eclipsed in importance by need for affect approach

as a determinant of cognitive risk perceptions in the sunscreen study, systematic processing contributed significantly to the creation of both cognitive and affective risk perceptions in the GM foods study.

Another interesting finding pertains to the relationship between social norms and risk perceptions. Social norms were negatively related to both cognitive and affective risk perceptions in the GM foods study; however, social norms appeared not to be influenced by either cognitive or affective risk perception in the nanoparticle sunscreen study. The difference in these findings possibly stems from the fact that vast majority of GM foods study participants (350 out of 379, 92.3%) were aware of genetically modified foods, while only a small percentage of participants (64 out of 373, 17.2%) were aware of sunscreen with nanoparticles. The more people are aware of each product, the more they are likely to know the risks involved and be conscious of the knowledge and opinions of others important to them (i.e., social norms). Similarly, another reason for a non-significant relationship for sunscreen could be that the survey participants were not able to answer confidently about social norm items because they did not know about the very existence of nanotechnology or the possible presence of nanoparticles in sunscreen products and had limited or no opportunity to consider how their actions might be viewed by family or friends.

Strengths and Limitations of Study

Strengths

There were several major strengths of this study. First, this research involved two (not just one) topical, risky products. Both continue to have profound impacts on our current and next generation and society at large. Second, it employed two parallel studies based on two sizable surveys (n=373 and n=379 for sunscreen and for GM foods respectively), providing statistical

power. Third, by conducting a pilot study and by applying the results of the sunscreen study to improve the GM foods study, the reliability of the findings was improved. Specifically, scaled measures showed high levels of reliability, with the possible exception of the cognitive risk perception scale (α=.66 for sunscreen and α=.62 for GM goods) although previous studies suggest the reliability scores (>.60) are adequate (Nunnally, 1967; Aron and Aron, 1999; Hair et al., 2006). A fourth strength of this study lies in the fact that it bridges two important bodies of literature: risk and consumer behavior. Fifth, this study sheds light on existing literature through the fact that it originated out of a desire to examine three important psychological dual-processing theories together – need for cognition v. need for affect, systematic v. heuristic processing, and cognitive v. affective risk perceptions. This was the first attempt to do so based on the knowledge of the author.

Limitations

There were several limitations in this study. First, it utilized online surveys, which limited gaining depth of insights that might have obtained from in-personal interviews or other methodologies that would enable participants to articulate how they went about processing the information. Second, it relied on convenience samples of college students not necessarily representative of actual potential purchasers or the adult population at large. Third, changes were made in the measurement of key variables between the sunscreen and GM foods that limited direct comparisons between products across the two studies, especially for level of prior perceived knowledge and attitude. When comparing the two products, the analysis was somewhat complicated by the use of 5-point scales in the sunscreen study and 7-point scales in the GM foods study. Fourth, there were major differences in awareness and use knowledge about the two products. In particular, participants' perceived knowledge about nanoparticle sunscreen

proved to be surprisingly negligible, while most people were generally aware of genetically modified foods. This problem might have been addressed through pre-testing of topics. Fifth, the survey design involved measuring the degree to which people engaged in both systematic and heuristic processing simultaneously without being able to discern whether people primarily engaged in systematic versus heuristic processing. Finally, secondary analysis relied on hierarchical analysis of purchase intention and might have been enhanced through the use of path analysis or structural equation modeling to examine the entire framework presented.

Future Research

Scholars can take advantage of several key findings from this study in the future. First, more researchers need to do more work to tap into two dimensions of need for affect, avoidance and approach. This study found that the former was positively related to heuristic processing, while the latter was positively related to systematic processing for both products. Moreover, NFA avoidance was positively related to affective risk perception, while NFA approach was positively related to cognitive risk perception in both the sunscreen and GM foods studies. It would be beneficial to develop a fuller picture of need for affect (especially need for affect approach) and its relationship to need for cognition. Although regression analyses might be used, a possibly beneficial approach would be to measure NFC and NFA and use a bifurcation strategy to sort participants and measure their responses to focal variables based on four conditions: high NFC/high NFA, high NFC/low NFA, low NRC/high NFA, and low NFC/low NFA.

Scholars can also utilize insights from the explanatory variables in this study in their future research. In particular, as evidenced in other studies, sex of purchaser can be quite useful in predicting purchase intention if it is more dominantly used among one sex over another (e.g., cosmetics for females and shave creams for males). The levels of awareness, product use and

perceived product knowledge also can be useful in studies dealing with risky products that are comparatively new or where large segments of the public remain uninformed but nonetheless might be asked to make judgments about them. Awareness of the underlying technology for example, remained a significant factor for the sunscreen study; on the other hand, it was not a significant factor in the GM foods study. When a new product with a novel innovation/technology is being introduced to the public, risk researchers would benefit by adapting the approach of product marketers in general by considering the effects of the level of awareness, product use and prior perceived knowledge in predicting purchase intention.

Going forward, the present author envisions pursuing several threads of research that will draw upon this research. Specifically, the author has a plan for two research projects. The first project will examine the role of need for affect in the context of environmental and health risks. That way, one can observe if the findings of this study can be generalized into other types of risks. Second, based in part on the author's interest in eventually relocating to the United States, the author anticipates a study project to investigate societal adoption by the public and their responses to the new State of California policy that aims to improve air quality by through a Clean Vehicle Rebate Project. The new program (CVRP, 2018, p. 1), will enable California residents to receive up to "$7,000 for the purchase or lease of a new, eligible zero-emission or plug-in hybrid light-duty vehicle." TRA variables and personality trait variables from this study could be utilized to test people's intention to participate in this program by categorizing prospective participants based on high versus low NFC and NFA and comparing participants who fit in each of the four quasi-experimental conditions suggested above.

Summing up, this study identified a framework in which personality traits based on psychological needs (NFC and NFA) led to different styles of processing and two forms of risk

perception that together were shown to influence purchase intention for two risky products. Notwithstanding the effects of other explanatory variables, this study provided general support for the approach. Future research by others needs to examine the validity and reliability of such a model, as well as the differential effects of the two sub-dimensions of need for affect, avoidance versus approach, and the distinction between cognitive and affective risk perceptions. These are intriguing findings and further data collection in the general population and in different contexts will help more fully understand such complex yet important relationships.

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APPENDIX A

QUESTIONNAIRE FOR SUNSCREEN STUDY AND INFORMED CONSENT FORM

The follow is the text of the survey conducted on QuestionPro for sunscreen containing nanoparticles. The appearance of the survey on screen is illustrated with the screenshots reproduced for the genetically modified foods study in Appendix C

Thank you for participating in this study. At the end of the questionnaire please provide your CSUID number, which we will only use in order to provide the 10 extra credit points. All identifying information will then be erased so that your responses are entirely anonymous. Note also, there are no right or wrong answers in the questionnaire (please refrain from Goggling terms while taking this survey). Thank you very much for your participation!

The purpose of the project is to help us better understand how college students feel about the use of nanoparticles in sunscreens. Nanoparticles are materials that can be made at a very small scale, smaller than 1/500th the width of a human hair. At that size, materials have different properties. For example, nanoparticles are used in sunscreens because they allow the lotion to go on clear rather than white. Nanoparticles are also used in a variety of other products.

First, let us ask about your thoughts about nanotechnology products in general.

How many times have you heard about the debate regarding "benefits vs. risks" associated with nanotechnology?

Yes, I have heard or read about the debate often (more than 5 times)
Yes, I have heard or read about the debate several times (3-5 times)
Yes, I have heard or read about the debate once or twice
No, I have not heard or read about the debate

For these questions, indicate how strongly you agree or disagree with the statement based on what you know about nanotechnology in general.

I think the use of nanotechnology in general is appropriate for consumers.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree
6. I do not know since I have never heard about nanotechnology

I think nanotechnology in general is a big step forward.

7. Strongly Agree
8. Agree
9. Uncertain
10. Disagree
11. Strongly Disagree
12. I do not know since I have never heard about nanotechnology

I think using nanotechnology in making consumer products in general is the more modern way of making products now.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree
6. I do not know since I have never heard about nanotechnology

Have you heard of sunscreen with nanoparticles (hereafter nano sunscreen)?

Yes
No

Have you ever used nano sunscreen?

Yes, I am aware that my sunscreen has nanoparticles
Maybe yes or Maybe no; I do not know whether the sunscreen product that I am using has nanoparticles or not
No, I do not use any sunscreen products

How concerned are you currently about the safety of nano sunscreen?

Extremely
Quite a lot
Somewhat
Just a little
Not at all

Next, we will be asking you to answer questions about your view of nano sunscreen. In advance, please make sure that you read the following set of statements regarding nanomaterials and nano sunscreen:

Nanomaterials are engineered on the scale of a billionth of a meter, about one ten-thousandth the width of a human hair. These tiny substances have moved into the marketplace over the last decade, in products as varied as cosmetics, clothing and paint. Nanoscale forms of substances like silver, carbon, zinc and aluminum have many useful properties. Nano zinc oxide sunscreen goes on smoothly, for example, and nano carbon is lighter and stronger than its everyday or "bulk" form. Also, various food companies have said they are interested in nanotechnology, which can help make products creamier without additional fat, intensify and improve flavors and brighten colors. So nanomaterials are starting to enter the food chain through well-known food products and their packaging.

But some scientists think that not enough is known about their potential health and environmental risks. Their small size allows nanoparticles to go places in the body where larger particles cannot and enter cells. They have been found in the blood stream after ingestion and inhalation, and while research on their health effects is limited, studies have shown them to have deleterious effects on mice and cells. And they can seep into the environment during manufacturing or disposal. Because the nanotechnology market is expanding — it represented $225 billion in product sales in 2009 and is expected to grow rapidly in the next decade — "today's exposure scenarios may not resemble those of the future," one report says.

In particular, looking at the potential harmful impact of nano sunscreen, the International Agency of Research on Cancer (IARC) categorized titanium dioxide (TiO_2) as a possible human carcinogen - in group 2B - while the hazards of nano-sized TiO_2 in sunscreen applications were fiercely debated. Yet, the IARC recognized that TiO_2 particles are being used in various sizes (nano and fine-sized particles), though the agency does not make this size distinction for the given categorization. Although, it is still unclear how much evidence is needed to give a final and credible answer to these environmental and safety issues, it seems evident that most parties in the debate ask for more research on the real impact of nanoparticles in sunscreens.
Source: (IARC, 2007)

Now, we would like to ask several questions about nano sunscreen and how you and other people think about it. Please indicate how strongly you agree or disagree with these statements.

I think the use of nano sunscreen is appropriate for consumers.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think nano sunscreen is a big step forward.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think nano sunscreen is the more modern way of using sunscreen now.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

When it comes to things like using sunscreen, it is important to me to follow the wishes of my closest friends.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

It would be acceptable to most people I know if I used nano sunscreen.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

When it comes to things like using sunscreen, it is important to me to follow the wishes of most people I know.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

It would be acceptable to my closest family members if I used nano sunscreen.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

When it comes to things like using sunscreen, it is important to me to follow the wishes of my closest family members.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

If nano sunscreen were labeled, I intend to seek out and purchase nano sunscreen during my regular trips to the grocery. (on a 5-point scale where 1 = true, 5 = false)

1. 1 true
2. 2
3. 3
4. 4
5. 5 false

If nano sunscreen were labeled, I intend to seek out and purchase nano sunscreen during my regular trips to the grocery. (on a 5-point scale where 1 = likely, 5 = unlikely)

1. 1 likely
2. 2
3. 3
4. 4
5. 5 unlikely

If nano sunscreen were labeled, I intend to seek out and purchase nano sunscreen during my regular trips to the grocery. (on a 5-point scale where 1 = probably, 5 = probably not)

1. 1 probably
2. 2
3. 3
4. 4
5. 5 Probably not

In thinking about the information in the statements you read about nanomaterials and nano sunscreen, how strongly would you agree or disagree with the following statements:

SYS

1) I thought about what actions I myself might take based on what I read.
2) I found myself making connections between the story and what I've read or heard about elsewhere.
3) I tried to think about the importance of the information for my daily life.
4) I thought about how the story related to other things I know.
5) I tried to relate the ideas in the story to my own personal experiences.

HUE

1) I skimmed through the story.
2) While reading the story, I focused on only a few points.
3) I did not spend much time thinking about the story.
4) The scenario contained more information than I personally need.
5) While reading the story, I did not think about the arguments presented in the story.

Now we would like to know your thoughts about the possible risks of using nano sunscreen. People have different kinds of emotional responses when they think about risk. How might these factors figure into your feeling about the possible risks that might be associated with using nano sunscreen?

The idea of nanoparticles in sunscreen makes me feel alarmed.

Strongly Agree
Agree
Uncertain
Disagree
Strongly Disagree

The idea of nanoparticles in sunscreen makes me feel sad.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

The idea of nanoparticles in sunscreen makes me feel depressed.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

The idea of nanoparticles in sunscreen makes me feel anxious.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

The idea of nanoparticles in sunscreen makes me feel worried.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

The idea of nanoparticles in sunscreen makes me feel unhappy.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

People understand risk in different ways. In thinking about the nature of nano sunscreen, how strongly would you agree or disagree with the following?

I am not knowledgeable about nano sunscreen.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I cannot control being harmed by nano sunscreen.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think that nano sunscreen may cause big health problems.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think it is difficult to understand the risks associated with nano sunscreen.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think the risks from nano sunscreen are very unpredictable.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think using nano sunscreen could pose a health-related financial risk.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

We would like to know a little bit about how you generally feel about things, just as a matter of habit, not in relation to any particular topic. Please indicate how strongly you agree or disagree with these statements. Remember, there are no right or wrong answers, just go with your first or "gut" reaction.

If I reflect on my past, I see that I tend to be afraid of feeling emotions.

Strongly Agree
Agree
Uncertain
Disagree
Strongly Disagree

I feel that I need to experience strong emotions regularly.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

Emotions help people get along in life.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I think that it is important to explore my feelings.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I find strong emotions overwhelming and therefore try to avoid them.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I would prefer not to experience either the lows or highs of emotion.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I do not know how to handle my emotions, so I avoid them.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

Emotions are dangerous—they tend to get me into situations that I would rather avoid.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

It is important for me to be in touch with my feelings

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

It is important for me to know how others are feeling.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

We would also like to know a little bit about how you generally think about things, just as a matter of habit, not in relation to any particular topic. Please indicate how strongly you agree or disagree with these statements. Again, there are no right or wrong answers, just go with your first or "gut" reaction.

I like to have the responsibility of handling a situation that requires a lot of thinking.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

Thinking is not my idea of fun.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I find satisfaction in deliberating hard and for long hours.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I only think as hard as I have to.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I really enjoy a task that involves coming up with new solutions to problems.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

Learning new ways to think does not excite me very much.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I prefer life to be filled with puzzles that I must solve.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

The notion of thinking abstractly is appealing to me.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.

1. Strongly Agree
2. Agree
3. Uncertain
4. Disagree
5. Strongly Disagree

Finally, we would like to ask just a couple demographic questions.

What is your sex?
- Female
- Male

What is your age (please type in numbers: e.g., 20)?

What is your standing?
- Freshman
- Sophomore
- Junior
- Senior

What is your eNAME (also known as your RamCT username)?

Invitation to participate in research, extra credit opportunity

We would like to invite you to participate in a research study to help us better understand how college students view the use of nanotechnology, specifically the use of nanoparticles in sunscreens. By participating in this study you will receive the 10 extra credit points. Information on the study and how to participate is below. The survey will be done online outside of class and takes about 10-12 minutes. If you cannot or would prefer not to participate in this study you may still earn the extra credit points. Instructions for that extra credit opportunity are at the end of this sheet. All of the details about the research project are provided below. Please take a few minutes to look this information over and give consideration to participating in this project. We would appreciate your truthful responses.

TITLE OF STUDY: "Nanoparticle Sunscreen."

INVESTIGATORS, WHO IS DOING THE STUDY?: This is a research project being conducted by JTC graduate student Sejin (Sage) Kim and faculty member Craig Trumbo.

WHAT IS THE PURPOSE OF THIS STUDY? The purpose of the project is to help us better understand how college students feel about the use of nano-particles in sunscreens. Nanoparticles are materials that can be made at a very small scale, smaller than 1/500th the width of a human hair. At that size, materials have different properties. For example, nanoparticles are used in sunscreens because they allow the lotion to go on clear rather than white. We are interested in knowing what college students think about this because sunscreen use can provide an important life-long health benefit for younger persons. The results will help us build a larger study looking at a broader range of young people.

WHO WILL SEE THE INFORMATION THAT I GIVE? As soon as extra credit has been assigned your name and all identifying information will be removed from this study so that your identity in this study is kept confidential. Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials.

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH? We are seeking participation from a random selection of college students.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The survey is being conducted online and takes about 10 minutes to complete.

WHAT WILL I BE ASKED TO DO? The survey contains questions about your views on nano-particle sunscreen. There are no potentially embarrassing or sensitive questions.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY? If you would prefer not to disclose your views on this topic you might not want to participate in the survey.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS? There are no foreseeable risks or discomforts to you from participating in this research study.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY? There are no direct benefits to you from participating in this research study. In a broader sense there may be benefits to public health planners from an improved understanding of how people feel about nano-particle sunscreen.

DO I HAVE TO TAKE PART IN THE STUDY? Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without loss of the extra credit. If you choose not to participate in the survey you may still earn the extra credits through a brief writing assignment take takes about the same amount of time and effort as the survey.

WHAT IF I HAVE QUESTIONS? Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind. You can contact the faculty supervisor, Craig Trumbo at 491-2077 or ctrumbo@colostate.edu or doctoral student Sage Kim at kim.sage@gmail.com. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator at 491-1655.

To participate in the study log into the survey website at this address:

http://nanosunscreen.questionpro.com

Alternate Extra Credit Opportunity:

If you cannot or would prefer not to participate in the nano-particle sunscreen study you may still earn the 10 extra credit points. This alternate extra credit opportunity will take about as much time as it takes to participate in the research study. To use this option follow the instructions below:

Drawing on material that has been presented, through lectures, readings, and other material, write a 200 word (about a half-page double spaced) reflective essay discussing you think changes in the Internet (e.g., speed, privacy, cost) will affect the practice of professional communication 5 years from now.

To submit your essay for extra credit, save the document as a PDF file and email it to: Sejin (Sage) Kim <kim.sage@gmail.com>

You may only complete one of these extra credit options. BE CERTAIN TO INCLUDE YOUR eNAME (also known as your RamCT username)

APPENDIX B

PILOT STUDY: NANO SUNSCREEN – DESCRIPTION AND RESULTS

Before examining the relationships between variables on the use of nano sunscreen, a pilot study was conducted with the instruments directly adapted from the previous studies during the 2013 Fall semester. All questions in respective instruments were incorporated into the survey (see Table 1). A 5-point scale, ranging from the least degree [1] through the most degree [5], was consistently used in the survey questionnaire.

Following IRB approval, four hundred and eleven undergraduates enrolled in Professional Communication and Composition classes at Colorado State University were recruited for the online survey via QuestionPro. Instruction sheets with the online survey URL were distributed and students had a week to participate. The students participated in the survey received extra credit points for their respective course. In the end, three hundred eighteen (318) students actually participated and the participation rate maintained 77%.

In order to investigate the relationships between variables on the use of nano sunscreen, this study utilized a survey method with the instruments adapted from the previous studies as well as modified ones based on the pilot study conducted earlier. Since many items this first study adopted were from natural disaster risk studies, we changed the wordings and expressions that are more suitable for nano-associated risks. This study was conducted during the 2014 Spring semester. All questions in respective instruments were incorporated into the survey (see Table 2). Like the pilot study, a 5-point scale, ranging from the least degree [1] through the most degree [5], was consistently used in the survey questionnaire.

Appendix Table B.1
Measures and Scales for Nano Sunscreen Pilot Key Variables

	Measures	[Mean(SD)]
Behavioral Intention (α = .92) *(1-5 scales; 1 being very likely & 5 being very unlikely)*	1. How likely do you think it is that you would purchase nano sunscreen in the not-too distant future, say in the next six months?	3.12(1.03)
	2. How likely do you think it is that you would actually apply nano sunscreen on your skin in the not-too distant future, say in the next six months?	3.07(1.07)
	3. How likely do you think it is that you would recommend nano sunscreen to a friend or relative in the not-too distant future, say in the next six months?	3.31(.99)
	Source: Ajzen (1991)	
Attitude toward Act (α = .82) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	1. I think the use of nano sunscreen is appropriate for consumers.	2.63(.75)
	2. I think nano sunscreen is a big step forward. 2.46(.76)	2.46(.76)
	3. I think nano sunscreen is the more modern way of using sunscreen now.	2.51(.77)
	Source: Ajzen (2011)	
Social Norm (α = .82) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	1a) It would be acceptable to my closest friends if I used nano sunscreen.	2.40(.86)
	1b)When it comes to things like using nano sunscreen, it is important to me to follow the wishes of my closest friends.	3.38(1.03)
	2a) It would be acceptable to most people I know if I used nano sunscreen.	2.41(.82)
	2b) When it comes to things like using nano sunscreen, it is important to me to follow the wishes of most people I know.	3.32(1.07)
	3a) It would be acceptable to my closest family members if I used nano sunscreen.	2.50(.84)
	3b) When it comes to things like using nano sunscreen, it is important to me to follow the wishes of my closest family members.	2.97(1.08)
	Source: Ajzen (2011)	
Risk Perception-Affective (α = .59) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	People have different kinds of *emotional responses* when they think about risk. How might these factors figure into your thinking about the possible risks that might be associated with using nano sunscreen?	
	1) makes me feel alarming.	3.14(1.06)
	2) makes me feel courageous. (R)	2.46(.90)
	3) makes me feel exhilarated. (R)	2.53(.94)
	4) makes me feel fearful.	3.30(.99)
	5) makes me feel worried.	3.13(1.07)
	6) makes me feel alive. (R)	2.42(.87)
	Source: Trumbo et al. (2011)	

Risk Perception-Cognitive (α = .33) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	People *understand* risk in different ways. In thinking about the nature of nano sunscreen, how strongly would you disagree or agree with the following? 1) I am knowledgeable about nano sunscreen. (R) 2) I think that nano sunscreen may cause catastrophic health problems. 3) I think the risks from nano sunscreen are very predictable. (R) 4) I think using nano sunscreen could pose a financial risk. Source: Trumbo et al. (2011)	 1.82(.95) 2.94(.75) 2.88(.73) 2.87(.74)
Heuristic Processing (α = .40) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	1) Past experiences with other products like this make it easier for me to decide how I feel about the issue of nano sunscreen. 2) Concerning any safety issue with nano sunscreen, I would rely on the experts' opinions rather than my own thoughts. 3) If I were given information messages about nano sunscreen, I would not spend much time deliberating on the information. 4) If I were given information messages about nano sunscreen, I would not think about the arguments presented in the information. Source: Smerecnik et al. (2012)	2.86(.89) 2.19(.99) 2.93(1.07) 3.24(1.06)
Systematic Processing (α = .73) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree))*	1) In order to be completely informed about nano sunscreen issues, I think that the more viewpoints I read the better off I will be. 2) I would make a strong effort to carefully examine the scientific information presented regarding nano sunscreen. 3) I would try to learn more about the issue of nano sunscreen. 4) When I encounter information about the issue of nano sunscreen, I would carefully think about it. 5) If I were given information messages about nano sunscreen, I would find myself making connections between the information and what I've read or heard about elsewhere. 6) If I were given information messages about nano sunscreen, I would think about how the information related to other things I know. Source: Smerecnik et al. (2012)	1.93(.82) 2.25(.94) 2.11(.88) 2.17(.80) 2.86(1.10) 2.50(.97)

Need for Affect (α = .78) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	1) If I reflect on my past, I see that I tend to be afraid of feeling emotions. (R)	2.67(1.14)
	2) I feel that I need to experience strong emotions regularly.	3.12(1.08)
	3) Emotions help people get along in life.	2.09(.85)
	4) I think that it is important to explore my feelings.	2.10(.89)
	5) I find strong emotions overwhelming and therefore try to avoid them. (R)	2.56(1.07)
	6) I would prefer not to experience either the lows or highs of emotion. (R)	2.51(1.08)
	7) I do not know how to handle my emotions, so I avoid them. (R)	2.25(.95)
	8) Emotions are dangerous—they tend to get me into situations that I would rather avoid. (R)	2.58(1.13)
	9) It is important for me to be in touch with my feelings.	2.16(.87)
	10) It is important for me to know how others are feeling.	1.96(.83)
	Source: Appel et al. (2012)	
Need for Cognition (α = .80) *(1-5 scales; 1 being strongly agree & 5 being strongly disagree)*	1) I like to have the responsibility of handling a situation that requires a lot of thinking.	2.36(.88)
	2) Thinking is not my idea of fun. (R)	2.36(.93)
	3) I find satisfaction in deliberating hard and for long hours.	2.91(1.08)
	4) I only think as hard as I have to. (R)	2.66(1.06)
	5) I really enjoy a task that involves coming up with new solutions to problems.	2.12(.79)
	6) Learning new ways to think does not excite me very much. (R)	2.32(1.02)
	7) I prefer life to be filled with puzzles that I must solve.	2.50(.92)
	8) The notion of thinking abstractly is appealing to me.	2.37(.94)
	9) I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)	2.45(.95)
	Source: Sherrard and Czaja (1999)	

(R) indicates reverse-coded items

Appendix B.2
Correlation and Covariance Matrix for Nanoparticle Sunscreen Pilot Study

Cronbach α reliability indicated	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Behavioral Intention α = .92 1-15 low values more likely to use	9.50 (2.87)	.49**	.39**	-.44**	-.29**	.27**	.10	-.09	-.10
2. Attitude toward Act α = .82 1-15 low values more positive	2.74	7.60 (1.95)	.49**	-.47**	-.33**	.29**	.19**	.00	.00
3. Social Norm α = .64 1-75 low values more pressure	11.01	9.44	23.41 (9.95)	-.25**	-.17**	.33**	.09	-.06	-.10
4. Risk Affect α = .59 1-30 low values more affect. risk	-4.27	-3.11	-8.31	16.96 (3.35)	.46**	-.25**	.04	.04	-.04
5. Risk Cognitive α = .33 1-20 low values more cog. risk	-1.53	-1.20	-3.11	2.85	10.50 (1.85)	-.19**	.11	.19**	.08
6. Heuristic Mode α = .40 1-20 low values more HEU mode	1.85	1.35	7.77	-1.98	-.86	11.22 (2.40)	-.12*	-.15**	-.16**
7. Systematic Mode α = .73 1-30 low values more SYS mode	1.01	1.34	3.37	.47	.71	-1.04	13.81 (3.60)	.16**	.22**
8. Need for Affect α = .78 1-50 low values more NFA	-1.48	.03	-3.63	.86	1.99	-2.13	3.29	24.00 (5.80)	.32**
9. Need for Cognition α = .80 1-45 low values more NFC	-1.52	-.00	-5.29	-.75	.75	-1.97	4.19	9.79	22.04 (5.31)

* p < .05; ** p < .01 [correlations above diagonal, covariances below, Sum(SD) on diagonal (n = 318)]

APPENDIX C

QUESTIONNAIRE FOR GM FOODS STUDY AND INFORMED CONSENT FORM

The following are screen shots from the GM foods study that contain the content of this survey and illustrate the appearance of both studies on Question Pro.

Thank you for participating in this study. At the end of the questionnaire please provide your eNAME (also known as your RamCT username), which we will only use in order to provide the extra credit points. All identifying information will then be erased so that your responses are entirely anonymous. Note also, there are no right or wrong answers in the questionnaire (please refrain from Googling terms while taking this survey). Thank you very much for your participation!

The purpose of the project is to help us better understand how college students feel about genetically modified food consumption. The term genetically modified organisms, GMOs (also known as biotech or genetically engineered food), refers to crop plants that have been modified in the laboratory to enhance desired traits, such as resistance to herbicides or improved harvest yield/nutritional content. Experts say this science, like any other, has no guarantees as its herbicide use could harm birds, insects, amphibians, marine ecosystems and soil organisms. There are potential benefits as well as risks. Source: (Poortinga & Pidgeon, 2006)

Have you heard of genetically modified organisms (GMOs) before?

1. 1. Yes
2. 2. No

Have you ever consumed genetically modified foods?

1. 1. Yes
2. 2. No
3. 3. I don’t know whether I have consumed them or not

How many times have you heard about the debate regarding genetically modified foods?

1. 1. I have heard or read about the debate often (more than 5 times)
2. 2. I have heard or read about the debate several times (3-5 times)
3. 3. I have heard or read about the debate once or twice
4. 4. I have not heard or read about the debate

For these questions, indicate how strongly you agree or disagree with the statement based on what you know about genetically modified organisms (GMOs)/GM foods in general.

How well informed you would say you are currently about GMOs? (on a 7-point scale where 1 = very informed, 7 = not informed at all)

1. 1 very informed
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 not informed at all

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be:(on a 7-point scale where 1 = pleasant, 7 = unpleasant)

1. 1 pleasant
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 unpleasant

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be:(on a 7-point scale where 1 = nice, 7 = awful)

1. 1 nice
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 awful

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be:(on a 7-point scale where 1 = fun, 7 = not fun)

1. 1 fun
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 not fun

Currently, how concerned are you about the safety of genetically modified foods?(on a 7-point scale where 1 = very concerned, 7 = not concerned at all)

1. 1 very concerned
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 not concerned at all

Next, we will be asking you to answer questions about your view of genetically modified organisms (GMOs). In advance, please make sure that you read the following set of statements regarding GMOs/GM foods: Potential risks associated with GM foods include: 1) Accidental contamination between genetically modified and non-genetically modified foods, 2) Adversely changing the nutrient content of a crop, and 3) Creation of super weeds and other environmental risks. Potential benefits associated with GM foods include: 1) Increased pest and disease resistance, 2) Drought tolerance, and 3) Increased food supply. According to the Food and Agriculture of the United Nations, genetically modified crops can reduce some environmental risks associated with conventional agriculture, but will also introduce new challenges that must be addressed. Society will have to decide when and where genetic engineering is safe enough.

How well informed you would say you are about GMOs after reading the statements?(on a 7-point scale where 1 = very informed, 7 = not informed at all)

1. 1 very informed
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 not informed at all

Now, we would like to ask several questions about genetically modified organisms (GMOs)/GM foods and how you and other people think about it. Please indicate how strongly you agree or disagree with these statements.

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (on a 7-point scale where 1 = pleasant, 7 = unpleasant)

1. 1 pleasant
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 unpleasant

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (on a 7-point scale where 1 = nice, 7 = awful)

1. 1 nice
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 awful

If GM foods were labeled, seeking out and purchasing GM foods during my regular trips to the grocery would be: (on a 7-point scale where 1 = fun, 7 = not fun)

1. 1 fun
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7 not fun

It would be acceptable to my closest friends if I consumed GM foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

When it comes to things like consuming GM foods, it is important to me to follow the wishes of my closest friends.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

It would be acceptable to most people I know if I consumed GM foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

When it comes to things like consuming GM foods, it is important to me to follow the wishes of most people I know.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

It would be acceptable to my closest family members if I consumed GM foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

When it comes to things like consuming GM foods, it is important to me to follow the wishes of my closest family members.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery. (on a 7-point scale where 1 = true, 7 = false)

6. 1 true
7. 2
8. 3
9. 4
10. 5
11. 6
12. 7 false

If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery. (on a 7-point scale where 1 = likely, 7 = unlikely)

6. 1 likely
7. 2
8. 3
9. 4
10. 5
11. 6
12. 7 unlikely

If GM foods were labeled, I intend to seek out and purchase GM foods during my regular trips to the grocery. (on a 7-point scale where 1 = probably, 7 = probably not)

6. 1 probably
7. 2
8. 3
9. 4
10. 5
11. 6
12. 7 probably not

In thinking about the information in the statements you read about genetically modified foods, how strongly would you agree or disagree with the followings:

I thought about what actions I myself might take based on what I read.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I found myself making connections between the statements and what I've read or heard about elsewhere.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I tried to think about the importance of the information for my daily life.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I thought about how the story related to other things I know.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I tried to relate the ideas in the statements to my own personal experiences.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I skimmed through the story.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

While reading the story, I focused on only a few points.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I did not spend much time thinking about the story.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The statements contained more information than I personally need.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

While reading the statements, I did not think about the arguments presented in the story.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Now we would like to know your thoughts about the possible risks of consuming GM foods. People have different kinds of emotional responses when they think about risk. How might these factors figure into your feeling about the possible risks that might be associated with consuming GM foods?

The idea of genetically modified foods makes me feel alarmed.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The idea of genetically modified foods makes me feel sad.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The idea of genetically modified foods makes me feel depressed.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The idea of genetically modified foods makes me feel anxious.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The idea of genetically modified foods makes me feel worried.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The idea of genetically modified foods makes me feel unhappy.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

People understand risk in different ways. In thinking about the nature of GM foods, how strongly would you agree or disagree with the following statements?

I am not knowledgeable about genetically modified foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I cannot control being harmed by genetically modified foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I think that genetically modified foods may cause big health problems.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I think it is difficult to understand the risks associated with genetically modified foods.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I think the risks from genetically modified foods are very unpredictable.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I think consuming GM foods could eventually pose a health-related financial risk.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

We would like to know a little bit about how you generally feel about things, just as a matter of habit, not in relation to any particular topic. Please indicate how strongly you agree or disagree with these statements. Remember, there are no right or wrong answers, just go with your first or gut reaction.

If I reflect on my past, I see that I tend to be afraid of feeling emotions.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I feel that I need to experience strong emotions regularly.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Emotions help people get along in life.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I think that it is important to explore my feelings.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I find strong emotions overwhelming and therefore try to avoid them.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I would prefer not to experience either the lows or highs of emotion.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I do not know how to handle my emotions, so I avoid them.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Emotions are dangerous--they tend to get me into situations that I would rather avoid.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

It is important for me to be in touch with my feelings.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

It is important for me to know how others are feeling.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

We would also like to know a little bit about how you generally think about things, just as a matter of habit, not in relation to any particular topic. Please indicate how strongly you agree or disagree with these statements. Again, there are no right or wrong answers, just go with your first or gut reaction.

I like to have the responsibility of handling a situation that requires a lot of thinking.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Thinking is not my idea of fun.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I find satisfaction in deliberating hard and for long hours.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I only think as hard as I have to.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I really enjoy a task that involves coming up with new solutions to problems.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Learning new ways to think does not excite me very much.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I prefer life to be filled with puzzles that I must solve.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

The notion of thinking abstractly is appealing to me.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.

1. 1. Strongly Agree
2. 2. Agree
3. 3. Somewhat agree
4. 4. Uncertain
5. 5. Somewhat disagree
6. 6. Disagree
7. 7. Strongly Disagree

Finally, we would like to ask just a couple of demographic questions.

What is your sex?

1. 1. Female
2. 2. Male

What is your age (please type in numbers: e.g., 20)?

What is your standing?

1. 1. Freshman
2. 2. Sophomore
3. 3. Junior
4. 4. Senior

What is your eNAME (also known as your RamCT username)?

Invitation to participate in research, extra credit opportunity

We would like to invite you to participate in a research study to help us better understand how college students view the use of nanotechnology, specifically the use of nanoparticles in sunscreens. By participating in this study you will receive the 10 extra credit points. Information on the study and how to participate is below. The survey will be done online outside of class and takes about 10-12 minutes. If you cannot or would prefer not to participate in this study you may still earn the extra credit points. Instructions for that extra credit opportunity are at the end of this sheet. All of the details about the research project are provided below. Please take a few minutes to look this information over and give consideration to participating in this project. We would appreciate your truthful responses.

TITLE OF STUDY: "Genetically Modified Foods."

INVESTIGATORS, WHO IS DOING THE STUDY?: This is a research project being conducted by JTC graduate student Sejin (Sage) Kim and faculty member Craig Trumbo.

WHAT IS THE PURPOSE OF THIS STUDY? The purpose of the project is to help us better understand how college students feel about genetically modified foods. The term genetically modified food (also known as biotech or genetically engineered food) refers to crop plants that have been modified in the laboratory to enhance desired traits, such as resistance to herbicides or improved nutritional content. Experts say this science, like any other, has no guarantees. There are potential benefits as well as risks. We are interested in knowing what college students think about this because food choices can provide an important life-long health benefit for younger persons.

WHO WILL SEE THE INFORMATION THAT I GIVE? As soon as extra credit has been assigned your name and all identifying information will be removed from this study so that your identity in this study is kept confidential. Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials.

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH? We are seeking participation from a random selection of college students.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The survey is being conducted online and takes about 10 minutes to complete.

WHAT WILL I BE ASKED TO DO? The survey contains questions about your views on genetically modified foods. There are no potentially embarrassing or sensitive questions.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY? If you would prefer not to disclose your views on this topic you might not want to participate in the survey.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS? There are no foreseeable risks or discomforts to you from participating in this research study.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY? There are no direct benefits to you from participating in this research study. In a broader sense there may be benefits to public health planners from an improved understanding of how people feel about genetically modified food.

DO I HAVE TO TAKE PART IN THE STUDY? Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without loss of the extra credit. If you choose not to participate in the survey you may still earn 10 extra credits through a brief writing assignment take takes about the same amount of time and effort as the survey.

To participate in the study log into the survey website at this address:

http://gmo.questionpro.com

If you cannot or would prefer not to participate in the GM foods study, you may still earn 10 points of extra credit by writing an essay. Please contact me at sejin.kim@colostate.edu for more details.