ABSTRACT

Title of Dissertation: THE DYNAMICS OF REACTANCE AND COGNITIVE STRUCTURE: REACTANCE, RESTORATION, AND TIME.

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This dissertation examined the effects of freedom-limiting communication on attitude structures at three points in time. A 2 (Threat to freedom: low threat vs. high threat) x 2 (Restoration postscript: present vs. filler postscript) x 3 (Time: immediate-time measurement vs. one-minute delay vs. two-minute delay) plus 3 (control groups for each time point: immediate-time measurement vs. one-minute delay vs. two-minute delay) between-participants design was employed. The results replicated the findings of existing research on reactance by showing that when threat to freedom was high, a boomerang effect emerged, leading to change in attitude and behavioral intention in the direction opposite to the one advocated in the message. This study also advanced the theory of reactance by documenting how threat to freedom affects both the focal attitude concept targeted by the message (here, *recycling*) as well as a concept related to the target concept (here, *energy conservation*). In addition, the effects of pairing different levels of threat to freedom with a restoration postscript were examined: The findings indicated that adding a

restoration postscript (defined as the suggestion that an individual still has freedom to make a decision) to low threat to freedom messages might be detrimental to persuasion as compared to adding a restoration component when threat to freedom is high. Finally, the effects of threat to freedom and restoration over time were considered: The results of the experiment suggest that reactance effects may not be persistent over time.

THE DYNAMICS OF REACTANCE AND COGNITIVE STRUCTURE: REACTANCE, RESTORATION, AND TIME.

By

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Chapter 1: Introduction

In persuasion research, there are instances of public service campaigns attempting to fight such risks as adolescent drug use, smoking, or underage drinking that failed to induce change consistent with the behavior advocated in the message (e.g., Backer, Rogers, & Sopory, 1992; Burgoon, Alvaro, Broneck, et al., 2002; DeJong & Winston, 1990; Hornik, 2002; Salmon & Atkin, 2003; Salmon & Murray-Johnson, 2000). Moreover, some campaigns resulted in attitude change directly opposite to the advocated position (e.g., Hornik et al., 2001), inducing a boomerang effect.

One theory explaining reduced persuasion and boomerang effects is the theory of psychological reactance (J. W. Brehm, 1966; S. S. Brehm & Brehm, 1981; Miron & Brehm, 2006).[1] The main tenet of the theory is that messages explicitly limiting or threatening to limit people's freedoms lead to an aversive motivation, known as reactance, and reactance is negatively related to persuasion. The results of the studies examining the effects of freedom-limiting communication (e.g., Dillard & Shen, 2005; Rains & Turner, 2007) suggest that the failure of many campaigns can, indeed, be attributed to reactance.[2]

Although the prevalence of reactance to persuasive messages is a concern for both scholars and practitioners, how reactance manifests itself over time remains unknown. Some investigations have focused primarily on the immediate effects of reactance on attitude change (e.g., Dillard & Shen, 2005; Rains & Turner, 2007); other studies (especially post-campaign interviews and surveys) do measure the outcomes of reactance at more removed periods of time (i.e., not immediately after the threat to freedom induction; e.g., Hornik et al., 2001). Yet the effects of reactance at different time points have not been examined: It is not known whether the effects of reactance diminish over time or instead become more pronounced as the studies of the mere-thought effect might suggest (see Tesser, 1978). Investigating the effects of reactance over time will shed light on the dynamics of reactance.

Reactance is typically examined in terms of a single outcome variable. There is evidence, however, that persuasive messages sometimes have a greater effect on other attitude concepts in the cognitive structure than on the attitude targeted by the message (Dinauer & Fink, 2005). Similar processes are likely for reactance: Because individuals center their efforts to restore freedom on the target concept, other concepts related to the target concept may be indirectly affected by the message. From now on and throughout the paper, the concept targeted by the persuasive message will be referred to as *the target concept*, and a concept associated with the target concept in the cognitive structures will be referred to as *the related concept*.[3]

A new direction in reactance research has been the examination of restorations designed to eliminate or reduce the perception of threat to freedom (e.g., C. H. Miller, Lane, Deatrick, Young, & Potts, 2007; Quick & Stephenson, 2008). It has been shown that a simple restoration postscript, defined as the suggestion that an individual still has freedom to make a decision, substantially reduced the perception of a threat to freedom (C. H. Miller et al., 2007). Despite this initial evidence of restoration effectiveness in reducing freedom threats, the relationship between the restoration and persuasion has not been explored. In addition, if restoration is expected to diminish reactance regarding the attitude concept targeted by the message (i.e., the target concept), it is likely that other attitudes related to the issue discussed in the message (i.e., related concepts) will be affected by restoration as well.

The underlying theory that allows for a more systemic understanding of attitude-related processes (i.e., allows examining multiple attitude concepts simultaneously) is the Galileo theory (e.g., Woelfel & Fink, 1980; Woelfel & Saltiel, 1988). The theory assumes that movement of attitude objects in individuals' cognitive structures represents attitude change processes (Dinauer, 2003). Such processes include reactance and boomerang effects, yet neither reactance nor boomerang effects have ever been examined in the context of relevant attitude structures. Employing the Galileo theory for the examination of individuals' cognitive structures under different conditions of freedom-limiting communication and at different times allows for comparison of the structural differences of individuals' cognitive structures. As a result, inferences can be made about the movements of attitude objects within the relevant attitude structures.

The purpose of this dissertation is to examine participants' attitude structures under different conditions of threat to freedom and restoration of freedom measured at three points in time. The sections below provide an overview of the theory of psychological reactance focusing on its antecedents, issues of measurements, and alternative methods of restoration of freedom. Next, the issue of time in attitude research will be discussed and relevant research will be presented. As this research is based on the investigation of individuals' cognitive structures, the Galileo theory and method will be described. The dissertation will conclude with the report of results and a discussion of implications and directions for future research.

Chapter 2: Reactance, Restoration, Cognitive Structure and Dynamics

The Theory of Psychological Reactance

Theoretical Foundations

J. W. Brehm’s theory of psychological reactance is a motivational theory of resistance to persuasion (Eagly & Chaiken, 1993). This motivational approach is not surprising given the time when the theory was written. As Eagly and Chaiken (1993) pointed out, the theory represents the spirit of attitude change research of the 1950s and 1960s that focused largely on the issues of motivation (e.g., cognitive dissonance theory). In fact, J. W. Brehm’s earlier work was primarily based on testing the theory of cognitive dissonance (Festinger, 1957) within the free-choice paradigm (Harmon-Jones, 2002).

In J. W. Brehm’s (1956) research on the free-choice paradigm, dissonance is aroused after individuals have made a decision. Dissonance is aroused because individuals become cognizant that the option chosen has some negative characteristics whereas the not-chosen option has some positive characteristics (i.e., individuals experienced post-decisional regret). This dissonance is subsequently reduced through the process of “subtracting the negative aspects of the chosen alternative or positive aspects of the rejected alternative; . . . [or] adding positive aspects to the chosen alternative or negative aspects to the rejected alternative” (i.e., the process known as spreading of alternatives; Harmon-Jones, 2002, p. 101).

The key implication for the theory of reactance stemming from the free-choice paradigm is that the ability to choose between alternatives is an important part of decision making. Reactance theory examines circumstances that eliminate or threaten this ability (J. W. Brehm, 1966). S. S. Brehm and Brehm (1981) argued that individuals value their freedom to choose among different options, especially when dealing with free behaviors. Free behaviors are those that people are aware of and perceive themselves as capable of executing (J. W. Brehm, 1966).[4] If the freedom to perform free behaviors is threatened, psychological reactance is induced. Reactance motivates people to restore the threatened or eliminated freedom (J. W. Brehm, 1966; Eagly & Chaiken, 1993). Thus, four components are central to reactance process: “freedom, threat to freedom, reactance, and restoration of freedom” (Dillard & Shen, 2005, p. 145).

Reactance Effects

In a typical reactance study, participants are pressured (usually by means of forceful language) to endorse a particular view or to perform a certain behavior (Eagly & Chaiken, 1993). As a result of this pressure, the participants may adopt attitudes and behaviors contrary to those prescribed by the messages. For example, Wright, Wadley, Danner, and Phillips (1992) examined the effects of threats to freedom on preference for dating partners. Participants were females who were shown pictures of two potential male dating candidates that the participants in the control condition rated as equally attractive. The female participants were randomly assigned to one of three conditions: a control condition, a mild persuasive attempt condition, and a high threat to freedom condition. All participants read both candidates’ profiles. In the mild-persuasive-attempt condition, the experimenter (a female) informally suggested to the participant that she liked candidate A and he seemed cute; in the high threat condition, the experimenter said “I don’t see that there is any choice but to choose A” (p. 87); and in the control condition, participants did not receive a message advocating for either candidate. The results indicated that 56% of the participants in the control condition chose candidate A; in the mild persuasion condition, 86% of participants chose candidate A; however, only 14% of the participants selected candidate A in the high threat condition. Thus, in the high threat condition, Wright et al.'s (1992) participants (consistent with the reactance predictions) moved away from the position advocated in the message (i.e., exhibited a boomerang effect) by choosing candidate B.

Such conceptualization of a boomerang effect is typical for many reactance studies: In these studies participants are given two options and then are pressured to choose one over the other (e.g., Heilman & Garner, 1975; Wright et al., 1992). In the case of Wright et al. (1992), the measure of attitude change was a choice between the two candidates, which is in essence a two-point scale from "selected" to "not selected." Such a conceptualization may facilitate finding a boomerang effect: If individuals' only option to manifest reactance is by selecting the only other alternative (i.e., not the one advocated by the message), they will resort to choosing this alternative. Thus, in case of a dichotomous measure, the results are more likely to yield a boomerang effect than in the case of a continuous attitude measure. This difference in dependent measure may be why some of the studies using continuous attitude measures only report reduced persuasion and not a boomerang effect (e.g., Worchel & Brehm, 1970). Perhaps, S. S. Brehm and Brehm (1981) were aware of this measurement issue as they argued that although a boomerang in an attitude or a behavior is the best evidence for reactance, reduced compliance or attitude change also provide support for the theory.

In methods terms, the difference between the boomerang effect and reduced persuasion is that reduced persuasion is measured by examining the difference between the low threat and high threat to freedom conditions. By examining these two conditions, it is only possible to ascertain that there was a change in persuasion across the low and high threat conditions, but this comparison does not allow determining whether the attitudes after receiving a high threat to freedom induction changed in the direction opposite to the initial attitudinal position. To demonstrate movement of attitudes in the direction opposite to the initial position (i.e., to demonstrate a boomerang effect), a control group has to be included in the design of a study. Some researchers maintain that some additional requirements must be satisfied to show a boomerang effect (e.g., Boster, Turner, & Lapinski, 2009), including having a pretest. However, selecting issues that are pro-attitudinal may not necessitate a pretest and simply having a control group may be sufficient. Thus, using a control group without a pretest was the approach used in this dissertation.

Measuring Reactance

Reactance was originally proposed to be a motivational state arising as a response to threats or limitation of freedoms that “cannot be measured” and can only be inferred from behavioral outcomes such as reduced compliance and boomerang attitude or behavior change (S. S. Brehm & Brehm, 1981, pp. 37-38). Dillard and Shen (2005) proposed an alternative, in which reactance is “operationalized as a composite of self-report indices of anger and negative cognitions” (p. 144). This operationalization of reactance is discussed next.

Dillard and Shen (2005) tested and compared four competing models of reactance, in which reactance was conceptualized as (a) purely cognitive; (b) purely affective; (c) as cognitive and affective (i.e., in structural equation modeling terms, cognition and affect are separate factors); and (d) as a blend of cognition and affect (i.e., cognition and affect are indicators of reactance, which is included as a single factor in the model). They conducted two studies that only differed in topic: Study 1 advocated for a private action (i.e., flossing one's teeth) and study 2 endorsed a public action (i.e., reducing one's own binge drinking). The messages were either framed in terms of threat to health or as a high or low threat to freedom. In the high threat to freedom message, participants in the flossing condition were told that not flossing is stupid and that they have to do it. Similarly, participants in the anti-binge-drinking condition that induced high threat were told that no other conclusion from the messages that they were given was possible: The participants must drink responsibly. In this study, a threat to freedom induction (low vs. high) was used as the independent variable. Anger was measured using a self-report of angry feelings, and negative cognitions were measured using a thought listing task. Results indicated that the model of reactance conceptualized as an amalgam of anger and negative cognitions was the best-fitting model. Rains and Turner (2007) and Quick and Stephenson (2007a) replicated Dillard and Shen's results. In sum, the results of these studies indicated that reactance can be successfully measured as a combination of anger and negative cognitions. The next section examines the antecedents that lead to reactance.

Antecedents to Reactance

S. S. Brehm and Brehm (1981) and subsequent reactance researchers have suggested a variety of antecedents of reactance. Antecedents frequently used in research to induce reactance are language intensity (e.g., Dillard & Shen, 2005; C. H. Miller et al., 2007) and intent to persuade (e.g., Dillard & Shen, 2005). Combining several antecedents (Dillard & Shen, 2005) has been shown to successfully elicit reactance. The same approach was adopted in this dissertation: The reactance induction was a composite of language intensity and intent to persuade. Such an approach was adopted because attempts to influence people may induce reactance (Burgoon, Alvaro, Grandpre, et al., 2002; Cialdini & Petty, 1981; Eagly & Chaiken, 1993); overt attempts at influence (using explicit and forceful language) are likely to increase the perception of freedom threats. Two antecedents to reactance, language intensity and intent to persuade, are discussed below.

Language intensity. Language intensity has been linked to the favorability with which a message recipient responds to a message (Burgoon, Jones, & Stewart, 1975; O'Keefe, 1997). C. H. Miller et al. (2007) defined language intensity in terms of message explicitness. Explicit messages "convey a single meaning and leave little doubt as to the source's intentions" (C. H. Miller et al., p. 223). Further, controlling language (as a form of explicit communication) is characterized by the use of imperatives (McLaughlin, Shutz, & Wight, 1980): Forceful modal verbs such as *should*, *ought*, and *must* suggest that the communication is an explicit command attempting to limit individuals' freedoms (C. H. Miller et al., 2007). For instance, C. H. Miller et al.'s (2007) participants were given messages advocating regular exercise. As predicted, controlling language increased perceived anger and the perception of threat to freedom as compared to when less controlling language was used. Other studies (e.g., Bensley & Wu, 1991; Doob & Zabrack; 1971; Quick & Stephenson, 2008; Worchel & Brehm, 1970) provide additional evidence linking forceful, intense, or dogmatic language to an increased magnitude of reactance.

Perceptions of intent to persuade as a threat to freedom. The theory of reactance suggests that any message with persuasive intent may be perceived to be a threat to freedom even if following the behavior or agreeing with the attitude endorsed by the message may be in an individual's best interest (Burgoon, Alvaro, Broneck, et al., 2002).

Furthermore, merely warning people about the persuasive intent of the message has been shown to negatively bias people's thoughts about the issue and the message (see discussion in Cialdini & Petty, 1981; Eagly & Chaiken, 1993; and Petty & Wegener, 1998). Similarly, Benoit's (1998) meta-analysis examining the effects of forewarning on persuasion showed that in the 12 studies that he considered, the participants who were warned about receiving a persuasive appeal were less persuaded than those who did not receive any such warning. These and other studies have demonstrated that the perceived intent to persuade has effects consistent with the theory of reactance (Heller, Pallak, & Picek, 1973; Kohn & Barnes, 1977; Worchel & Brehm, 1970).

Overcoming Reactance

Effects of freedom-threatening messages can be alleviated by providing individuals with alternative ways to restore threatened freedoms. Restoration of freedom implies giving back a "sense of autonomy and self-determination" (C. H. Miller et al., 2007, p. 224; see also J. W. Brehm, 1966; Worchel & Brehm, 1971). Restoration of freedom can be achieved directly (J. W. Brehm, 1966) and indirectly (e.g., Burgoon, Alvaro, Broneck, et al., 2002; Worchel & Brehm, 1970).

Direct restoration can be achieved through a boomerang effect: In that case, individuals can restore their lost or threatened freedom by engaging in a behavior directly opposite to the one advocated in the message (J. W. Brehm, 1966). In addition to the boomerang effect, direct restoration of freedom may be achieved by expressing negative attitudes toward the behavior advocated in the message (Burgoon, Alvaro, Grandpre, et al., 2002; Dillard & Shen, 2005; Rains & Turner, 2007) or having behavioral intentions opposing the recommendations proposed by the message (Buller, Borland, & Burgoon, 1998).

Indirect restoration of freedom can occur through derogating the message (Grandpre et al., 2003; Quick & Considine, in press; Quick & Stephenson, 2007a) or the source of the message (Burgoon, Alvaro, Broneck, et al., 2002; C. H. Miller et al., 2007; Wicklund, 1974). Lost freedoms can also be restored vicariously: Vicarious restoration is achieved either when an alternative freedom is restored instead of the one that was directly threatened (C. H. Miller et al., 2007) or when "an individual associates with others or merely observes others perform the threatened behavior" (Quick & Stephenson, 2008, p. 452). In addition, lost or threatened freedoms can be restored by giving some of the threatened or lost freedoms back; Heilman and Garner (1975) provided an example of how such restoration of freedom works.

Heilman and Garner (1975) conducted a study of the effects of reactance on compliance. Their participants took part in a simulation of vinegar tasting (four different kinds). All the participants were told that they would receive some money for their participation, but some of them were told they would be paid a bonus each time they tasted vinegar, and others were told that if they refused to taste the vinegar they would be punished (i.e., they would have to pay a penalty). In addition, the participants were told that they either had or did not have a choice of the kind of vinegar that they were to taste. Heilman and Garner found the lowest compliance in the threat of punishment with no choice condition. But when some of the freedoms were restored (i.e., participants were given a choice of the vinegar that they were going to taste), the compliance rate of the participants who were threatened with a punishment but were given a choice as to the kind of vinegar that they were to taste was identical to the choice with reward condition. Thus, this study shows that limiting individuals' freedoms but giving some of the freedoms back (i.e., providing them with some choice) can be a successful form of restoration, helping to override the effects of reactance-inducing communication.

More recently, C. H. Miller et al. (2007) used a restoration postscript to counteract the effects of the high threat to freedom. The postscript message restored participants' freedom by "the simple suggestion" (p. 224) that it is ultimately up to them to decide whether or not to perform a behavior (here, exercise) advocated in the message. C. H. Miller et al. reasoned that when a restoration postscript follows a persuasive appeal, the persuasive intent of the message will appear less explicit and participants' threatened freedoms will be restored. Their results were consistent with their predictions: Pairing high threat message with a restoration postscript reduced participants' perceptions of threat to freedom. In their discussion, the authors hypothesized that a restoration postscript "offers an uncomplicated, direct, and apparently effective way to help avert harmful boomerang effects" (p. 234). Further, they posited that restoration postscript can be also used to "disguise the overt nature of a persuasive message" (p. 225). Thus, it is likely that restoration postscripts are effective for both low and high threat to freedom messages because in the case of the former, it ameliorates the mild threat to freedom inherent in any persuasive communication (see Burgoon, Alvaro, Grandpre, et al., 2002), and in the case of the latter, it reduces the effects of reactance.

In sum, C. H. Miller et al. (2007) proposed that including a restoration postscript offers "a rather simple and straightforward" approach to restoration of freedom (p. 234). In this dissertation, the effects of this approach were further tested. Although the results of C. H. Miller et al.'s (2007) results indicated that a restoration postscript helped reduce the perception of the threat to freedom, the effects of restoration on attitude change were not addressed in their study. Further examination is required to understand the relationship between restoration and persuasion. Moreover, no attempts have been made to examine the effects of the restoration postscripts on reactance within the context of relevant attitude structures and at different points in time. This dissertation is the first attempt to address these questions. The section below presents the literature on attitude change trajectories and reviews evidence for the effects of time on reactance.

Time and the Effects of Reactance

In the persuasion literature, the role of temporal trajectories of attitude change has been given little attention (Kaplowitz & Fink, 1988). A typical attitude change study records changes in individuals' attitudes and beliefs at only one point in time, namely, after receipt of the stimulus message, then compares the experimental group to the control group, on the basis of which inferences about attitude change are generated (Chung, Fink, & Kaplowitz, 2007). As Chung et al. pointed out, such an approach to attitude change rests on a problematic assumption that after the experimental inductions, attitudes and beliefs reach equilibrium and remain unchanged until the receipt of some new information. Given that belief change can occur even in the absence of new information (e.g., J. W. Brehm & Wicklund, 1970; Fink, Kaplowitz, & Hubbard, 2002; Kaplowitz, Fink, & Bauer, 1983; Tesser, 1978; Valacher, Nowak, & Kaufman, 1994; Walster, 1964), this assumption is likely to be erroneous.

Despite this general lack of attention to the examination of attitude change over time, several studies have attempted to theoretically specify the temporal trajectories of attitude change (e.g., J. W. Brehm & Wicklund, 1970; Fink et al., 2002; Kaplowitz et al., 1983; Tesser, 1978; Valacher et al., 1994; Walster, 1964). Tesser (1978), for example, showed that in the absence of any persuasive communication, merely thinking about a topic leads to attitude polarization. (Note that attitude polarization was inferred from the proportion of participants who became more extreme on their initial position.) However, exposing individuals to a message has a different effect: Kaplowitz et al. (1983) suggested that any decision-making process may be thought of as a series of motions towards and away from the position advocated in the message.

The aforementioned research indicates that measuring attitudes at one point in time, typically immediately after the receipt of a message, provides a very limited representation of the attitude change process at work. Despite the obvious relevance of time to the study of reactance, there have been only two studies pertinent to the examination of reactance effects over time. Walster (1964) examined the effects of post-decisional regret at four different points in time. Army draftees were asked to choose one of two careers to pursue in their two years of service. Both careers were described to include both positive and negative features of each career option. The participants were randomly assigned to either the immediate response, four-minute-delay, 15-minute-delay, or 90-minute-delay condition. Consistent with previous studies on dissonance, regret was assessed by re-measuring the attractiveness of the two career options after the initial decision was made; if the chosen option was rated as less attractive as compared to a non-chosen one, post-decisional regret was inferred. At the subsequent measurement, if the chosen option was rated as more attractive as compared to the initial rating, and the rejected option was rated as less attractive as compared to the initial rating, dissonance reduction was inferred. Walster's results indicated some dissonance reduction in the immediate condition (as inferred from small, although not significantly different from zero, difference between the increase in attractiveness of the chosen option and the decrease in attractiveness of the rejected option), post-decisional regret in the four-minute-delay condition (as inferred from a significant difference between the decrease in attractiveness of the chosen option and the increase in attractiveness of the rejected option), and dissonance reduction in the 15-minute condition (as inferred from a substantial, statistically significant difference between the increase in attractiveness of the chosen option and the decrease in attractiveness of the rejected option). Miron and Brehm (2006) contended that what Walster referred to as a post-decisional regret (i.e., a reversal tendency after giving up one of the alternatives) was a reactance effect.

Another attempt to study temporal effects of reactance is a study by R. L. Miller (1976), who focused on the effects of reactance induced through overexposure. His rationale for the overexposure effect stemmed from Zajonc's (1968) discussion of the mere exposure effect, especially its later conceptualization, which posited an inverted-U-shaped relationship between the amount of the exposure and evaluative ratings. In this later conceptualization, the inverted-U-shaped effect at higher levels of exposure was suggested to be due to reactance (Zajonc, Shaver, Tavris, & van Kneveld, 1972).

In R. L. Miller's (1976) examination of the overexposure-induced reactance effects, participants were exposed to posters advocating foreign aid reduction.[5] Attitudes were measured at four different points in time. On the first day of the experiment, non-exposure (i.e., control group) participants completed a questionnaire about their attitudes to foreign aid. The first wave of exposure (30 posters) started the next day and the posters were left for three days in the common areas of a dormitory. In the evening of day four of the study (i.e., the third day of the exposure), a randomly selected moderate exposure group of participants completed the dependent measures. For the second wave of the exposure, 170 additional posters were placed on the walls and were also left there for three days (as in the moderate exposure condition). On the evening of day seven, overexposure participants were asked to complete the dependent measures. The dormitories were cleared of posters the next day. Finally, the participants in the delayed post-test condition were asked to indicate their attitudes to foreign aid on day twelve of the experiment (they presumably had seen the posters during the exposure period).

R. L. Miller's (1976) results showed the effect of reactance as indicated by reduced persuasion in the overexposure condition; however, at the delayed post-measure the effect of reactance was less in magnitude but not significantly different from the overexposure effect.[6] In sum, although not the strongest evidence for reactance, R. L. Miller's data were consistent with reactance theory predictions. In addition, this study is the only attempt at examining the temporal trajectories of the effects of overexposure-induced reactance.

Despite R. L. Miller's (1976) investigation, very little is known about reactance beyond the immediate effects measured right after the threat to freedom induction. Thus, the understanding of the dynamics involved in reactance may be incomplete. Single time measures of reactance effects do not add to the understanding of the cognitive dynamics: To draw conclusions about the temporal trajectories of reactance, attitude measures at more than two points in time are needed. Two points in time only allow the demonstration of linear effects; a greater number of points allows for greater specificity regarding the shape of the attitude change function. Moreover, examining the dynamics of reactance within the context of relevant attitude structures may shed light on the effects of freedom threats on not only the target concept, but other related concepts as well. The theory providing a framework for an examination of cognitive structures and movements within them is reviewed below.

Examining Cognitive Structures: The Galileo Theory

Theoretical Framework

Attitude change researchers have long been interested in understanding the relationships between persuasion and attitude structure. Rosenberg (1956), for example, pointed out the importance of cognitive structures for understanding the composition of what he referred to as “attitudinal cognitoriums” (p. 369). Tourangeau, Rasinski, and D’Andrade (1991) provide some evidence that attitudinal structures consist of linked attitudes and beliefs. These structures are stored in memory, and, more importantly, due to the interconnectedness of concepts in these structures, activating one element in an attitudinal structure can facilitate the retrieval of other related attitudes and beliefs (Judd, Drake, Downing, & Krosnick, 1991). For example, Tourangeau et al.’s (1991) participants were asked to respond to different questions regarding two topics: abortion and welfare. The results indicated that participants responded to a question faster when it was preceded by a question on the same topic as opposed to a different one.

Despite the centrality of attitude structures for persuasion research, few attempts have been made to integrate a structural approach to attitudes with persuasion (Dinauer, 2003). Many researchers, following McGuire’s (1969) conceptualization, view persuasive messages as disturbances to attitudinal structures that initiate movement within those structures (Dinauer, 2003). However, as Dinauer pointed out, the majority of persuasion research explains this movement without the specification of attitude structures.

Early attempts to create a theoretical framework that focuses specifically on attitude structures and persuasion can be found in Woelfel and Fink (1980) and Woelfel and Saltiel (1988). Referred to as Galileo theory, this framework allows for the examination of global mental structures of beliefs and attitudes (Gordon, 1988), and the observation of changes in attitudes over time (Gillham & Woelfel, 1977). In addition to other theories based on the examination of global structures of attitudes and beliefs (such as balance and other consistency theories), Galileo theory provides an elegant and precise method for the representation of those structures.

At the heart of the theory is the idea that concepts can be represented in cognitive space (Kaplowitz et al., 1983). This space is “a set of concepts that have location and mass” (Kaplowitz et al., 1983, p. 234). Distances between the concepts allow for inferences of similarity and dissimilarity (Gillham & Woelfel, 1977). The theory posits that estimating distances is inherent in human judgment; therefore, estimating distances between concepts and classes of concepts is a reliable method of measuring attitudes (e.g., Gordon, 1988).

Attitudes can be inferred from the relative position of the individuals’ self-referent terms (often denoted by the concept *me*; see, e.g., Neuendorf, Kaplowitz, Fink, & Armstrong, 1987). In the attitudinal structure, concepts that individuals consider important, good, and desirable are located close to a self-referent term (see Barnett, Serota, & Taylor, 1976; Neuendorf et al., 1987; Serota, Cody, Barnett, & Taylor, 1977). Similarly, the concepts located further away from the self-referent terms are those that are viewed as less important, worse, and less desirable.

Attitudinal positions closest to self-referent terms are more likely to be accepted and endorsed by individuals. For example, Woelfel (1976) predicted that political candidates closest to the concept *me* are more likely to be supported in elections. As Barnett et al. (1976) pointed out, an effective strategy to maximize preference for the candidate is to identify vectors that "will enable the candidate's point to converge with Me" (p. 230). In addition to attitudes, behavioral intentions can be inferred from the location of the self-referent and the behavior-related concept (Woelfel & Fink, 1980). For example, if *me* is located closer to *voting*, an intention to vote in upcoming elections can be inferred. Understanding objects' locations and the distances between them allows researchers to design persuasive appeals attempting to shorten the distance between the self-referent and the attitude- or behavior-related object proposed in the message.

There are many advantages to employing the Galileo theory in attitude change research. First, it provides a framework for examining attitude concepts systemically. As Dinauer and Fink (2005) indicated, the examination of changes in an attitude object targeted by a persuasive appeal may lead to changes in attitude concept not mentioned in the message. Second, employing the Galileo theory makes finding cognitive change possible without active control of the answers on the part of participants. Because the estimation of distances is an indirect measure (Fink, Monahan, & Kaplowitz, 1989), it allows the representation of individuals' attitudes without participants trying to control the representation of their self-image, which would result in a social desirability bias.

Methodological Framework

Galileo theory is related to Torgerson's (1958) work on multidimensional scaling (MDS). Torgerson's conceptualization rests on an assumption that part of any perception is the process of differentiating. Objects are differentiated from each other based on their dissimilarities on one or more underlying characteristics. MDS represents a combination of well-known measurement and analytical techniques.

Similar to semantic-differential scales that allow representation of meaning in (typically) three-dimensional space, MDS allows for exploration of individuals' cognitive maps in a multidimensional space without presupposing the number of dimensions. To determine cognitive maps, individuals are asked to estimate pairwise differences of concepts of interest as ratios of distances (see Gillham & Woelfel, 1977). Judgments are obtained using a magnitude scaling approach: Participants are provided with an arbitrary standard (i.e., a yardstick) relative to which they make their judgments (Gillham & Woelfel, 1977).

In analytical terms, MDS is an application of principal components analysis to a matrix derived from pairs of dissimilarity scores (Torgerson, 1958). Given the assumptions underlying principal components analysis (see Pett, Lackey, & Sullivan, 2003), using ratio-type measures (to estimate distances between concepts as discussed above) offers several advantages over traditional (e.g., Likert-type) measures (Gordon, 1988).[7] The dissimilarity judgments are unbounded at the top (i.e., can theoretically range from zero without an upper bound) and are relatively continuous. Evidence for the effectiveness of the MDS approach is substantial (e.g., Barnett, & Kincaid, 1983; Dinauer & Fink, 2005; Gillham & Woelfel, 1977; Gordon, 1988; Kincaid, Yum, & Woelfel, 1983; Neuendorf et al., 1987; Fink et al., 1989; Woelfel, Holmes, Newton, & Kincaid, 1988). Research has demonstrated the "precision, stability, and equivalence" of MDS when compared to more traditional measures (Gillham & Woelfel, 1977, p. 222). In addition, Gillham and Woelfel have shown that MDS can be used successfully when examining attitude change over time.

Present Research: The Dynamics of Reactance and Cognitive Structure

The purpose of this study is to examine participants' cognitive structures under different conditions of threat to freedom measured over time. To have a meaningful trajectory, at least three points in time must be examined. (In this study, time was treated as a between-subjects effect.) Reactance was induced through the combination of language intensity and the presence of persuasive intent. Specifically, the persuasive intent in the message was made clear, and participants were told that they must perform the advocated behavior.

A 2 (Threat to freedom: low threat vs. high threat) x 2 (Restoration postscript: present vs. filler postscript) x 3 (Time: immediate-time measurement vs. one-minute delay vs. two-minute delay) plus 3 (control groups for each time point: immediate-time measurement vs. one-minute delay vs. two-minute delay) between-participants design (15 conditions total) was employed. The control conditions were not fully crossed in the proposed design because for the purposes of establishing a baseline, having three control conditions measuring the effects of reactance at three different times was sufficient. In all conditions, but at different points in time (depending on the time condition, which was a between-subject effect), participants were asked to estimate distances between pairs of concepts related to the topic of the persuasive message (determined from a pilot test) and also including such concepts as *me*, *good*, *bad*, and *angry*. *Bad* and *angry* represent the negatively valenced cognitive and affective elements that characterize reactance. *Me* and *good* were included to help determine the behavioral intention and positive attitude towards the concepts in the cognitive structure (see Woelfel & Fink, 1980).

Hypotheses

To illustrate spatial configurations under different levels of threat, an approach used in Fink et al. (1989) was adopted. This approach involves providing graphic representations for the hypotheses (see below). Note that a positive attitude in the hypotheses is inferred from the distance between the concept of interest and *good*: The closer the distance between the concept of interest and *good*, the more positive the attitude toward the concept of interest. A negative attitude is inferred from the distance between the concept of interest and *bad*: The closer the distance between the concept of interest and *bad*, the more negative the attitude toward the concept of interest. A behavioral intention is inferred from the distance between the concept of interest and *me*: The closer the distance between the concept of interest and *me*, the greater the behavioral intention regarding the concept of interest. Finally, the amount of anger toward the concept of interest is inferred from the distance between the concept of interest and *anger*: The closer the distance between the concept of interest and *anger*, the greater the anger toward the concept of interest.

Because traditional reactance research does not address the dynamics of reactance, the initial tests of reactance (i.e., H1 through H4, and RQ1 and RQ2) are based on the immediate-time measurement. Note that the predictions in H1-H4 deal only with the target concept. Recall that the target concept is defined as a concept that was targeted by the persuasive message. The rationale for the first set of hypotheses is presented below.

Hypothesis 1 predicted a particular spatial configuration for the target concept across the three levels of threat to freedom. H1 is represented by Figure 1. Recall that three conditions are involved in determining the effects of reactance: a control condition, a low threat to freedom condition, and a high threat to freedom condition. To establish reduced persuasion, a comparison between the low and high threat to freedom conditions is required. To demonstrate a boomerang effect (i.e., to demonstrate movement of attitudes in the direction opposite to the initial position), attitudes and behavioral intentions in the high threat to freedom condition have to be compared to the control condition. Finally, reduced persuasion in the high threat condition (as compared to the low threat condition) implies that in the absence of a high threat to freedom component of a message, there is persuasion (i.e., an attitude change or a change in a behavioral intention in the direction of the position advocated in the message). To determine that the low threat to freedom message was indeed persuasive, a comparison of attitudes and behavioral intentions in the low threat to freedom condition versus the control condition is required.

Taken together, the three effects described above (i.e., reduced persuasion, boomerang effect, and increased persuasion) can be represented as an inverted-U-shaped effect of the amount of threat on positive attitudes and behavioral intentions. Based on existing reactance research, the most positive attitude and greater behavioral intention are expected in the low threat to freedom condition as compared to both the control and the high threat to freedom conditions. However, in the high threat condition the amount of positive attitude and behavioral intention is expected to be significantly less as compared to the control condition. For negative attitude and anger towards the target concept (as determined from the distances between negatively valenced concepts such as *anger* and *bad* and the *target concept*), the opposite pattern is predicted: a U-shaped effect of the amount of threat on negative attitude and anger. The least negative attitude and anger are expected in the low threat to freedom condition as compared to both the control and the high threat to freedom conditions. However, in the high threat condition the amount of negative attitude and anger is expected to be significantly greater as compared to the control condition. Recall that in terms of distances, less distance indicates greater closeness of the concepts to each other, thus the following generic hypothesis is proposed:

> H1: At the immediate time measurement, a U-shaped effect of the threat to freedom on positive attitude and behavioral intention is proposed such that the least distance between the *target concept* and *me* and the *target concept* and *good* is expected when threat to freedom is low as compared to both the control condition and when threat to freedom is high. However, the distance between the *target concept* and *me* and the *target concept* and *good* is expected to be significantly greater when threat to freedom is high as compared to the control condition. An inverted-U-shaped effect of the threat to freedom on negative attitude and anger is proposed such that the most distance between the *target concept* and *bad* and the *target concept* and *anger* is expected when threat to freedom is low as compared to both the control condition and when threat to freedom is high. However, the distance between the *target concept* and *bad* and the *target concept* and *anger* is expected to be significantly smaller when threat to freedom is high as compared to the control condition.

Hypotheses 2 through 4 are planned comparisons designed to test specific effects that are part of the generic prediction posited in H1. Specifically, H2 predicts reduced persuasion in the high threat to freedom condition as compared to the low threat to freedom condition; H3 hypothesizes a boomerang effect when comparing the high threat to freedom condition to the control condition; and H4 proposes that there is persuasion in the low threat to freedom condition as compared to the control condition. In terms of distances between concepts, these predictions are further explicated below.

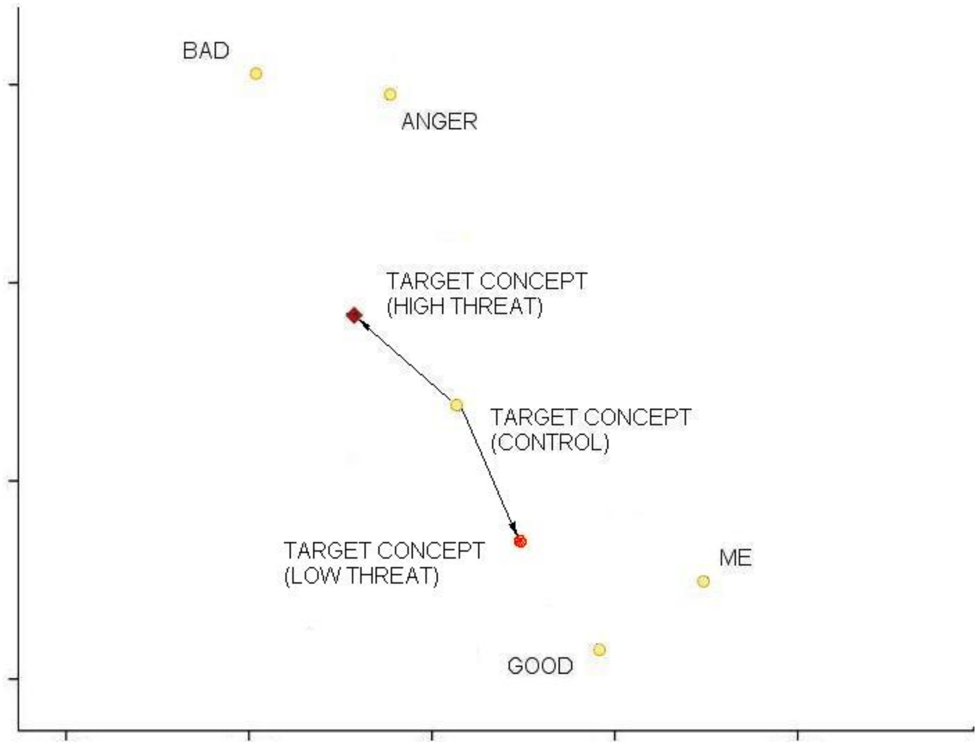


Figure 1. Representation of H1. The arrow represents the movement of the target concept across three conditions.

H2 deals with predictions regarding the reduced persuasion effect. H2 is represented by Figure 2.

> H2: At the immediate time measurement a threat to attitudinal or behavioral freedom causes reduced persuasion. When freedoms are threatened, (a) the concept denoting the attitude or behavior proposed by the message moves further away from the *me* and *good* (as compared to when threat to freedom is low); and (b) the concept denoting the attitude or behavior proposed by the message moves closer to *bad* and *angry* (as compared to when threat to freedom is low). Thus, the

following planned comparisons are presented. When threat to freedom is high, distances between the *target concept* and *me* and the *target concept* and *good* are larger as compared to when threat to freedom is low. Conversely, when threat to freedom is high, distances between the *target concept* and *good* and the *target concept* and *anger* are smaller as compared to when threat to freedom is low.

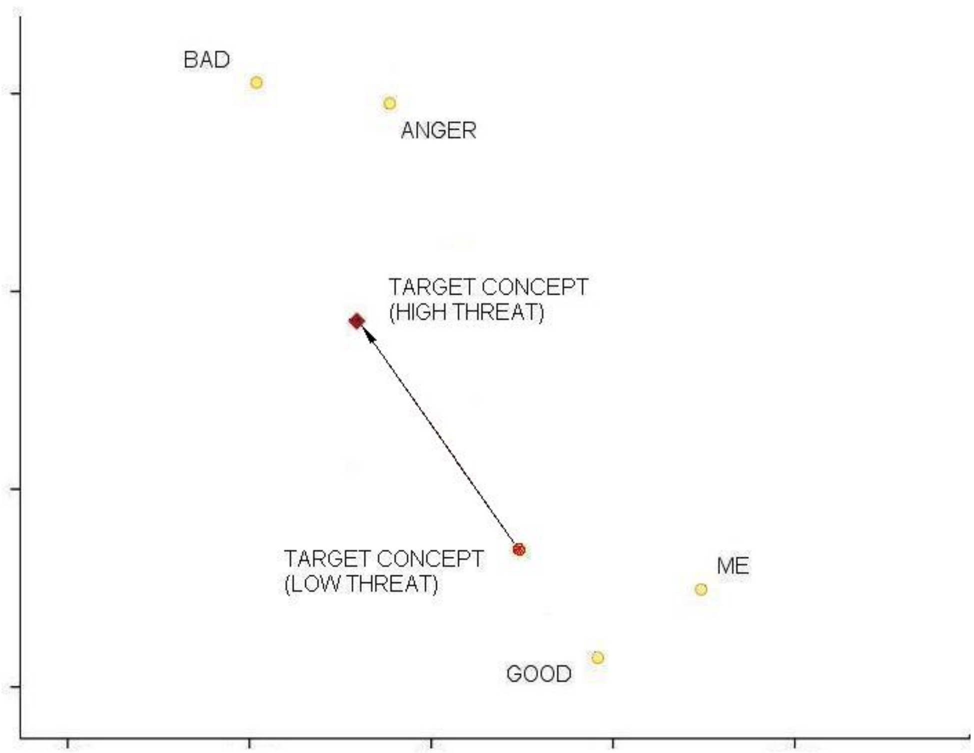


Figure 2. Representation of H2. The arrow represents the movement of the target concept across two conditions.

Reduced persuasion is the minimum requirement to show the outcomes of reactance, but the presence of a boomerang effect makes a stronger case for reactance. Therefore, it is predicted that a boomerang effect results from a threat to freedom induction. H3 is represented by Figure 3. Thus,

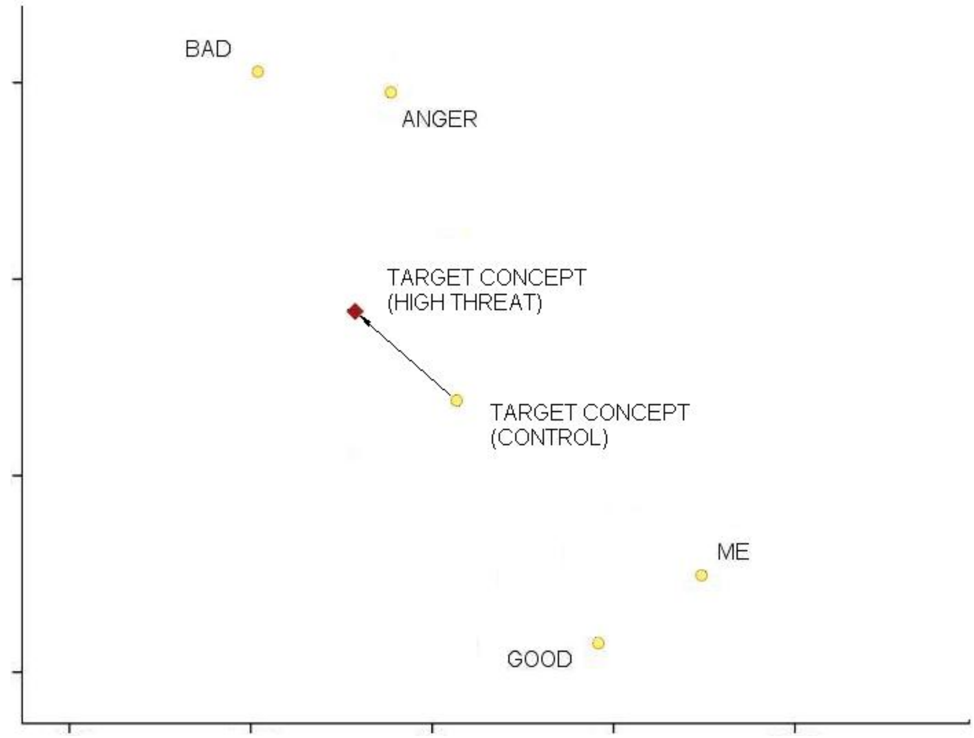


Figure 3. Representation of H3. The arrow represents the movement of the target concept across two conditions.

H3: At the immediate time measurement a threat to attitudinal or behavioral freedom causes a boomerang effect: When freedoms are threatened, (a) the concept denoting the attitude or behavior proposed by the message moves further away from *me* and *good* (as compared to the control condition); and (b) the concept denoting the attitude or behavior proposed by the message moves closer to and clusters around the concepts of *bad* and *angry* (as compared to the control condition). Thus, the following planned comparisons are presented. When threat to freedom is high, distances between the *target concept* and *me* and the *target concept* and *good* are larger as compared to the control condition. Conversely, when threat to freedom is high, distances between the *target concept* and *good* and the *target concept* and *anger* are smaller as compared to the control condition.

H4 examined an increase in positive attitude and behavioral intention as a result of the message in the low threat to freedom condition. To be able to determine whether a message resulted in persuasion, attitudes (both positive and negative), behavioral intention, and anger towards the target concept can be compared across the low threat to freedom condition and the control condition. H4 is represented by Figure 4. Thus,

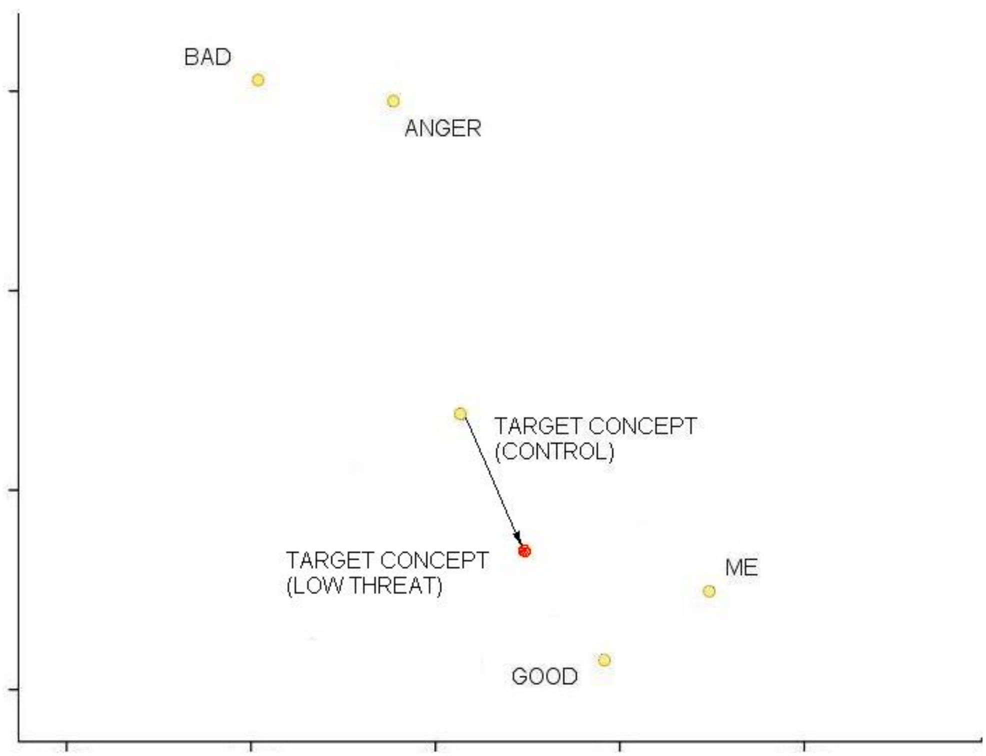


Figure 4. Representation of H4. The arrow represents the movement of the target concept across two conditions.

H4: At the immediate time measurement, low threat to attitudinal or behavioral freedom leads to persuasion as compared to the control condition. When threat to freedom is low, (a) the concept denoting the attitude or behavior targeted by the message moves closer towards the concepts *me* and *good* (as compared to the control condition); and (b) the concept denoting the attitude or behavior targeted by the message moves further away from *bad* and *angry* (as compared to the control condition). Thus, the following planned comparisons are presented. When threat to freedom is low, distances between the *target concept* and *me* and the *target concept* and *good* are smaller as compared to the control condition. Conversely, when threat to freedom is high, distances between the *target concept* and *good* and the *target concept* and *anger* are larger as compared to the control condition.

Hypothesis 5 focuses on the effects of restoration paired with freedom-limiting messages on persuasion. The rationale for this prediction is based on C. H. Miller et al.'s (2007) finding that using a restoration postscript (i.e., a suggestion that it is ultimately up to message recipients to decide whether or not to perform the behavior advocated in the message) may counteract the effects of the high threat to freedom. Further, adding a restoration postscript is expected to reduce threats to freedoms even when a threat to freedom is low. As discussed above, any attempt at persuasion may be perceived as freedom threatening (Burgoon, Alvaro, Grandpre, et al., 2002); however, as C. H. Miller et al. (2007) suggested, when a restoration postscript follows a persuasive appeal, the persuasive intent of the message appears less explicit. Thus, it is likely that restoration postscripts are effective for both low and high threat to freedom messages because in the case of the former, a restoration postscript ameliorates the mild threat to freedom that may be found in any persuasive communication, and in the case of the latter, it reduces the effects of reactance.

In sum, across the two levels of threat to freedom, adding a restoration postscript to a persuasive message is expected to result in an increase in positive attitude and behavioral intention as compared to the no-restoration condition. As a result, in the high threat without restoration condition, less positive attitude and behavioral intention is expected as compared to the high threat with restoration condition. However, adding a restoration postscript to a high threat message might not fully remove the effects of high threat to freedom (thereby making the effects of a high threat with restoration message similar to a low threat without restoration message). Therefore, less positive attitude and behavioral intention are expected in the high threat with restoration condition as compared to the low threat without restoration condition. Finally, the most positive attitude and the greatest behavioral intention (as compared to high threat without restoration condition, high threat with restoration condition, and low threat without restoration condition) are expected in the low threat with restoration condition. In sum, the entire prediction in H5 can be presented as two linear effects (one for positive attitude and the other for behavioral intention). Recall that, in terms of distances, more behavioral intention (as determined from the distance between the *target concept* and *me*) and positive attitude (as determined from the distance between the *target concept* and *good*) indicate less distance between concepts. The following hypothesis is proposed:

> H5: At the immediate time measurement, the distance between the *target concept* and *good*, and the *target concept* and *me*, from least to most, is: low threat to freedom with restoration condition, low threat to freedom without restoration condition, high threat to freedom with restoration condition, and high threat to

freedom without restoration condition.

The next two research questions explore the idea that there is more to persuasion than changes in the target concept (Dinauer & Fink, 2005). Some evidence indicates that persuasive messages may have a greater effect on other attitude concepts in the cognitive structure than on the attitude targeted by the message (Dinauer & Fink, 2005). Similar processes are likely for reactance: Because individuals focus their efforts to restore freedom on the target concept, other related concepts may be indirectly affected by the message. Recall that the concept targeted by the persuasive message is referred to as the target concept, and the concept associated with the target concept in the cognitive structure is referred to as the related concept. (Note that the association of concepts is assessed by the speed of concept retrieval from memory.)

Two research questions are posed:

RQ1: At the immediate time measurement, what are the motions associated with a related concept? Specifically, how does reactance affect the related attitude concept?

RQ2: At the immediate time measurement, what are the effects of restoration postscript on a related concept?

Finally, the study proposes investigating the configurations of cognitive structures at three points in time. There is no agreement in attitude change research on the time points that are the best for detecting changes in individuals' attitude over time. R. L. Miller (1976) increased the amount of exposure to experimental materials over time, and, once the reactance manipulation was over (at the post-test), there was a reduction in the magnitude of reactance. In the present experiment, the amount of threat to freedom is not increased over time but remains constant. Therefore, it is likely that the magnitude of reactance at the second time measurement (one-minute delay) will be less than at the immediate time measurement, and it will reduce further at the third time measurement (two-minute delay):

H6: There is a decay of reactance that takes place over time.

Finally, because the effects of restoration over time are unknown, a research question is posited:

RQ3: What are the temporal trajectories of the target concept as a result of restoration?

Chapter 3: Method

In the third chapter of this dissertation, first, the approaches to data collection and analysis are discussed, including data trimming, data transformation and the approach to index formation. Then, four pilot studies conducted prior to the main experiment are presented and their results are discussed. Finally, the method of the main experiment is described, including the participants, study design, procedures, instrumentation and the analytical strategy used to generate cognitive maps and to determine significance in the movement of concepts across experimental conditions.

Data Collection and Analysis

Before collecting the data for the proposed experiment, four pilot studies were conducted. The purpose of the first pilot study was to select a topic for the main experiment. In the second pilot study, concepts to include in cognitive maps were determined. In the third pilot study, the key concepts for the messages were generated; and in the final pilot study, messages were tested for their ability to induce psychological reactance. The purpose of the main experiment was to examine the effect of reactance at three points in time and to document changes in the configurations of cognitive spaces under different threat to freedom and restoration conditions. Data collection for this dissertation was approved by the University of Maryland Institutional Review Board (date of approval: November 20, 2007). All of the pilot test measures were based on printed questionnaire responses. The final experiment was conducted on laptops, using MediaLab (Jarvis, 2004) and DirectRT (Jarvis, 2006) software packages. All four pilot tests and the main experiment are described below.

Data Trimming

The data in each segment of this dissertation were first examined for the presence of outliers. An outlier is defined as an observation that substantially deviates from other observations in a given sample (Grubbs, 1969). Because magnitude scales are bounded at zero and unbounded at the top, the scores obtained through this method of scaling are likely to be positively skewed and contain outliers. The presence of outliers was determined by examining the descriptives and the histograms (with a normal curve) of a given variable. If outliers were present, the data were trimmed by recoding that variable's scores to a lower value. (Note that none of the cases were deleted as a result of this procedure.) Two strategies for dealing with outliers were utilized in the present dissertation. In Pilot Study 3, all values that were above 1000 were trimmed by recoding them to be equal to 1000. This approach is rather crude; therefore, in the main experiment a more conservative approach was used. An attempt was made to trim as little as possible. To ensure conservative trimming, the following steps were used. The distribution of each variable was first examined based on the frequencies of scores and the histogram. If outliers were present, percentile values associated with the ninety-fifth, the ninetieth, the eighty-fifth and the eightieth percentile were generated. Trimming the scores to the highest percentile was considered first. If the outliers were still present after trimming the data to the eightieth percentile, the scores were further transformed using nonlinear transformations (see below). In addition to the examination for the presence of outliers, the variables were also examined for their approximate normality, and if the violation of normality assumption was present, those variables were transformed. Data transformations are further discussed below.

Data Transformation

An important assumption for the analyses based on the general linear model is that the residuals of the dependent variables are approximately normal (Bauer & Fink, 1983; Fink, 2009). To help meet this assumption, if a continuous dependent variable appeared relatively non-normal, it was transformed. The transformations used improved the skewness of the continuous dependent variables.[8] Some of the variables required a constant first be added to the original score because nonlinear transformations cannot be performed on zero values. The choice of a constant and the specific transformation was done through trial and error. The initial and post-transformation means, standard deviations, skewness and kurtosis values for all continuous dependent variables (transformed as necessary) are summarized in the Tables 1 through 3 (presented after the endnotes in this manuscript).

Index Formation

Trimmed and transformed (as necessary) data were used to form indexes. All indexes in this dissertation were formed by saving the first unrotated principal component. This is a commonly used procedure (see Afifi, Clark, & May, 2004), which involves using principal component analysis and an unrotated one-component solution; standardized regression component scores are then calculated for each participant. Because each item is weighted proportionally to its contribution to the principal component, using these procedures produces a better index as compared to simple summation or averaging of the items.

Pilot Study 1

The purpose of this pilot study was to select a topic for the main experiment. The selected topic had to meet a few initial requirements. The selected topic had to be proattitudinal, following Worchel and Brehm’s (1970) contention that having counterattitudinal beliefs on an issue serves as an exercise of freedom. In addition, to avoid pretesting participants' initial attitude towards the topic, only the topics that are likely to be uniformly proattitudinal (i.e., the majority of research participants were likely to be favorably predisposed towards these issues) were considered. For example, topics like legalizing marijuana would not be selected as there are likely to be participants for whom this is a proattitudinal topic and those for whom this is a counterattitudinal issue. Materials for Pilot Study 1 are provided in Appendix A.

Participants

A sample of 45 students was recruited from undergraduate communication courses at the University of Maryland. Forty-nine percent (n = 22) were male. The mean age was 19.71 (Mdn = 20.00; SD = 1.84), with ages ranging from 18 to 29 years of age. Forty-seven percent (n = 21) of participants were non-Jewish Caucasian, 27% (n = 12) were Jewish Caucasian, 11% (n = 5) were African-American, 13% (n = 6) were Asian, and the remaining participants (1%) did not fit into the provided categories. Twenty-nine percent (n = 13) were freshmen, 22% (n = 10) were sophomores, 27% (n = 12) were juniors, and 22% (n = 10) were seniors. All students received extra-credit in a communication course for their participation.

Procedures

Participants were invited into the experimental laboratory and were asked to list five issues that they often hear about from their parents, media, friends, or other sources. They were informed that there were no right or wrong answers and that the researcher was just interested in their views. The data were then coded for frequencies by the author.

Results and Discussion

The results indicated that out of 45 participants, 18 mentioned the Iraq war, 14 mentioned campus housing, 10 mentioned elections, nine mentioned global warming, eight mentioned abortion, and seven mentioned discrimination and tuition. The remaining issues were mentioned by fewer than five participants and, therefore, were not considered.

Next, consistent with Worchel and Brehm's (1970) assertion that a proattitudinal topic is required for a reactance induction, topics were examined with regard to whether or not they were likely to be proattitudinal. Based on these criteria, three topics were selected: global warming, discrimination, and tuition.[9] Campus housing was not selected because it only applied to a narrow segment of students living on campus (freshmen and sophomores) and excluded juniors and seniors. The issues of the war in Iraq, election, and abortion were not selected due to the likely difference in opinions on these issues among college students.

Although each of the three remaining topics (i.e., global warming, discrimination, and tuition) was a plausible option, a decision was made to select a topic that is likely to have a simple recommended behavior that can be advocated in the message (i.e., a behavior that has the most efficacy, meaning that a student is likely to perceive that a recommended behavior is easy to do and it can help reduce the effects of climate change; for a discussion of efficacy, see Bandura, 1997, and Witte, 1992). It is likely that in the cases of discrimination and college tuition, student participants might perceive low levels of efficacy in their ability to influence solutions to these issues. Conversely, in the case of global warming, a range of simple behaviors, such as changing light-bulbs in the house, conserving water, or recycling, should be easy behaviors for students to do.

The fact that the topic of global warming has multiple simple behaviors that can help reduce climate change offers an additional advantage. When examining individuals' cognitive structures, having multiple simple behaviors allows for comparison of locations of the concepts associated with these simple behaviors. As a result, the location of the concept targeted by the freedom-limiting message and the one that was not a part of the message can be compared. The rationale for the possible differences in concept locations stems from Dinauer and Fink's (2005) argument that the change for the target concept might not be as pronounced as a change in location of a non-target concept (referred to here as a related concept). Thus, receiving freedom-limiting communication regarding a target concept (e.g., recycling) may lead to reduced persuasion or a boomerang effect, but more positive attitudes toward related concepts (e.g., conservation of water or changing light-bulbs in the house) may be observed in the same high threat to freedom condition.

Based on the results of Pilot Study 1, global warming was selected as the general topic for this study. The purpose of the second pilot study was to determine the concepts in individuals' cognitive structures regarding the topic of global warming.

Pilot Study 2

In determining the concepts to use in the MDS procedure, it is recommended that the concepts should not be imposed by the researcher but instead be derived from the population being examined (Neuendorf et al., 1987). Therefore, the purpose of the second pilot study was to determine the concepts in the individuals' cognitive structures regarding the issue of global warming. Materials for Pilot Study 2 are provided in Appendix B.

Participants

A sample of 43 students was recruited from undergraduate communication courses at the University of Maryland. Fifty-six percent (n = 24) were male. The mean age was 19.26 (Mdn = 19.00; SD = 1.70), with ages ranging from 18 to 28 years of age.

Forty-two percent (*n* = 18) of participants were non-Jewish Caucasian, 23% (*n* = 10) were Jewish Caucasian, 14% (*n* = 6) were African-American, 12% (*n* = 5) were Asian, 5% (*n* = 2) were Indian, and the remaining participants did not fit into the provided categories. Forty-four percent (*n* = 19) were freshmen, 37% (*n* = 16) were sophomores, 12% (*n* = 5) were juniors, and 7% (*n* = 3) were seniors. All students received extra-credit in a communication course for their participation.

Procedures

To ascertain the concepts that people associate with the topic of global warming, participants were asked to make a list of all possible associations that they may have with the phrase *global warming*. Participants were instructed to write down a list of either words or short phrases to make the derived data appropriate for concept mapping. The participants were timed to ensure that everybody had the same amount of time to activate topic-relevant constructs: Participants were given one minute to complete this task.

Results and Discussion

Participant responses were analyzed in terms of frequencies. Different concepts representing the same general theme were grouped together by the author for these analyses. Participants generated 207 global-warming-related words and word combinations. Among the 17 themes that emerged, the following themes, presented in descending order, were most frequent (note that *n*s represent the number of total responses that fit this particular theme): (1) ice- and ice-melting-related concepts (e.g., *ice melting*, *Antarctica*, *snow*; *n* = 33, representing 16% of total responses); (2) Al-Gore-related concepts (e.g., *Al Gore*, *The Inconvenient Truth*; *n* = 21, representing 10% of total responses); (3) temperature- and temperature-increase-related concepts (e.g., *heat*, *temperature*, *temperature rising*; *n* = 20, representing 10% of total responses); (4)

pollution-related concepts (e.g., *pollution*, *emissions*, *carbon-dioxide*; *n* = 20, representing 10% of total responses); (5) ozone- and ozone-depletion-related concepts (*ozone*, *ozone depletion*, *radiation*; *n* = 16, representing 8% of total responses); (6) solution-related concepts (e.g., *recycling*, *alternative fuel*, *energy conservation*; *n* = 16, representing 8% of total responses). The remaining themes had less than 8 percent of responses, and therefore were not considered further. These six general themes were further narrowed down into six concepts to be used in the main experiment: *melting ice*, *Al Gore*, *rising temperature*, *pollution* (*CO_2*), *conservation of energy*, and *recycling*. To infer attitudes and to interpret the effects of reactance on cognitive structures, five additional items were included: *me*, *good*, *bad*, *angry* and *my freedom*.

In summary, based on the results of the Pilot Study 2, the concepts for the main experiment were selected. These 11 concepts were: *melting ice*, *Al Gore*, *rising temperature*, *pollution* (*CO_2*), *energy conservation*, *recycling*, *me*, *good*, *bad*, *angry*, and *my freedom*.[10]

From the list of the 11 concepts, two concepts were considered as potential message topics: *recycling* and *energy conservation*. *Recycling* was selected as the target concept, meaning that in the main experiment the pro-recycling position will be advocated in the message; and *energy conservation* was selected as the related concept, which although will not be targeted in the message, but the attitude toward and behavioral intention regarding this concept will be assessed in the main experiment. This assessment will be done to ascertain the effects of freedom threatening communication on the concept related to *recycling* in the attitude structure. Note that the conclusion *recycling* and *energy conservation* are related concepts was based on the fact these two concepts were retrieved from participants' memory in the close proximity to each other within a relatively short time frame (1 minute). This conclusion is consistent with existing research on attitude accessibility (e.g., Tourangeau et al., 1991).

Pilot Study 3

The purpose of Pilot Study 3 was to create a pro-recycling persuasive message. Galileo software has procedures designed to help generate a persuasive message strategy. Generating a message strategy commonly involves associating concepts with certain attributes (Woelfel, 1990). In the context of this study, the focus was to create more positive attitudes to recycling by connecting *recycling* with *good*. Automated Strategy Generator (ASG; Woelfel, 1990) is designed to calculate the links that need to be strengthened to connect two concepts (referred to as the target pair; i.e., *recycling* and *good* in this study). ASG reads the coordinates generated from the participants' average of pairwise comparisons, and then calculates the projected effects of every possible strategy for repositioning these two concepts in the Galileo space (Woelfel, 1990). As an output, the program generates a list of concepts that need to be addressed in the persuasive message that are predicted to bring the concepts in the target pair closer together. Materials for Pilot Study 3 are provided in Appendix C.

Participants

A sample of 29 students was recruited from undergraduate communication courses at the University of Maryland. Eighty three percent (n = 25) were female. The mean age was 22.72 years (Mdn = 22.00; SD = 4.46), with ages ranging from 20 to 45 years of age. Eighty percent (n = 24) of participants were non-Jewish Caucasian, 10% (n = 3) were African-American, 3% (n = 1) were Hispanic and the remaining participants (7%; n = 2) did not fit into the provided categories. Twenty-three percent (n = 7) of the participants were juniors, and 73 % (n = 22) were seniors. All students received extra-credit in a communication course for their participation.

Procedures and Instrumentation

When participants came to the lab, the experimenter (i.e., the author) explained how to respond to magnitude scale questions, and then participants did a practice exercise (see Appendix C for the materials). The experimenter discussed the results of the practice exercise with the participants to make sure that the instructions were adequately understood. Next, participants were asked to respond to all possible comparison pairs (55 comparison pairs total) derived from the 11 concepts (see Pilot Study 2) and to complete a demographic questionnaire. To control for outliers, all comparison pairs were first trimmed to a lower value. Trimmed values were then transformed by adding a constant and taking the natural logarithm: transformed variable = ln(trimmed original variable + 100). Means, standard deviations, skewness and kurtosis for all the variables before and after transformations are summarized in Table 1.

Results and Discussion

To create individuals' cognitive maps, a mean response of transformed values for each pair was calculated. Then, the means were anti-transformed to retain the original metric in which the pairwise dissimilarities estimates were made. The anti-transformation involved exponentiating the value obtained through transformation and subtracting 100. These anti-transformed means were entered into the Galileo software to obtain coordinates. The ASG was performed to generate a message strategy. For the present study, the criterion pair (i.e., the pair of concepts that it was decided to bring closer together) was *recycling* and *good*. However, the results indicated that *recycling* and *good* were already close enough together and, based on the concepts derived from the Pilot

Test 2, it was impossible to bring them any closer: The output indicated that the remaining distance to bring concepts together was around zero. Therefore, a new criterion pair was selected. The subsequent analyses examined the strategy of bringing *recycling* and *me* closer together. The results indicated that the following concepts needed to be included into the message to bring the target pair closer together: *melting ice, rising temperature*, CO_2, and *good*.

Pilot Study 4

The purpose of Pilot Study 4 was to ascertain the effectiveness of the reactance manipulation.

Participants

A sample of 40 students was recruited from undergraduate communication courses at the University of Maryland. Forty percent (n = 16) were male. The mean age was 20.38 (*Mdn* = 20.00; *SD* = 4.45), with ages ranging from 18 to 46 years of age. Fifty-eight percent of participants (n = 23) were non-Jewish Caucasian, 10% (n = 4) were Jewish Caucasian, 10% (n = 4) were African-American, 7.5% (n = 3) were Asian, 2.5% were Hispanic (n = 1), 2.5% (n = 1) were South Asian (i.e., Indian or Pakistani), and the remaining participants (10%; n = 4) did not fit into the provided categories. All students received extra-credit in a communication course for their participation.

Design and Procedures

A 2 (Threat to freedom: low threat to freedom vs. high threat to freedom) x 2 (Restoration postscript: present vs. absent) plus 1 (No-message condition) independent group experimental design was employed. The dependent variables for the manipulation checks were perceptions of threat and anger induced by the message.

Participants were randomly assigned to one of the five experimental conditions.

First, the participants completed a practice exercise in which the experimenter went over the instructions of how to respond to magnitude scales; the explanation of the instructions was followed by two examples (instructions and examples were identical to the *opinion* instructions for Pilot Study 3; see Appendix C).

First, the participants in all conditions were asked a few questions about their attitude about recycling. Next, all of the participants (except for those in the no-message condition) read statements regarding global warming. Reactance was induced through a combination of language intensity and intent to persuade. In this study, source credibility was held constant and a highly credible source regarding the environmental issues was selected. Source selection was made on the basis of Fink, Bessarabova, and Cai's (2007) pilot test that examined the credibility of eight weather- and climate-related organizations. Their results indicated that, as compared to other seven organizations in this pilot study, the U.S. Environmental Protection Agency (EPA) was rated as having one of the highest levels of credibility. Thus, the EPA was selected as the message source for the study. Both messages (high threat to freedom and low threat to freedom) were of identical length (118 words). In the low-threat condition the participants read:

> It is important to know about the benefits of recycling: Recycling is good and, moreover, it works!
>
> **Recycle! Recycle! Recycle! Recycle!**
>
> Below is some important information about the benefits of recycling that we would like you to consider:
>
> The Environmental Protection Agency (EPA) has shown that carbon dioxide pollution (CO_2) has resulted in melting of the ice masses and the rising of the

global temperatures. Based on EPA data, recycling works! Recycling significantly decreases carbon dioxide pollution: The EPA found that manufacturing from the recycled paper provides a considerable reduction in CO_2 emissions.

Recycle! Recycle! Recycle!

Do not ignore this very important message. It cannot be stressed enough, recycling is important: You can definitely do something to help!

In the high threat condition the participants read:

The information <u>you must know</u> about the benefits of recycling: Recycling is good, and it works!

There's really no choice when it comes to recycling: You simply have to do it!

The information about the importance of and benefits of recycling that <u>you must know</u>:

The Environmental Protection Agency (EPA) has shown that carbon dioxide pollution (CO_2) has resulted in melting of the ice masses and the rising of the global temperatures. Based on EPA data, recycling works! Recycling significantly decreases carbon dioxide pollution: The EPA found that manufacturing from the recycled paper provides a considerable reduction in CO_2 emissions.

<u>You must recycle</u>, there's no other choice!

Do not ignore this message. Recycling is important: You must help!

Immediately after the message, the participants received either a restoration or a filler postscript. Both postscripts were written in smaller font and were of identical length (53 words). The restoration postscript was as follows:

You've probably heard a lot about recycling, even messages similar to this. Of course, you don't have to listen to any of them. You know what is best for yourself. We all make our own decisions and you make your own decisions too. The choice is yours. You're free to decide for yourself.

Participants receiving a filler postscript read the following:

> You've probably heard a lot about recycling. You've probably heard a lot of messages telling you that recycling is important. You've probably even heard messages similar to this. These messages are designed to be able to communicate with many different types of people. Different people will read the message that you've read today.

After reading the message the participants responded to series of magnitude scales. In the no-message condition, the participants only responded to the questions about threat and anger perception: All questions specific to the message were not included. Finally, all participants provided their demographic information.

Instrumentation

Means, standard deviations, skewness, and kurtosis for all the variables before and after transformations are summarized in Table 2. None of the variables in Pilot Study 4 required trimming.

Manipulation check: Perceptions of threat to freedom. The perception of threat to freedom index comprised two items: the perception of being manipulated and the perception of being pressured. These items came from Dillard and Shen (2005; see also C. H. Miller et al., 2007).[11] Participants' level of threat to freedom was measured by asking "how much do you feel that the message tried to manipulate you?" and "how much do you feel that the message tried to pressure you?" The response option was a magnitude scale with 0 indicating that their freedom was not threatened at all and 100 indicating that their freedom was moderately threatened. Both items were transformed as follows: item transformed = ln(original item + 1). The mean for the perception of threat to freedom index was 5.84 (*SD* = 4.51; Cronbach's alpha = .89).

Manipulation check: Anger. The anger index comprised four items: irritated, angry, annoyed, and aggravated (Dillard & Shen, 2005; C. H. Miller et al., 2007). The response option was a magnitude scale with 0 indicating that the participants were not angry at all and 100 indicating that they were moderately angry. All the items were transformed as follows: item transformed = ln(original item + 1). The mean for the anger index was 6.63 (*SD* = 8.02; Cronbach's alpha = .92)

Involvement. Involvement was measured by asking participants to indicate how much they cared about recycling. They were asked to provide a magnitude scale estimate with 0 indicating that they did not care about recycling at all and 100 indicating that they cared about recycling moderately. This item was transformed: transformed variable = ln(original variable + 1). S. S. Brehm and Brehm (1981) argued that for psychological reactance induction individuals have to be moderately issue-involved, thus the effect of involvement was controlled in this pilot study by using it as a covariate in the analyses that follow.

Results and Discussion

All of the analyses were done on the transformed variables. To examine the effects of the threat induction on the perceptions of anger and threat to freedom (i.e., manipulation checks), two univariate ANCOVAs were performed. Based on S. S. Brehm and Brehm's (1981) assertion that moderate issue involvement is required to induce psychological reactance, all manipulation check analyses were performed with involvement as a covariate. The threat induction and the restoration induction were used as independent variables. Because the no-message condition was not crossed with restoration, it was omitted from these analyses.

First, the perception of threat to freedom was used as the dependent variable (the threat to freedom index was formed by saving first unrotated principal component). The results of the univariate ANCOVA indicated that only the threat induction (and not restoration induction or the interaction of the threat induction with restoration induction) had a significant effect on perceived threat to freedom, $F(1, 27) = 24.02$, $p < .001$, partial $\eta^2 = .47$. The R^2 for the entire model was .51 (adjusted $R^2 = .44$). The effect of involvement as a covariate was significant, $F(1, 27) = 6.90$, $p = .01$, partial $\eta^2 = .20$. Thus, these results indicated that the high threat induction ($M = 0.69$; $SD = 0.72$; $n = 16$) elicited significantly more perceived threat to freedom as compared to the low threat induction ($M = -0.40$; $SD = 0.82$; $n = 16$).

Second, anger was used as the dependent variable (the anger index was formed by saving first unrotated principal component). Similarly, the results of the univariate ANCOVA indicated that only the threat induction (and not restoration induction or the interaction of the threat induction with restoration induction) was significantly related to anger, $F(1, 27) = 7.35$, $p = .01$, partial $\eta^2 = .21$. The R^2 for the entire model was .25 (adjusted $R^2 = .14$). The effect of the covariate was not significant, $F(1, 27) = 0.37$. Thus, these results indicated that the high threat induction ($M = 0.50$; $SD = 1.08$; $n = 16$) elicited significantly more anger as compared to the low threat induction ($M = -0.38$; $SD = 0.71$; $n = 16$).

Finally, the existence of a linear effect as opposed to a curvilinear effect on perceived threat to freedom and anger was examined. Two univariate ANCOVAs were performed with threat induction, including the no-message condition (coded as 0), low threat to freedom condition (coded as 1) and high threat to freedom condition (coded as 2) used as the independent variable. Here as well, involvement was used as a covariate (see S. S. Brehm & Brehm, 1981). To examine the proposed linearity of the induction on the manipulation checks, polynomial contrasts were used.

First, the perception of threat to freedom was used as the dependent variable (the threat to freedom index was formed by saving first unrotated principal component). The overall ANOVA, which has 2 degrees of freedom, indicated that the effect of the threat to freedom induction on the perception of threat to freedom was significant, $F(2, 35) = 18.64$, $p < .001$, partial $\eta^2 = .52$. The significant linear contrast, which has 1 degree of freedom (contrast estimate = 1.24 [$SE = .23$], $p < .001$), indicated that the three levels of the threat induction formed a line and not a quadratic curve (i.e., the quadratic effect was not significant), meaning that the means of perceived threat in the no-message condition ($M = -0.89$; $SD = 0.75$; $n = 7$), low threat condition ($M = -0.40$; $SD = 0.82$; $n = 16$) and the high threat condition ($M = 0.69$; $SD = 0.72$; $n = 16$) were in the predicted order. The R^2 for the entire model was .53 (adjusted $R^2 = .49$). The effect of involvement as a covariate was significant, $F(1, 35) = 7.44$, $p = .01$, partial $\eta^2 = .18$.

Second, anger was used as the dependent variable (the anger index was formed by saving first unrotated principal component). The overall ANOVA, which has 2 degrees of freedom, indicated that the effect of the threat to freedom induction on anger was significant, $F(2, 35) = 4.57$, $p < .05$, partial $\eta^2 = .21$. The significant linear contrast, which has 1 degree of freedom (contrast estimate = .70 [$SE = .29$], $p = .02$), indicated that in the case of anger the three levels of the threat induction also formed a line and not a quadratic curve (i.e., the quadratic effect was not significant), meaning that the means of anger in the no-message condition (*M* = -0.51; *SD* = 0.74; *n* = 7), low threat condition (*M* = -0.38; *SD* = 0.71; *n* = 16), and the high threat condition (*M* = 0.50; *SD* = 1.08; *n* = 16) were in the predicted order. The R^2 for the entire model was .22 (adjusted R^2 = .16). The effect of the covariate was not significant, $F(1, 35) = .04$.

Based on these results, it was concluded that the manipulations were successful.

The Main Experiment

The purpose of this experiment was to examine the effects of reactance at three different points in time and to document the configurations of cognitive spaces under different threat to freedom and restoration conditions.

Participants

A sample of 439 students was recruited from undergraduate communication courses at the University of Maryland. Thirty-four percent (*n* = 151) were male. The mean age was 20.03 years (*Mdn* = 20.00; *SD* = 2.70), with ages ranging from 18 to 53 years of age. Forty-eight percent (*n* = 209) of participants were Non-Jewish Caucasian, 12% (*n* = 51) were Jewish Caucasian, 11% (*n* = 48) were African-American, 13% (*n* = 56) were Asian or Asian-American, 4% (*n* = 17) were Hispanic; 4% (*n* = 16) were South-Asian (Indian or Indian-American or Pakistani or Pakistani-American), one participant was Native-American, one participant was Arab or Arab-American, 3% (*n* = 11) did not fit into the provided categories, and the remaining participants (7%; *n* = 29) did not respond to this demographic question. All students received extra-credit in a communication course for their participation.

Design and Procedure

A 2 (Threat to freedom: low threat vs. high threat) x 2 (Restoration postscript:

present vs. filler postscript) x 3 (Time: immediate-time measurement vs. one-minute delay vs. two-minute delay) plus 3 (control groups for each time point: immediate-time measurement vs. one-minute delay vs. two-minute delay) design (15 conditions total) was employed. The manipulations of threat and restoration were identical to those used in Pilot Study 4. Time was manipulated using DirectRT (Jarvis, 2006) and is described below.

Participants were invited into the experimental laboratory, where they first completed consent forms (in the waiting area) and then were seated at a computer. Participants were randomly assigned to one of the 15 experimental conditions. Data were collected in small groups with no more than eight people at a time. Participants could not see each other as they participated in the experiment because partition screens separated each computer station. First, the participants completed a practice exercise in which the experimenter (i.e., the author) explained the instructions regarding how to respond to magnitude and multidimensional scales. (These instructions were identical to those used in Pilot Study 3; see Appendix C). This explanation was followed by two examples for each type of response scale.

Next, the participants in all conditions answered survey questions measuring their attitude toward recycling, and then the participants read recycling messages identical to those used in Pilot Study 4. However, for the main experiment all of the materials were presented on personal computers using the MediaLab software (Jarvis, 2004). The participants in the immediate-time condition were asked to perform an MDS task (i.e., estimation of pairwise dissimilarities between concepts) immediately after reading the message. The participants in the one-minute delay and two-minute delay conditions received the following message designed to improve the plausibility of the time manipulation:

> Please wait for the next section of the study to upload. Sometimes, if the server is overloaded it can take up to a couple of minutes. Please be patient.

This message remained on the screen for either one or two minutes (depending on the time condition), after which the participants were asked to complete the MDS task and manipulation check measures. At the end of the study, the participants were debriefed about the purpose of the experiment.

Instrumentation

The distribution of all continuous variables was examined for their approximate normality (see data transformation section above). If, as assessed by the variable's skewness, a continuous variable appeared relatively non-normal, it was transformed. Prior to transformations, the items were first trimmed to a smaller value to control for outliers.[12] Means, standard deviations, skewness, and kurtosis, before and after transformation (trimmed as necessary), are summarized in Table 3. All of the analyses were performed on the transformed variables. Indexes were formed by saving the first unrotated principal component (Means, standard deviations and Cronbach's alphas for the indexes using transformed data when necessary, are provided below).

Comparison pairs. To measure participants' attitudes in the format appropriate for magnitude scaling, participants were asked to estimate the pairwise dissimilarities between all possible pairs of concepts. The instructions were identical to those used in Pilot Study 3 (see Appendix C). In addition to the 11 concepts derived from Pilot Study 2 (i.e., *melting ice*, *Al Gore*, *rising temperature*, *CO_2*, *conservation of energy*, *recycling*, *me*, *good*, *bad*, *angry*, and *my freedom*), the message source (i.e., *the EPA*) was included in the MDS comparisons, creating 66 comparison pairs in all. The order following order of comparison pairs was used: *the EPA*, *melting ice*, *Al Gore, rising temperature*, *CO_2*, *conservation of energy, recycling, me*, *good*, *bad, angry*, and *my freedom*; the comparison questions were asked in the order they appeared below the diagonal in the symmetrical matrix of all possible pairwise comparisons.

All derived pairwise dissimilarity estimates were examined for the presence of outliers. If outliers were present, these items were first trimmed to a lower value. (Note that none of the cases were deleted as a result of this procedure.) When trimming the data, an attempt was made to be conservative and trim as little as possible. To ensure conservative trimming, the following approach was used. The distribution of each variable was first examined based on the frequencies of scores and the histogram. If outliers were present, percentile values associated with the ninety-fifth, the ninetieth, the eighty-fifth and the eightieth percentile were generated. Trimming the scores to the highest percentile was considered first. If the outliers were still present after trimming the data to the eightieth percentile, the scores were further transformed using nonlinear transformations (see below). The majority of the estimates were trimmed to the ninetieth percentile of the original value except for *ice and my freedom, ice and anger, temperature and my freedom, energy conservation and bad, recycle and anger, good and anger, bad and my freedom, my freedom and anger, EPA and bad,* and *EPA and anger*, which were trimmed to the eighty-fifth percentile. The items *recycle and bad* and *good and bad* were trimmed to the eightieth percentile. All the items were then transformed by adding the same constant to each trimmed variable and taking the natural logarithm of the sum: transformed variable = ln(trimmed original variable + 50). The constant was added because logarithmic transformations cannot be performed on zero values. The specific constant was determined through trial and error.

Involvement. Involvement was measured by asking participants to indicate how much they cared about recycling. They were asked to provide a magnitude scale estimate with 0 indicating that they did not care about recycling at all and 100 indicating that they cared about recycling moderately. This item was first trimmed to the ninetieth percentile and then transformed: transformed variable = ln(trimmed original variable + 100). S. S. Brehm and Brehm (1981) argued that to induce psychological reactance individuals have to be moderately issue-involved, thus the effect of involvement was controlled in this pilot study by using it as a covariate in the analyses that follow.

Manipulation check: Perception of threat to freedom. In addition to the items used in Pilot Study 4 (*How much do you feel that the message tried to manipulate you?* and *How much do you feel that the message tried to pressure you?*), two additional items (*How much did the message threaten your freedom to make a decision yourself?* and *How much did the message try to make a decision for you?*) were included in the perception of threat to freedom index. A magnitude scale was used with 0 indicating that participants' freedom was not threatened at all and 100 indicating that their freedom was moderately threatened. All the items were first trimmed to the ninetieth percentile and then transformed as follows: item transformed = $(\text{trimmed original item} + 10)^{.4}$. The mean for the perception of threat to freedom index was 20.68 (SD = 7.52; Cronbach's alpha = .86)

Manipulation check: Anger. As in Pilot Study 4, the anger index (M = 11.20; SD = 4.11; Cronbach's alpha = .87) comprised four items: irritated, angry, annoyed, and aggravated (Dillard & Shen, 2005; C. H. Miller et al., 2007), with the magnitude scale response option, where 0 indicated that the participants were not angry at all and 100 indicated that they were moderately angry. All the items were transformed as follows: item transformed = ln(trimmed original item +5). In addition, a single-item measure, irritated at the source of the message, was included. This item was trimmed to the 90th percentile. Based on the skewness and kurtosis values for this variable, transforming this variable was not necessary.

Manipulation check: Negative thoughts. Relevant negative thoughts were derived through a thought-listing procedure. Following Dillard and Shen (2005), affective thoughts were considered redundant with the participants' responses to the affective magnitude scale items, therefore affective thoughts were identified and removed from further analyses (i.e., affective thoughts were not counted as negative relevant thoughts). Affective thoughts were identified by using a list of affective terms (e.g., angry, guilty, happy) compiled by Shaver, Schwartz, Kirson, and O'Connor (1987). A thought was classified as affective whenever those terms appeared and as cognitive otherwise. An undergraduate research assistant was recruited to help with this coding. To make sure that this coding was reliable, another undergraduate research assistant was recruited to code 20 percent of the data (Scott's *pi* = .90).

The remaining thoughts were coded in terms of valence (positive, negative, or neutral) and relevance to the message (relevant or irrelevant) by two undergraduate research assistants. Negative relevant thoughts were defined as responses that expressed disagreement with the message, revealed a negative intention to comply with the message, indicated that a participant was intending to do something contrary to the message, derogated the source of the message or the message itself (e.g., the message was boring or stupid), or disagreed with the tone of the message (e.g., the message was pushy). To calculate inter-coder reliability, twenty percent of the data were coded by the two coders (Scott's *pi* = .80). Any disagreement between coders was resolved through discussion. The number of relevant negative thoughts was transformed: transformed number of relevant negative thoughts = ln(original variable + 1.70).

Analytical Strategy

Generating cognitive maps. The derived transformed pairwise dissimilarity estimates in each experimental condition were first averaged, and then anti-transformed to preserve the original measurement units. The anti-transformation involved exponentiating the value obtained through transformation and subtracting 50. Next, the anti-transformed means were entered into Galileo Software (Woelfel, 1993) and the coordinates establishing the locations of the 12 concepts in the cognitive space were generated. To generate the coordinates, Simplified Process for Entering Data (SPED) and Microgral procedures were used (Woelfel, 1993). Galileo researchers (e.g., Woelfel, 1990) warn against comparing cognitive maps derived from Microgral generated coordinates. Woelfel showed that using Microgral generated coordinates may lead to space differences that are artificial and are merely a result of the algebraic algorithms used to generate the coordinates. To remedy this, a rotation to congruence is recommended. This rotation involves selecting some arbitrary reference points (here, all concepts in a space in a particular condition) and rotating concepts in other spaces to the concepts in the reference space. Spaces were rotated to least-squares best fit (i.e., congruence) using Intergal and V56 procedures of the Galileo program (Woelfel, 1993).

In this study rotation was performed based on the specific hypotheses. If a given hypothesis dealt with change over time, concepts from the appropriate maps were rotated in a time-series fashion (i.e., time two was rotated to time one, and time three was rotated to time two); but if a given hypotheses dealt with a comparison across the threat to freedom and restoration conditions, then a rotation was performed based on the maps of interest that were a part of a given hypothesis. For example, H1 through H4 required comparing spaces in the low threat to freedom, control, and the high threat to freedom conditions. As a result, at the immediate time measurement the coordinates in the control condition were rotated to the coordinates in the low threat to freedom condition and the coordinates in the high threat to freedom condition were rotated to the coordinates in the control condition. Using such a rotation makes sense because comparing the control condition to the low threat to freedom condition establishes whether or not the participants who received a persuasive message (as compared to those who did not) exhibited more attitude change or greater behavioral intentions as a result of the message; comparing the high threat to freedom condition to the control condition allows determining whether participants exhibited a boomerang effect as a result of the high threat to freedom induction.

Determining the number of dimensions. For any k concepts included in a cognitive space (12 in the present study), there are $k - 1$ possible dimensions. Not all of these dimensions should be included in the analyses as some of these $k - 1$ dimensions do not explain a substantial amount variance and may also be imaginary (i.e., the dimensions that have negative eigenvalues and emerge as a result of pairwise dissimilarities violating the triangle inequality; Woelfel, 1990). Therefore, the next step was to determine which dimensions explained a substantial amount of variance and should be included in further analyses.

Based on the eigenvalues generated by the Galileo software (Woelfel, 1993), scree plots were generated, and the traditional approach to the examination of scree plots was applied (i.e., the presence of significant bend was interpreted as a cut-off point). In addition, the sum of all the real eigenvalues was divided by the number of all real dimensions. Positive eigenvalues larger than the average were interpreted as explaining a substantial amount of variance. Based on the examination of all the spaces in this study, two real dimensions predominated (but see Barnett & Woelfel, 1979). An illustration of this process is provided in the Appendix D: The eigenvalue scree plots rotated in a time-series fashion are presented in Figures D-1 through D-15 and the calculations used to determine averages are presented in Table 4.

Determining motion of concepts across cognitive spaces. The motion of concepts across cognitive spaces was determined using the two dimensions as established above. Note that in this dissertation, the motion of concepts across conditions is a between-participants effect. The word *motion* is used to indicate differences in distances across conditions. Here, *motion* is a descriptive term; it should not be inferred that motion was measured as a within-participants effect. Galileo output allows determining the location and motion for any concept across experimental conditions. However, for this dissertation the main focus was determining how the distances for the pairs of concepts change across the conditions of interest. For example, to be able to infer reduced persuasion in the case of attitude toward recycling when threat to freedom is high (as compared to when threat to freedom is low), the distances between *recycling* and *good* in the low threat to freedom condition and the high threat to freedom condition have to be examined.

To calculate the distance (the notation for the distances between concepts used below is $D_{ij,}$ indicating that D is the distance between concept i and concept j) between the two concepts in the same space (i.e., condition), the coordinates in two spaces of interest and across the two dimensions have to be located and their distance found. To do so, a Pythagorean Theorem approach (i.e., a square of the hypotenuse is equal to the sum of the squares of the sides) was applied and the following formula to calculate distances was used:

> D_{ij}^2 = (the location of concept A in space A in dimension 1 – the location of concept B space A in dimension 1)^2+ (the location of concept A in space A dimension 2 – the location of concept B space A dimension 2)^2.

To get the value for the actual distance, the square root of $D_{ij}^2$was used.

Once the distance between two concepts was calculated in one space, a similar set of calculations was performed to determine the distance between the same set of concepts in another space. A simple subtraction was used to determine the magnitude of the difference.

Significance testing. To test whether the differences between the pairs of concepts across conditions were statistically significant, a specific analytical strategy was developed. Because the dimensionality of the pairwise comparisons was important to this research, the selected strategy required that the dimensionality of the data be taken into consideration. Two data sources were available to calculate statistical significance: first, the data that derived from the participants' pairwise dissimilarity estimates of the 12 concepts; and second, the data obtained from the Galileo-rotated to congruence coordinates in different spaces. Using either of these data sources to calculate statistical significance posed some problems, which are discussed below.

If using the data derived from the participants' pairwise dissimilarity estimates of the 12 concepts, a reasonable approach may be to perform univariate ANOVAs using the pairwise estimates as the dependent variables. However, in light of the aforementioned eigenvalue analysis and the examination of scree plots revealing that in these data a two-dimensional solution appeared plausible, performing univariate ANOVAs with dependent variables using all $k - 1$ dimensions was deemed not to be appropriate. Therefore, this approach to significance testing had to be modified.

Contrary to the ANOVA analyses discussed above, the data obtained from the Galileo-rotated to congruence coordinates did take dimensionality into consideration, but because the generated coordinates came from aggregate data, there were no variability measures around each concept in the cognitive spaces. Using aggregate data was appropriate for the space- and coordinate-generation analyses, but the lack of variability measures around the means made significance testing impossible. Therefore, to use these data, a strategy had to be developed to allow generating measures of variability to be included in the analyses.

To remedy the lack of dimensionality information in the ANOVA, an approach was developed allowing the amount of variance explained by each of the two dimensions to be taken into account. To do so, the transformed scores derived from the participants' pairwise dissimilarity estimates for a specific cognitive space (i.e., condition) were multiplied by the ratio of eigenvalue for that dimension to the total eigenvalues for all dimensions in that particular space.[13] The same procedures were repeated for both dimensions for all conditions. The calculations for the eigenvalue formula are provided in

Table 5.

To resolve the lack of variability information around the means obtained through the Galileo method, an approach developed by Fink and Chen (1995) was used. This approach represents a modified version of the jackknife procedure reported in Mosteller and Tukey (1977). The essence of any jackknife procedure is that when variability information is unavailable, these procedures allow drawing a number of subsamples from a given sample and provide steps to determine pseudo-variability measures that can be subsequently used to calculate pseudo-*t* tests or analyses of variance. A modified version of the jackknife procedure used by Fink and Chen (1995) involved selecting three subsamples containing two-thirds of the data and generating the pseudo-values from these three subsamples.

The complexity of the data in the present study posed additional difficulties as, before calculating the pseudo-*t* tests, the same steps that were used to generate the rotated coordinates have to be performed for each of the three subsamples in each of the 15 conditions. Specifically, the data from all the participants in a given condition (i.e., 66 pairs of all concepts) have to be first selected and manually reentered into SPED: The format of the Galileo data files does not allow for cutting and pasting from the SPSS or Excel files. Next, Microgal syntax has to be run to generate an initial set of coordinates. For the 15 conditions, these steps have to be repeated 60 times.[14] Then, based on the hypotheses, coordinates in specific conditions have to be selected and rotated to congruence (e.g., if concepts in the low threat to freedom condition have to be compared to a high threat to freedom condition, each jackknifed subsample has to be rotated to congruence). These procedures have to be repeated four times: Three rotations have to be performed for each of the jackknifed subsamples and one rotation has to be performed for the transformed full set of data. The generated rotated coordinates can then be entered into the SPSS or Excel to generate pseudo-significance tests.

The essence of significance testing based on the modified jackknife procedure involves estimating how much each concept moved on each of the two dimensions across the conditions of interest, and then based on the pseudo-variability values, calculating pseudo-*t* tests. To calculate pseudo-values for one concept of interest, the following steps have to be followed:

1. Rotated coordinates of interest have to be found. For example, to test the amount of variability around *recycling* when threat to freedom was low as opposed to the control condition, the coordinates for *recycling* in both conditions have to be generated. The coordinates of interest have to be generated in the three jackknifed subsamples and the full data set.
2. Differences in locations for a concept of interest between the two conditions in dimension one have to be calculated. (These procedures have to be repeated for the three jackknifed subsamples and the full data set.) The results of these calculations can be used as a proxy for standard deviations. Following Mosteller and Tukey's (1977) procedure, the following formula can be used to calculate a pseudo-mean for each concept of interest on the first dimension: $[N\ (y_{all})] – [(N\ \text{-}1)\ (y_{jk})]$, where N is the number of all jackknifed subsamples, y_{all} is the location difference for the concept of interest on dimension one between the two conditions using the transformed data derived from all the participants,

and y_{jk} is the location difference on dimension one between the two conditions of interest for the concept of interest using the coordinates derived from each jackknifed subsample. To obtain the mean for the concept of interest, the outcome of this formula for each jackknifed subsample has to be averaged.

3. To obtain a pseudo standard error, the following formula was used: $SD/\sqrt{N}$.

4. Then, a confidence interval was computed, where the *t* value with appropriate degrees of freedom and alpha level was used.

5. These procedures have to be performed for all the concepts of interest for a given hypothesis for both dimension one and dimension two.

It is obvious from the steps described above that the jackknife procedure is cumbersome, time-consuming, and has a high likelihood of error (because the Galileo software does not automate this procedure). Therefore, a decision was made to test for statistical significance using the ANOVA approach that adjusts for the amount of variance explained by a given dimension, as described at the beginning of this section. (From now on this procedure will be referred to as variance-adjusted ANOVA). To cross-validate the variance-adjusted ANOVA approach, a modified jackknife procedure was performed to test a few selected predictions. Although both procedures (i.e., variance-adjusted ANOVA and jackknife) approach significance testing somewhat differently, the convergence of the results from both methods can be viewed as an adequate way to cross-validate these procedures. The results of the cross-validation are reported in the results chapter below.

Planned comparisons: Overcoming the lack of orthogonality. To test significance across specific pairs of conditions, variance-adjusted *t*-test analyses (similar to variance-adjusted ANOVAs described above) may be performed. For some hypotheses (e.g., H1-H4), the significance tests across specific pairs of conditions were predicted as planned comparisons. In some cases, these planned comparisons were nonorthogonal. For example, planned comparisons for H1 through H4 involved comparing the low threat condition to the control condition (H4), the control condition to the high threat condition (H3) and the high threat condition to the low threat condition (H2). To remedy this lack of orthogonality, a correction for nonorthogonality can be used. In this dissertation, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. For example in H1-H4, there were three planned comparisons, thus the significance level for those analyses was (.05/3) or .017.

Chapter 4: Results

In Chapter 4 the results of the main experiment are presented. The chapter starts with a description of the manipulation checks for perceptions of threat to freedom, anger, and negative relevant thoughts. Then, the results of the method cross-validation for significance testing are presented. Finally, the results for the hypotheses and research questions are detailed.

Manipulation Checks

Manipulation Check: Perceptions of Threat to Freedom

Manipulation checks were only performed on the fully crossed part of the design. A univariate ANCOVA was performed to ascertain the effect of threat manipulation on perceived threat with involvement used as a covariate. Threat, time, and restoration inductions were used as the independent variables, and the perceived threat was used as the dependent variable (the threat to freedom index was formed by saving the first unrotated principal component). The R^2 for the entire model was .08 (adjusted R^2 = .04). The effect of the covariate was not significant, $F(1, 341) = 0.32$. The results indicated that the effect of the threat induction was significant, $F(1, 341) = 19.64$, $p < .001$, partial $\eta^2 = .05$. The individuals in the low threat condition perceived significantly less threat to freedom ($M = -0.11$; $SD = 0.92$; $n = 179$) than individuals in the high threat condition ($M = 0.35$; $SD = 1.06$; $n = 175$). Neither the effect of restoration induction, $F(1, 341) = 0.26$, nor the time induction, $F(2, 341) = 0.14$, was significant. Further, there were no significant interactions between the independent variables. Based on these results it was concluded that the effect of the threat to freedom manipulation on perceived threat to freedom was successful.

Manipulation Check: Anger

A univariate ANCOVA was performed to determine the effect of threat manipulation on perceived anger with involvement used as a covariate. Threat, time, and restoration inductions were used as the independent variables. Anger was used as the dependent variable (the anger index was formed by saving first unrotated principal component). The R^2 for the entire model was .05 (adjusted R^2 = .02). The effect of the covariate was significant, $F(1, 341) = 5.09$, $p = .03$, partial $\eta^2 = .02$. The effects of threat, $F(1, 341) = 1.27$, restoration, $F(1, 341) = 0.99$, and time, $F(2, 341) = 1.25$, were not significant.

The participants were also asked how irritated they were at the message source.[15] Therefore, participants' level of irritation at the source of the message was also considered as a manipulation check for perceived anger. Once again, a univariate ANCOVA was performed with involvement as a covariate. Threat, time, and restoration inductions were used as the independent variables, and the perceived irritation at the source of the message was used as the dependent variable. (Recall that this variable is a single item measure that did not require transformation). The R^2 for the entire model was .05 (adjusted R^2 = .02). The effect of the covariate was significant (one-tailed test), $F(1, 341) = 2.60$, $p = .108$ (two-tailed), partial $\eta^2 = .01$. The effect of the threat manipulation on perceived irritation at the source of the message was significant, $F(1, 341) = 8.29$, $p = .004$, partial $\eta^2 = .02$. Specifically, in the low threat condition ($M = 22.40$; $SD = 35.66$; $n = 179$), the participants were significantly less irritated at the message source as compared to high threat condition ($M = 34.14$; $SD = 40.92$; $n = 175$). The effects of neither restoration, $F(1, 341) = 0.73$, nor of time, $F(2, 341) = 0.43$, were significant. Further, there were no significant interactions between the independent variables. Based on these results it was concluded that the effect of threat manipulation based on how irritated the participants were at the source of the message was successful.

Manipulation Check: Negative Relevant Thoughts

A univariate ANCOVA was performed to ascertain the effect of threat manipulation on negative relevant thoughts, with involvement used as a covariate. The threat, time, and restoration inductions were used as the independent variables and negative relevant thoughts were used as the dependent variable (this variable is a transformed number of negative relevant thoughts). The R^2 for the entire model was .05 (adjusted R^2 = .02). The effect of the covariate was not significant, $F(1, 341) = .004$. The results indicated that threat induction was significant, $F(1, 341) = 4.88$, $p < .05$, partial $\eta^2 = .02$. Specifically, individuals in the low threat condition had significantly fewer negative relevant thoughts (M = 0.99; SD = 0.50; n = 179) than individuals in the high threat condition (M = 1.11; SD = 0.53; n = 175). The effect of the restoration induction was not significant, $F(1, 341) = 1.36$, and there were no significant interactions between the independent variables. However, the effect of the time induction was significant, $F(2, 341) = 5.01$, $p < .01$. A polynomial contrast revealed a significant negative linear effect for time. Specifically, study participants had more negative relevant thoughts in the immediate-time condition (M = 1.17; SD = 0.53; n = 115) than in the one-minute-delay condition (M = 0.99; SD = 0.50; n = 119), and there was no difference in negative relevant thoughts reported in the one-minute-delay condition as compared to the two-minute-delay condition (M = 1.00; SD = 0.51; n = 120). Based on these results it was concluded that the effect of threat manipulation on the generated negative relevant thoughts was successful.

Hypothesis Testing

Notation and Preliminary Remarks

Recall that the notation for the distances between concepts used in this dissertation is $D\ i, j_{,}$ indicating the distance between concept *i* and concept *j*. Distances between concepts were calculated using the Pythagorean approach described above. All of the values in the graphs below are presented in the original measurement units (100 units represent a moderate-level difference) because all of these graphs were generated on the anti-transformed data. Significance testing was performed on the transformed data.

Significance Testing: Cross Validation

To cross-validate the approaches to significance testing (i.e., to compare the results of variance-adjusted ANOVAs and *t* tests to the results of the modified jackknife procedure), significance testing was done for the first generic hypothesis (H1) and one of the planned comparisons that is part of H1. In selecting a planned comparison, a decision was made to cross-validate the predictions in which less dramatic change was expected: Specifically, the most motion was expected between the low threat and the high threat conditions (i.e., reduced persuasion), and less motion was expected between the low threat and the control conditions or the high threat and control conditions. To make cross-validation more convincing, showing the results converge in the case where more subtle differences were expected was selected for the analyses: Indeed, if both approaches are capable of detecting smaller differences between conditions as significant, using one less labor-intensive approach may be sufficient. Thus, the motion between low threat to freedom condition and control condition (i.e., H4) was examined for cross-validation.

First, the significance for H1 was tested by eight different ANOVAs (one for each concept pair for each dimension).[16] The threat to freedom induction was used as the independent variable, and the dimension-specific distances between *recycling and good,* *recycling and me, recycling and bad*, and *recycling and anger* (adjusted for the variance accounted for by each dimension as described above) were used as the dependent variables. To establish the sign of the relationship between the independent and dependent variables, a correlation between the threat induction and each dependent variable was calculated (from a positive correlation between variables, a positive relationship was inferred, and from a negative correlation, a negative relationship was inferred).

The results of the overall variance-adjusted ANOVAs, which have 2 degrees of freedom, and bivariate correlations between the threat induction and each dependent variable are presented in Table 6. The results of the polynomial contrasts, which have 1 degree of freedom, indicated that, on dimension one, a significant positive (as inferred from positive correlations between threat induction and each dependent variable) linear effect of the threat to freedom induction was found for all four dependent variables: *recycling and good* (contrast estimate = .30 [SE = .08], p < .001), *recycling and me* (contrast estimate = .39 [SE = .06], p < .001), *recycling and bad* (contrast estimate = .57 [SE = .09], p < .001), and *recycling and anger* (contrast estimate = .40 [SE = .10], p < .001).

The results of variance-adjusted ANOVAs on dimension two yielded a significant negative (as inferred from negative correlations between the threat induction and each dependent variable) linear effect of the threat to freedom induction on *recycling and me* (contrast estimate = -.13 [SE = .03], p < .001), *recycling and good* (contrast estimate = -.15 [SE = .04], p = .001), *recycling and bad* (contrast estimate = -.12 [SE = .05], p = .01), and *recycling and anger* (contrast estimate = -.19 [SE = .05], p < .001). Based on these results, it was concluded that the motion described in H1 was statistically significant.

To examine whether the motion of concepts across the low threat to freedom and the control condition was significant (i.e., to test significance for H4), variance-adjusted t tests were performed.[17] The details of the variance-adjusted t tests are presented in Table 7. Note that because the comparisons for H1 through H4 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for those analyses was (.05/3) or .017. The t-test results indicated that across the low threat and control conditions, the changes in distances between *recycling and good*, *recycling and bad*, and *recycling and anger* were statistically significant only on dimension two, but not dimension one. The mean distances on dimension two indicated that greater motion occurred in the control condition as compared to the low threat condition (see Table 7 and Figure 5). The distance between *recycling and me* on dimension two was not significant, but on dimension one it approached significance (at $p = .045$) based on a one-tailed test. (Note that because planned comparisons in this study were directional, one-tailed tests are appropriate). The mean distances on dimension one indicated that greater motion occurred in the low threat condition as compared to the control condition (see Table 7 and Figure 5). Based on these results it was concluded that the motion for the concepts of interest in H4 was significant.

Next, to cross-validate the results obtained from the variance-adjusted ANOVAs and t test, the analyses based on the jackknife approach were conducted. The calculations required for the jackknife approach are summarized in Tables 8 through 11. The results indicated that for dimension one, the motion of *good* in the low threat to freedom condition as compared to the control condition was significant. As inferred from Figure 5, in the low threat condition, *good* moved in a less positive direction on dimension one as compared to the control condition. For dimension two, *recycling* exhibited significant movement. Figure 5 indicates that in the low threat condition, *recycling* moved in a more positive direction on dimension two as compared to the control condition. Taken together, these results indicated that as recycling moved on dimension two, only *good* (but none of the other concepts) exhibited significant motion on dimension one. In sum, similarly to variance-adjusted ANOVAs, using the jackknife approach deemed the motions of some concepts across conditions significant.

The variance-adjusted ANOVAs and *t* tests reported above and the results of the modified jackknife procedure are different approaches to examining statistical significance. However, the fact that both show evidence of statistically significant differences in motion across conditions validates the variance-adjusted ANOVA and *t*-test approach that takes the variance explained by a particular dimension into consideration. Thus, to determine significance in all hypotheses tested in this study, the variance-adjusted ANOVA and *t*-test approach was used.[18]

Hypotheses 1-4

In light of the significant differences between the conditions of interest in H1 (see Table 6), the specific planned comparisons and the results based on Galileo analyses are further discussed below. The graphic representations of H1 through H4 are presented in Figures 5 and 6.

First, the reduced persuasion effect proposed in H2 was examined. To test whether the differences in distances for the concepts of interest in the high threat to freedom condition as compared to the low threat to freedom condition were different, variance-adjusted *t* tests were performed. The details of the variance-adjusted *t* tests are presented in Table 12. Recall that because the comparisons for H2 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for these analyses was (.05/3) or .017. The variance-adjusted *t* test results indicated that across the low threat and high threat conditions, the distance between *recycling and me* changed significantly on both dimensions: The mean distances on dimension one indicated that greater motion occurred in the high threat condition as compared to the low threat condition, and on dimension two greater motion occurred in the low threat condition as compared to the high threat condition (see Table 12 and Figure 5). The distance between *recycling and good*, *recycling and bad*, and *recycling and anger* changed significantly only on dimension one but not dimension two. The mean distances on dimension one indicated that across these three dependent variables, greater motion occurred in the high threat condition as compared to the low threat condition (see Table 12 and Figure 5). Based on these results it was concluded that the motion for the concepts of interest in H2 was significant.

Next, the reduced persuasion effect based on Galileo analyses was examined. To do so, at the immediate time measurement the distances between *me* and *recycling* as well as *recycling* and *good* at high versus low threat to freedom were compared. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). The results confirmed the existence of the reduced persuasion effect: When threat to freedom was high, *recycling* was located 49.46 units further away from *me* (*D recycling, me* = 167.77) and 40.73 units away from *good* (*D recycling, good*

= 105.21), as compared to when threat to freedom was low (*D recycling, me* = 118.31 and *D recycling, good* = 64.47).

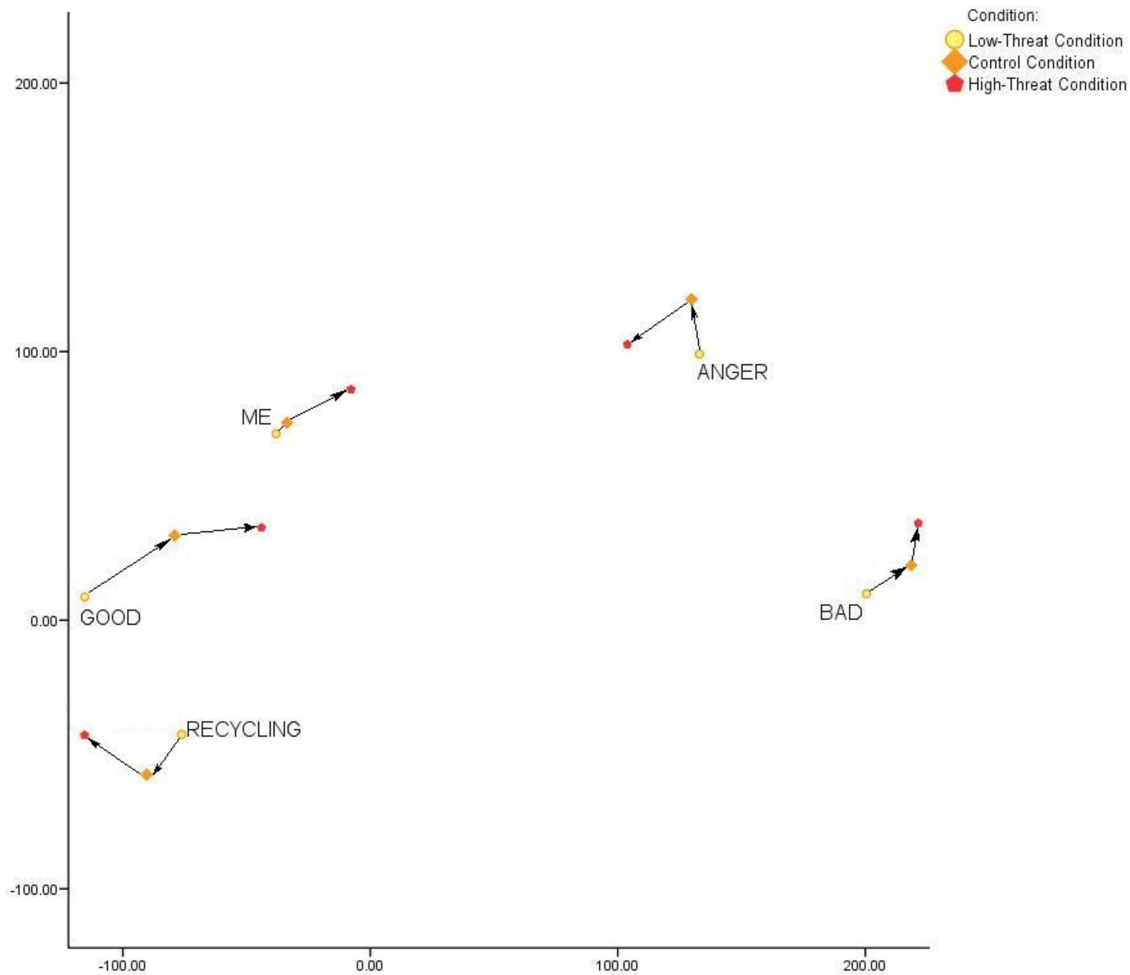


Figure 5. Concept location in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for H1-H4 at the immediate time measurement. The distances were derived from the two-dimensional solution using the Galileo analyses.[19] Distances were anti-transformed.

The distances between *recycling* and *bad* and *recycling* and *anger* at low and high levels of threat were also examined. The results indicated that when threat to freedom was high, *recycling* (*D recycling, bad* = 346.00) was not perceived more negatively than when threat to freedom was low (*D recycling, bad* = 281.62). Instead, *recycling* was viewed as 64.39 units less negative when threat to freedom was high as compared to when threat to freedom was low. Similarly, and contrary to what was expected, when threat to freedom was high, *recycling* moved 10.54 units further away from *anger* (*D recycling, anger* = 263.15) as compared to when threat to freedom was low (*D recycling, anger* = 252.61). Thus, H2 was partially supported.

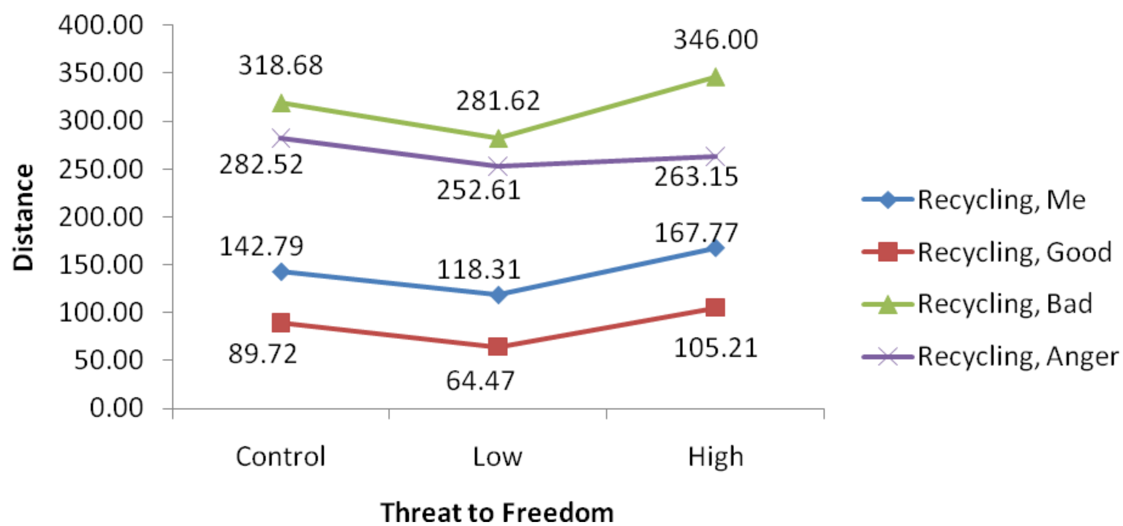


Figure 6. The distances for the listed pairs (derived from the two-dimensional solution using the Galileo analyses) in the low threat, control, and high threat conditions at the immediate time measurement. The graph represents the reduced persuasion, a boomerang effect, and an increase in persuasion predicted in H2 through H4. Smaller numbers indicate less distance. Distances were anti-transformed.[20]

Results for H3 are presented next. To test whether the differences in distances for the concepts of interest in the high threat to freedom condition as compared to the control condition were statistically significant, variance-adjusted *t* tests were performed. The details of the variance-adjusted *t* tests are presented in Table 13. Recall that because the comparisons for H1-H4 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for these analyses was (.05/3) or .017. The variance-adjusted *t*-test results indicated that across the high threat and control conditions, the distance between *recycling and me*, *recycling and good*, *recycling and bad*, and *recycling and anger* changed statistically significantly on both dimensions. The mean distances on dimension one for all four dependent variables indicated that greater motion occurred in the high threat condition as compared to the control condition, and on dimension two, greater motion occurred in the control condition as compared to the high threat condition (see Table 13 and Figure 5). Based on these results it was concluded that the motion for the concepts of interest in H3 was significant.

Next, the results based on Galileo analyses were examined. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). H3 posited that at the immediate time measurement, a threat to attitudinal or behavioral freedom causes a boomerang effect. In the context of present research, it was proposed that the boomerang effect will manifest itself in the following way: When freedom is threatened, *recycling* was expected to move further away from *me* and *good* (as compared to the control condition) and move closer to and cluster around *bad* and *angry* (as compared to the control condition).

Consistent with this prediction, *recycling* was located 24.98 units further away from *me* when threat to freedom was high (*D recycling, me* = 167.77) as compared to when no message or a freedom threat were present (*D recycling, me* = 142.79). Similarly, the distance between *recycling* and *good* increased 15.48 units when threat to freedom was high (*D recycling, good* = 105.21) as compared to the control condition (*D recycling, me* = 89.72). This motion away from individuals' initial position confirms the predicted boomerang effect for the positively valenced dependent variables (i.e., *recycling and me* and *recycling and good*).

Recycling was also predicted to move closer to *bad* and *anger* in the high threat condition as compared to the control condition. The results indicated that when threat to freedom was high, contrary to this prediction, *recycling* moved 27.33 units away from *bad* (*D recycling, bad* = 346.00) as compared to the control condition (*D recycling, bad* = 318.68), whereas *recycling* and *anger*, as predicted, moved 19.37 units closer together (*D recycling, anger* = 263.15) as compared to the control condition (*D recycling, anger* = 282.52). Based on these results, the predictions regarding negatively valenced pairs of concepts (*recycling and bad* and *recycling and anger*) were only partially supported. Overall, H3 was partially supported.

H4 was examined next. H4 predicted that at the immediate time measurement, low threat to attitudinal or behavioral freedom leads to persuasion as compared to the control condition. Recall that the statistical significance of the motion of concepts across these two conditions was determined in the cross-validation section of this chapter (see above; for the variance-adjusted *t*-tests results, see Table 7). Because the motion across conditions was deemed significant, the results based on Galileo analyses were examined and the findings are reported below. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). In terms of distances, H4 predicted that when threat to freedom is low, (a) the concept denoting the attitude or behavior targeted by the message moves closer towards the concepts *me* and *good* (as compared to the control condition); and (b) the concept denoting the attitude or behavior targeted by the message moves further away from *bad* and *angry* (as compared to the control condition). Consistent with this prediction, when threat to freedom was low, the distance between *recycling* and *me* decreased by 24.48 units, and the distance between *recycling* and *good* decreased by 25.25 units as compared to the control condition.

Contrary to the prediction regarding negatively valenced concepts, the distances between *recycling* and *bad* and *recycling* and *angry* did not increase in the low threat condition as compared to the control condition. Instead, the results indicated that when threat to freedom was low, *recycling* and *bad* moved 37.06 units closer (*D recycling, bad* = 281.62) as compared to the corresponding distance in the control condition (*D recycling, bad* = 318.68), and *recycling* and *anger* moved 29.91 units closer (*D recycling, anger* = 252.61) as compared to the corresponding distance in the control condition (*D recycling, anger* = 282.52). Based on these results, the predictions regarding negatively valenced pairs of concepts (*recycling and bad* and *recycling and anger*) were only partially supported. Overall, H4 was partially supported.

In sum, the results for H1 through H4 confirmed the predicted boomerang effect (H3) and reduced persuasion (H2) when threat to freedom was high for positive attitude (as determined form the distance between *recycling* and *good*) and behavioral intention (as determined from the distance between *recycling* and *me*). In addition, as compared to the control condition, receiving a pro-recycling message when threat to freedom was low resulted in an increase in positive attitude and behavioral intention (H4). The overall U-shape of the effect of freedom threat on the distances between *recycling* and *good* and *recycling* and *me* predicted in H1 was also supported (see Figure 6): As a result of the threat to freedom induction, the least distance between *recycling* and *me* and the *recycling* and *good* was found when threat to freedom was low as compared to both the control condition and when threat to freedom was high. However, the distance between *recycling* and *me* and *recycling* and *good* was significantly greater when threat to freedom was high as compared to the control condition. These effects are not as clear for negatively valenced pairs (i.e., *recycling* and *anger* and *recycling* and *bad*); potential explanations for these results are addressed in the discussion chapter.

Hypothesis 5

This hypothesis explored the effects of a restoration postscript on persuasion. H5 posited that at the immediate time measurement, the distance between the *recycling* and *good* and the *recycling* and *me* from least to most is: low threat to freedom with restoration condition, low threat to freedom without restoration condition, high threat to freedom with restoration condition, and high threat to freedom without restoration condition. Univariate variance-adjusted ANOVAs with polynomial contrasts were conducted to test for statistical significances. To represent the predicted linear effect, a variable was created, for which the low threat with restoration condition was coded as 1, low threat without restoration condition was coded as 2, high threat with restoration condition was coded as 3, and high threat without restoration condition was coded as 4; this variable was used as the independent variable. The dimension-specific distances between *recycling and good* and *recycling and me* (adjusted for the variance accounted for by each dimension as described above) were used as the dependent variables. The details of the variance-adjusted ANOVAs and the bivariate correlations between the independent (with conditions coded linearly) and the dependent variables are presented in Table 14. The results indicated that, for dimension one, a linear effect of the independent variable (with conditions coded linearly) on positive attitude (i.e., *recycling and good*) and behavioral intention (i.e., *recycling and me*) was supported; and, for dimension two, the linear effect was not significant.

For *recycling* and *me* (see Figures 7 and 8), the predicted linear pattern of amount of persuasion held for all conditions except for low threat with restoration condition: The presence of the restoration postscript resulted in greater behavioral intentions (i.e., reduced the amount of reactance) in all conditions except for when low threat message was paired with restoration. Specifically, in the high threat with restoration condition, the distance between *recycling* and *me* was 30.57 units less (*D recycling*, *me* = 136.95) as compared to the distance between *recycling* and *me* (*D recycling*, *me* = 167.53) in the high threat without restoration condition, but in the low threat with restoration condition, the distance between *recycling* and *me* increased by 9.25 units (*D recycling*, *me* = 136.95) as compared to the distance between *recycling* and *me* (*D recycling*, *me* = 123.11) the low threat without restoration condition.[21] In the case of attitudes, in the low threat with restoration condition, the distance between *recycling* and *good* (*D recycling*, *good* = 107.28) increased by 26.39 units as compared to the distance between *recycling* and *good* (*D recycling*, *good* = 80.89) in the low threat without restoration condition. However, in the high threat with restoration condition, the distance between *recycling* and *good* (*D recycling*, *good* = 70.24) decreased by 37.49 units as compared to the distance between *recycling* and *good* (*D recycling*, *good* = 107.74) in the high threat without restoration condition.

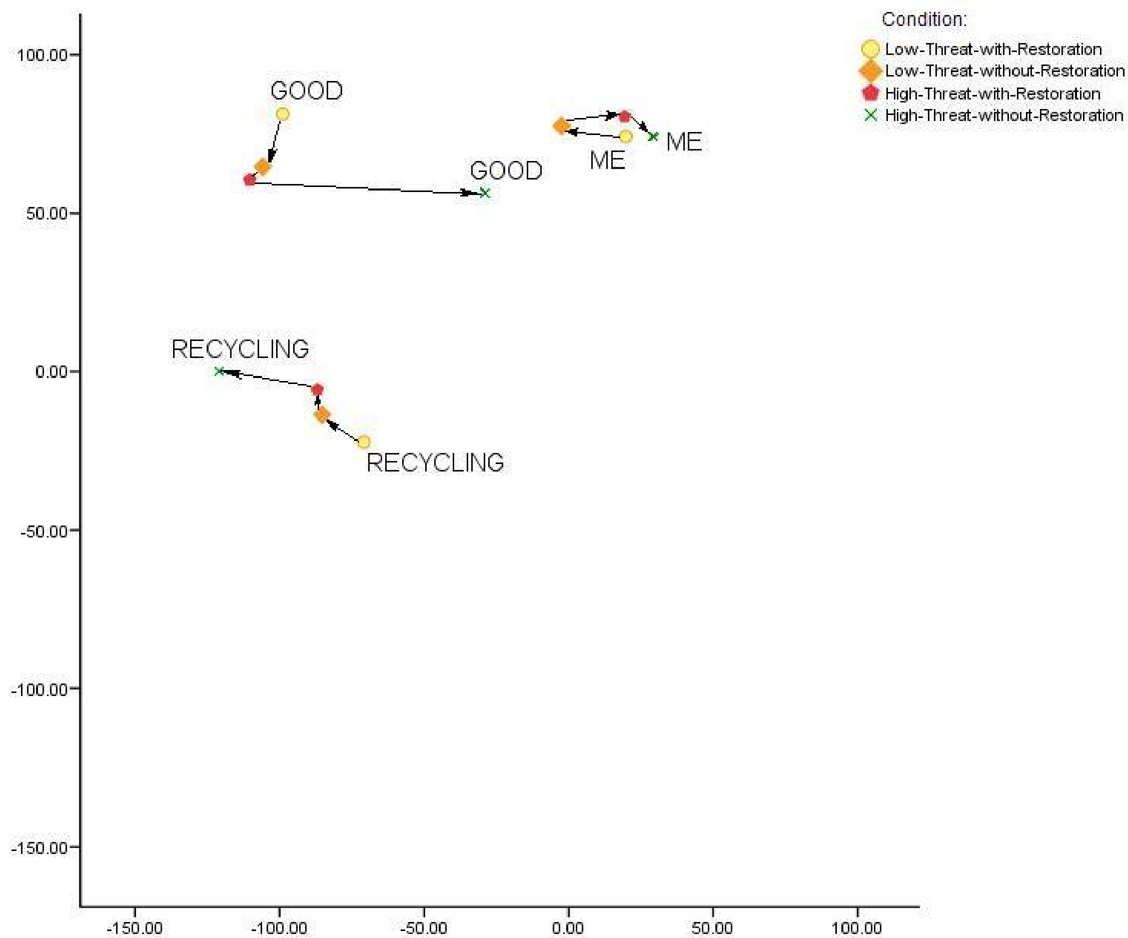


Figure 7. Concept location in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for H5 at the immediate time measurement across different threat and restoration conditions. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

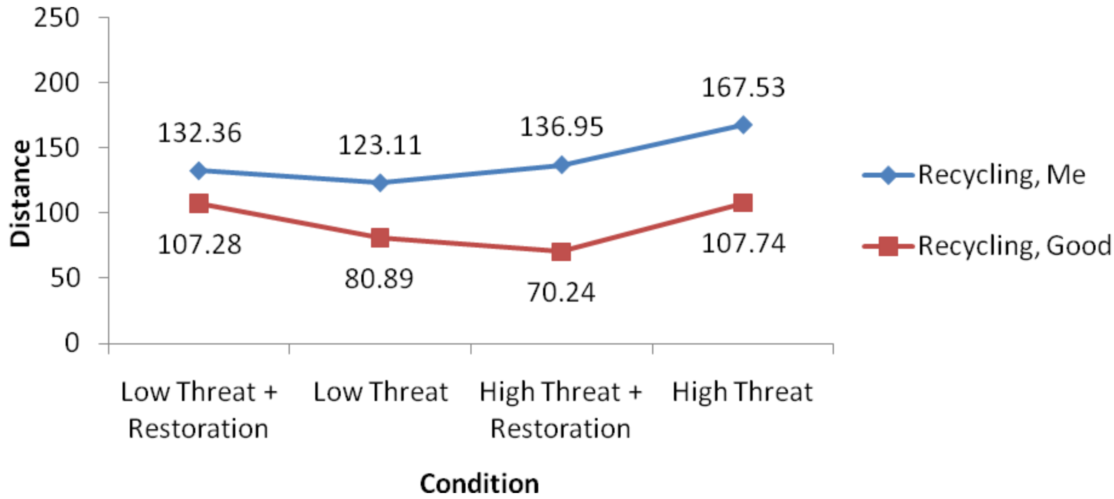


Figure 8. The distances for the listed pairs (derived from the two-dimensional solution using the Galileo analyses) in the low threat with restoration, low threat without restoration, high threat with restoration, and high threat without restoration conditions at the immediate time measurement (H5). The order of the conditions was coded to represent the linear effect tested in this hypothesis. Smaller numbers indicate less distance. Distances were anti-transformed.

Figure 9 contains an alternative representation of H5. In this figure, the findings for H5 are presented as an interaction between threat to freedom and restoration on the distances between *recycling* and *me* and *recycling* and *good.* These results indicate that there appears to be an interaction between threat to freedom and restoration on the distances between *recycling* and *me* and *recycling* and *good.* In the absence of a restoration postscript, the distance between *recycling* and *me* and *recycling* and *good* was always smaller in the low threat condition as compared to the high threat condition: Specifically, the distance between *recycling* and *me* in the high threat without restoration condition was 167.53 units, and the corresponding distance in the low threat without restoration condition was 123.11 units. Similarly, the distance between *recycling* and *good* in the high threat without restoration condition was 107.74 units, and the corresponding distance in the low threat without restoration condition was 80.89 units.

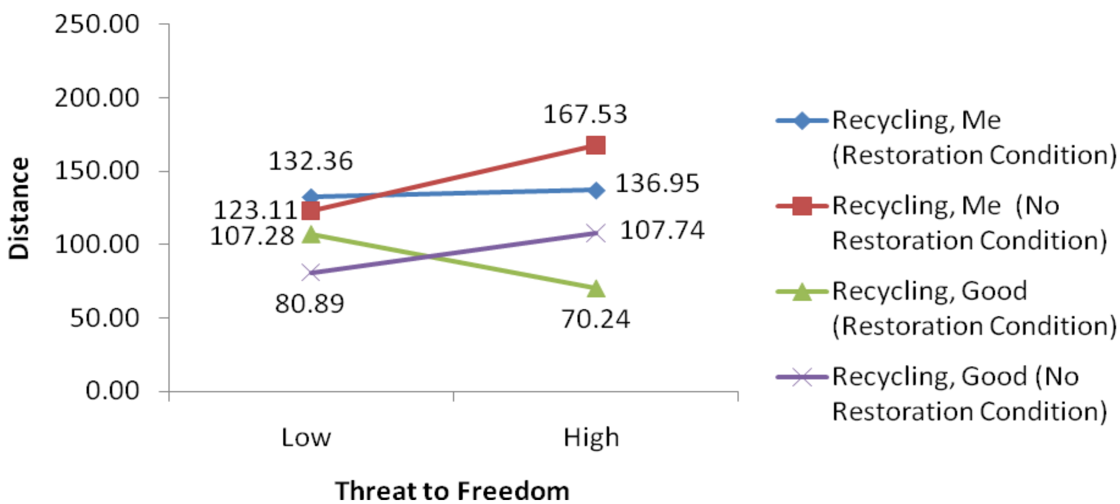


Figure 9. Alternate representation of H5 as an interaction between threat to freedom and restoration on the distances between *recycling* and *me* and *recycling* and *good* (derived from the two-dimensional solution using the Galileo analyses). Smaller numbers indicate less distance. Distances were anti-transformed.

Interestingly, adding a restoration postscript made the distances between *recycling* and *me* across the two levels of threat almost the same: The distance between *recycling* and *me* in the high threat with restoration condition was 136.95 and the distance between *recycling* and *me* in the low threat with restoration condition was 132.36. However, the distance between *recycling* and *good* was 37.04 units larger in the low threat with restoration condition (*D recycling*, *good* = 107.28) as compared to the corresponding distance in the high threat with restoration condition (*D recycling, good* = 70.24), indicating that adding a restoration postscript to a persuasive message decreased the positive attitude in the low threat to freedom condition as compared to the high threat to freedom condition.

A trend is evident here: Pairing a low threat to freedom message with a restoration postscript led to a reduction in positive attitude (as determined from an increase in distance between *recycling* and *good*) and behavioral intention (as determined from an increase in distance between *recycling* and *me*) as compared to when a restoration postscript was not included into the low threat message. However, when threat to freedom was high, the presence of a restoration postscript led to a considerable increase in both positive attitude (as determined from a decrease in distance between *recycling* and *good*) and behavioral intention (as determined from a decrease in distance between *recycling* and *me*). Based on these results, H5 was partially supported.

The rationale for the next set of tests is based on Dinauer and Fink's (2005) suggestion that there is more to attitude change than simply changes in the target attitude concept (here, *recycling*), and the motion for other related concepts associated with the target attitude concept (here, *energy conservation*) should be examined.

Research Question 1

RQ1 asked about the motions associated with the related concept at the immediate time measurement. Recall that the related concept is defined as a concept associated with the concept targeted by a persuasive message. In the present research, the related concept was *energy conservation*. The patterns for *energy conservation* at the immediate time measurement are summarized in Figures 10 and 11.

To explore RQ1, the reactance patterns observed for the target concept (i.e., *recycling*) were examined for the related concept (i.e., *energy conservation*). Once again, univariate variance-adjusted ANOVAs with planned comparisons (similar to the tests used for H1-H4) were performed. For these analyses, the threat to freedom induction was used as the independent variable, and the dimension specific distances between *energy conservation and good* and *energy conservation and me* (adjusted for the variance accounted for by each dimension as described above) were used as the dependent variables.

The results of the overall variance-adjusted ANOVAs, which have 2 degrees of freedom, are presented in Table 15. The results of the polynomial contrasts, which have 1 degree of freedom, indicated that, for dimension one, a significant positive (as inferred from positive correlations between the threat induction and each dependent variable) linear effect of the threat to freedom induction was found for both dependent variables: *energy conservation and me* (contrast estimate = .35 [SE = .08], $p < .001$) and *energy conservation and good* (contrast estimate = .32 [SE = .08], $p < .001$).

The results of variance-adjusted ANOVAs on dimension two yielded a significant negative (as inferred from negative correlations between the threat induction and each dependent variable) linear effect of the threat to freedom induction on *recycling and me* (contrast estimate = -.15 [SE = .04], $p = .001$) and *recycling and good* (contrast estimate = -.14 [SE = .04], $p = .002$). Based on these results, it was concluded that the overall motion explored in RQ1 was statistically significant.

To examine whether a pattern of motion observed for *energy conservation* across the control, low threat, and high threat conditions was similar to the pattern of motion observed for the target concept (i.e., *recycling*), planned comparisons identical to the ones conducted for H2 through H4 were performed. Statistical significance for the differences in the distances across conditions of interest was tested by variance-adjusted *t* tests. Recall that because these planned comparisons are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons, thus the significance level for these analyses was (.05/3) or .017. The details of the variance-adjusted *t* tests are presented in Table 16.

First, it was tested whether the distances between *energy conservation* and *me* and *energy conservation* and *good* across the high threat to freedom and the control conditions were significant. The variance-adjusted *t*-test results indicated that across the high threat and control conditions, the distances between *energy conservation* and *good* and *energy conservation* and *me* changed significantly on both dimensions. The mean distances on dimension one for all four dependent variables indicated that greater motion occurred in the high threat condition as compared to the control condition, and on dimension two, greater motion occurred in the control condition as compared to the high threat condition (see Table 16 and Figure 10).

Second, variance-adjusted *t* tests were performed to tests whether the differences in distances between *energy conservation* and *me* and *energy conservation* and *good* across the high threat and low threat conditions were significant. The *t*-test results indicated that across the high and low threat conditions, the distance between *energy conservation* and *good* and *energy conservation* and *me* changed statistically significantly only on dimension one, but not on dimension two. The mean distances on dimension one indicated that greater motion occurred in the high threat condition as compared to the low threat condition (see Table 16 and Figure 10).

Finally, the differences in distances between *energy conservation* and *me* and *energy conservation* and *good* across the low threat to freedom and the control condition were examined. The *t*-test results indicated that neither distances were significantly different. (Note that because these analyses were conducted for a research question, one-tailed tests are not appropriate). The results for RQ1 based on the Galileo analyses were examined next.

First, the differences between the high threat to freedom and the control conditions were examined. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). The results of the Galileo-derived analyses indicated that for behavioral intention, there was no boomerang effect: When threat to freedom was high, the distance between *energy conservation* and *me* (*D energy conservation, me* = 137.40) reduced by 11.21 units (*D energy conservation*, *me* = 148.61) as compared to when the freedom-threatening message was absent. There was, however, a reduced persuasion effect: When threat to freedom was low, the distance between *energy conservation* and *me* (*D energy conservation*, *me* = 98.53) reduced by 38.87 units (*D energy conservation*, *me* = 137.40) as compared to when threat to freedom was high. Receiving a pro-recycling message resulted in an increase in behavioral intention for *energy conservation* in the low threat condition: As compared to the control condition, the low threat to freedom message moved *energy conservation* and *me* 50.08 units closer to each other.[22] This distance is almost twice as much as the amount of persuasion related to *recycling* (i.e., the target concept): As a result of a pro-recycling message, the distance between *recycling* and *me* increased by only 24.48 units when threat to freedom was low as compared to the control condition.

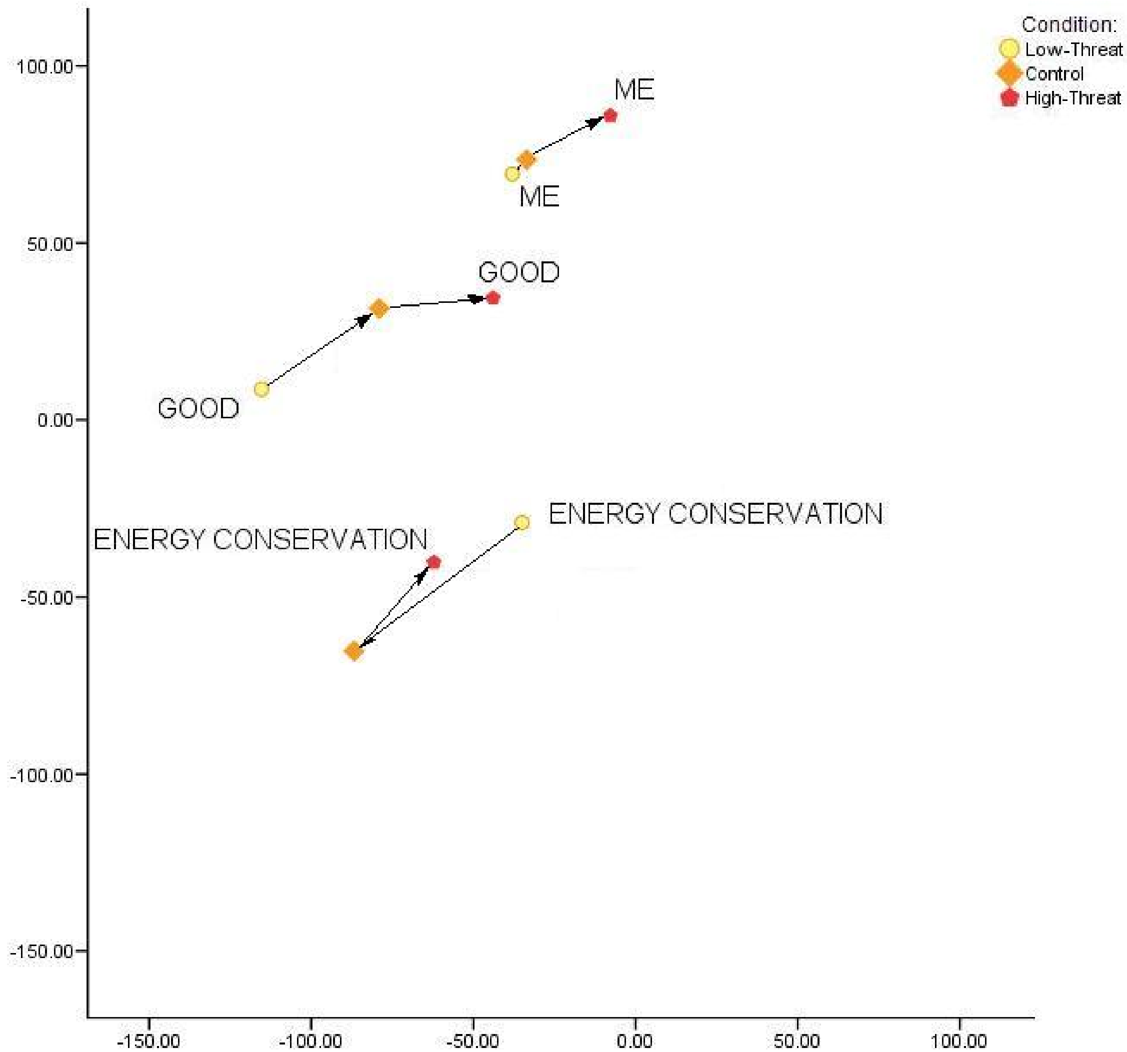


Figure 10. Concept location in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for RQ1 at the immediate time measurement. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

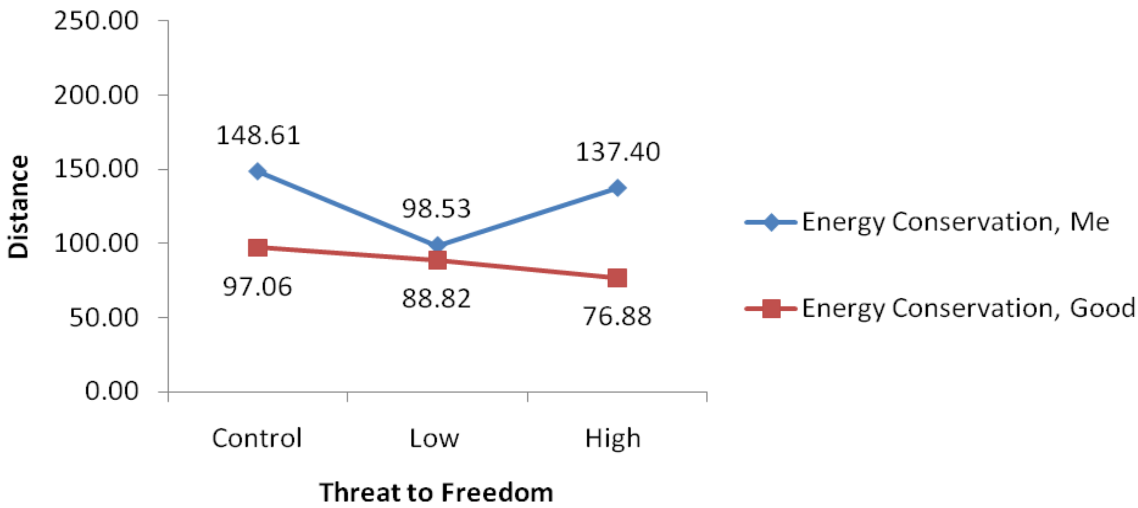


Figure 11. The distances for the listed pairs (derived from the two-dimensional solution using the Galileo analyses) in the low threat, control and high threat conditions at the immediate time measurement (RQ1). Smaller numbers indicate less distance. Distances were anti-transformed.

A similar increase in positive attitude resulted in the case of *energy conservation* and *good*, although to a much smaller degree: As compared to the control condition (in which *D energy conservation*, *good* = 97.06), the distance between *energy conservation* and *good* in the low threat to freedom condition decreased by 11.94 units (*D energy conservation*, *good* = 88.82).[23] However, this difference is only about a half of the amount of persuasion related to *recycling*: As a result of a pro-recycling message, the distance between *recycling* and *good* increased by 25.25 units when threat to freedom was low as compared to the control condition, indicating that the change in the concept targeted by a message were greater in magnitude as compared to the change in the related concept.

Neither reduced persuasion nor a boomerang effect were apparent in the case of positive attitudes: Instead of having the largest distance between *energy conservation* and *good* being in the high threat condition (as compared to the low threat and the control conditions), this distance was the smallest, 76.88 units (as compared to 88.82 units in the low threat condition and 97.06 units in the control condition). It also should be noted that the differences between these numbers are small (and the distances across the low threat and the control condition were not significant based on variance-adjusted *t* tests reported above), indicating the lack of drastic fluctuations between conditions.

In sum, the results for RQ1 have shown that the patterns for the target attitude concept (i.e., *recycling*) do not replicate for the related concept (i.e., *energy conservation*). Instead of a boomerang effect present in the case of *recycling and me* and *recycling and good* at the high level of threat, there was a reduced persuasion effect for the intention to conserve energy (which still resulted in an increased intention to conserve energy as compared to the control condition), and there was an increase in positive attitude to *energy conservation* (as compared to the low threat and control conditions). Next, RQ2 was examined.

Research Question 2

RQ2 asked about the effects of a restoration postscript on *energy conservation* at the immediate time measurement (see Figures 12 and 13). Univariate variance-adjusted ANOVAs with polynomial contrasts were performed. To examine whether the linear effect (i.e., that at the immediate time measurement the amount of reactance from least to most is: low threat with restoration condition, low threat without restoration condition, high threat with restoration condition, and high threat without restoration condition) predicted for the target concept (i.e., *recycling*) also held for *energy conservation*, linear effects similar to H5 were explored first. The independent variable was created representing conditions coded linearly (the low threat with restoration condition coded as 1, low threat without restoration condition coded as 2, high threat with restoration condition coded as 3, and high threat without restoration condition coded as 4). The dimension-specific distances between *energy conservation and good* and *energy conservation and me* (adjusted for the variance accounted for by each dimension as described above) were used as the dependent variables. The details of the variance-adjusted ANOVAs and the bivariate correlations of the independent and the dependent variables (computed to determine the sign of the relationship between the independent and dependent variables) are summarized in Table 17. The results showed a significant positive (as determined from a positive correlation between the independent variable and each dependent variable) linear effect of the independent variable (with conditions coded linearly) on both attitude and behavioral intention for dimension one. For dimension two, the linear effect was not significant.

In sum, based on the results of variance-adjusted ANOVAs, it was concluded that the differences in motion of *energy conservation* and *me* and *energy conservation* and *good* across the low threat with restoration condition, low threat without restoration condition, high threat with restoration condition, and high threat without restoration condition were statistically significant. The details of the Galileo analyses are further discussed next. The Galileo results are represented by Figures 12 and 13. Figure 14 represents the results of RQ2 as an interaction between the threat induction and restoration. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric).

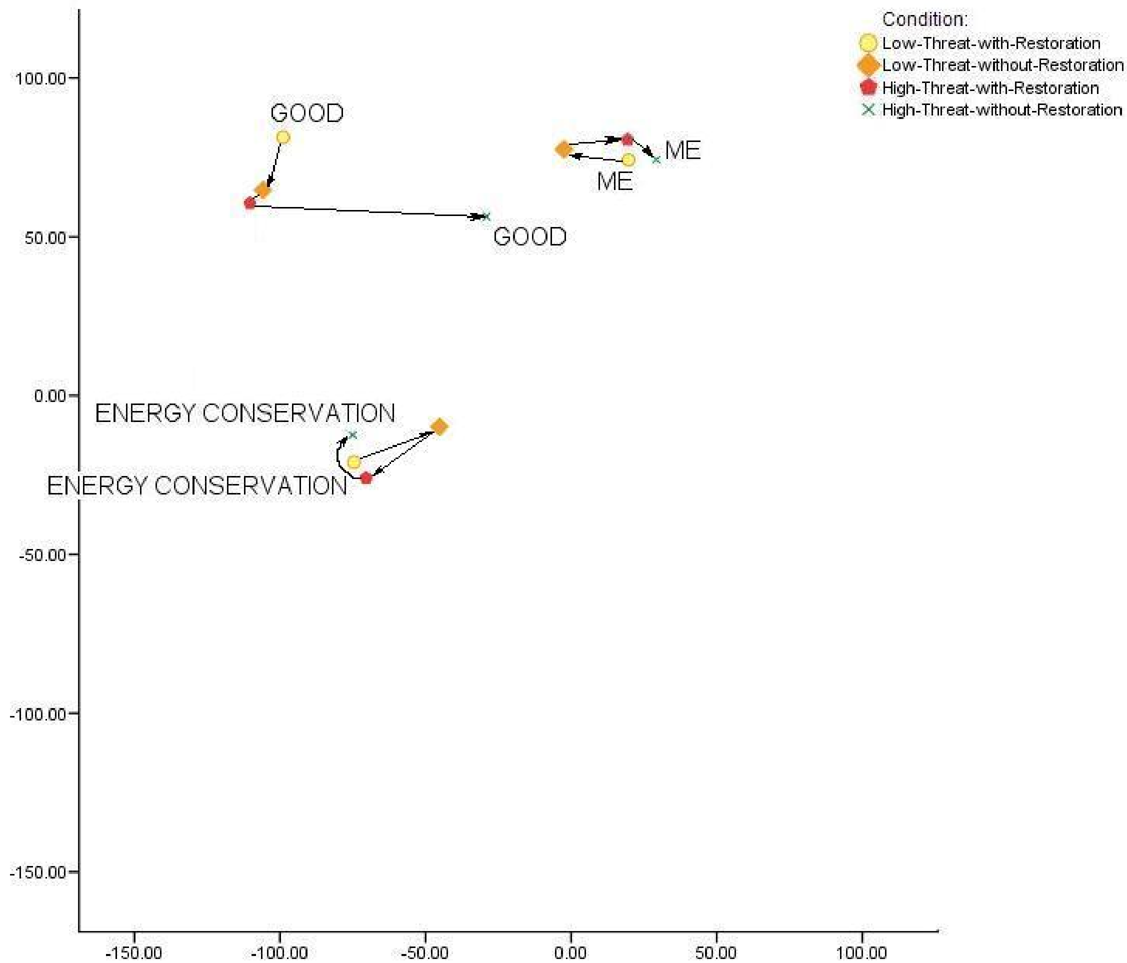


Figure 12. Concept location in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for RQ2 at the immediate time measurement. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

Based on the Galileo analyses, when a high threat to freedom message was paired with the restoration postscript, the results were different from the ones found for the target concept (i.e., *recycling*): Contrary to reactance reduction as a result of a restoration postscript being paired with a high threat to freedom message, an increase in reactance regarding the attitude to energy conservation and a very small increase in reactance regarding the intention to conserve energy were observed: For positive attitude, the presence of a restoration postscript when threat to freedom was high increased the distance between *energy conservation* and *good* by 12.50 units (compare *D energy conservation*, *good* = 82.72 in the high threat without restoration condition vs. *D energy conservation*, *good* = 95.22 in the high threat with restoration condition); for behavioral intention, this increase was substantially smaller 3.63 units (compare: *D energy conservation*, *me* = 135.63 in the high threat without restoration condition vs. *D energy conservation*, *me* = 139.25 in the high threat with restoration condition).[24]

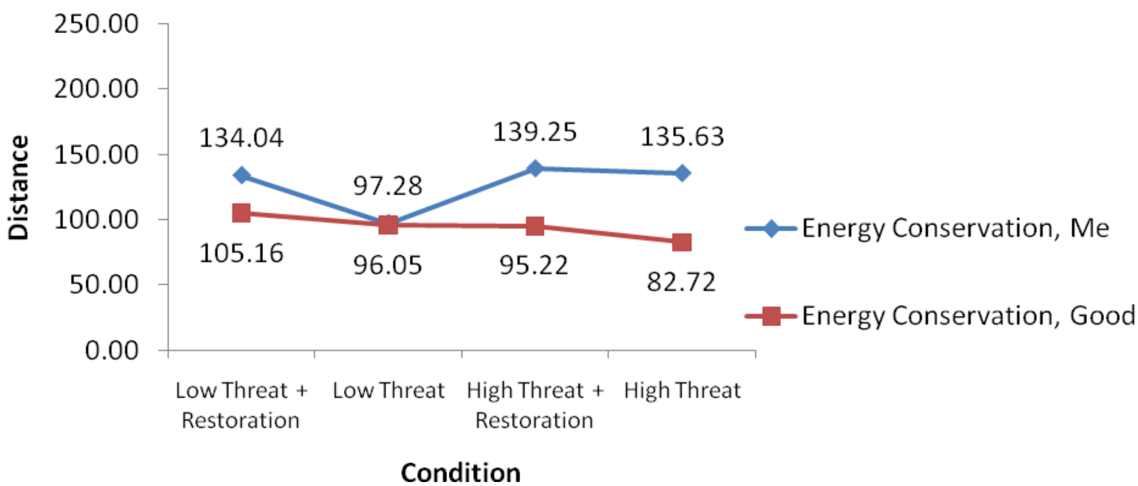


Figure 13. The distances for the listed pairs (derived from the two-dimensional solution using the Galileo analyses) in the low threat with restoration, low threat without restoration, high threat with restoration and high threat without restoration conditions at the immediate time measurement (RQ2). Smaller numbers indicate less distance. Distances were anti-transformed.

When examining the distances for *energy conservation* and *me* and *energy conservation* and *good* across the low threat without restoration and low threat with restoration conditions, results similar to the ones found for *recycling* emerged: For both positive attitude and behavioral intention, a decrease in positive attitude (as determined from an increase in distance between *energy conservation* and *good*) and behavioral intention (as determined from an increase in distance between *energy conservation* and *me*) was found when a low threat message was paired with a restoration postscript. Specifically, the distance between *energy conservation* and *me* in the low threat without restoration condition (*D energy conservation*, *me* = 97.28) increased by 36.76 units as compared to the distance between these concepts in the low threat with restoration condition (*D energy conservation*, *me* = 134.04). The distance between *energy conservation* and *good* in the low threat without restoration condition (*D energy conservation*, *good* = 96.05) also increased by 9.11 units as compared to the distance between these concepts in the low threat with restoration condition (*D energy conservation*, *good* = 105.16).[25]

Figure 14 contains an alternative representation of RQ2. In this figure, the findings for RQ2 are presented as an interaction between the threat to freedom induction and restoration on the distances between *energy conservation* and *me* and *energy conservation* and *good.* These results indicate that there appears to be no interaction effect between the threat to freedom induction and restoration on the distance between *energy conservation* and *good*. Adding a restoration postscript to either the high or low threat message did not affect the positive attitude to *energy conservation*. Regardless of whether a restoration postscript was present or absent, the distance between *energy* *conservation* and *good* was always less in the high threat condition as compared to the low threat condition. Specifically, in the high threat without restoration condition the difference between *energy conservation* and *good* was 13.32 units smaller (*D energy conservation*, *good* = 82.76) than the distance in the low threat without restoration condition (*D energy conservation*, *good* = 96.05); similarly, in the high threat with restoration condition the difference between *energy conservation* and *good* was 9.94 units smaller (*D energy conservation*, *good* = 95.22) than the distance in the low threat without restoration condition (*D energy conservation*, *good* = 105.16).

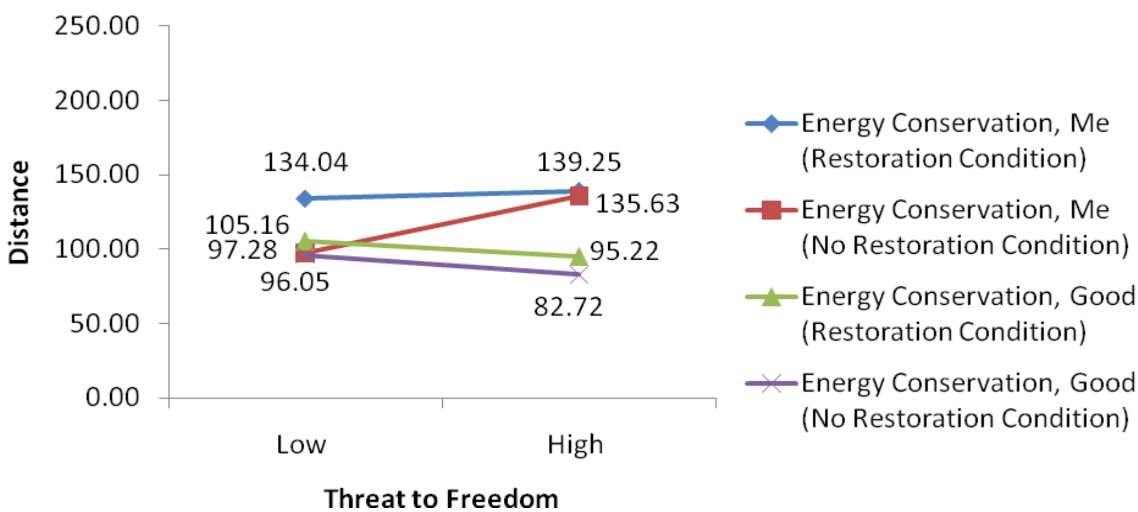


Figure 14. Alternate representation of RQ2 as an interaction between threat to freedom and restoration on the distances between *energy conservation* and *me* and *energy conservation* and *good* (derived from the two-dimensional solution using the Galileo analyses). Smaller numbers indicate less distance. Distances were anti-transformed.

However, there appears to be an interaction between the threat to freedom induction and restoration on the distance between *energy conservation* and *me*. In the absence of a restoration postscript, the distance between *energy conservation* and *me* in the high threat without restoration condition was 135.63 and the distance between *energy conservation* and *me* in the low threat without restoration condition was 97.28, indicating the distance between *energy conservation* and *me* in the low threat without restoration condition was 38.5 units larger than the distance in the low threat without restoration condition. Adding a restoration postscript made the distances between *energy conservation* and *me* across the two levels of threat almost the same: The distance between *energy conservation* and *me* in the high threat with restoration condition was 139.25 and the distance between *energy conservation* and *me* in the low threat with restoration condition was 134.04. (Recall that the same pattern was observed for *recycling* and *me*.)

Taken together, these results indicate that, when threat to freedom was high, adding a restoration postscript affected *energy conservation* (i.e., the related concept) differently than *recycling* (i.e., the target concept): Instead of increasing positive attitude and behavioral intention (i.e., reducing reactance) in the high threat condition, a restoration postscript resulted in virtually no change for behavioral intention and some decrease in positive attitude (i.e., an increase in reactance). When threat to freedom was low, the effect of restoration for the related concept was similar to the effects of restoration for the target concept (i.e., *recycling*): In the case of *energy conservation*, adding a restoration postscript resulted in some reduction in positive attitude (as determined from an increase in distance between *energy conservation* and *good*) and a substantial reduction in behavioral intention (as determined from a substantial increase in distance between *energy conservation* and *good*), indicating an increase in reactance. H6 is discussed next.

Hypothesis 6

The final set of tests dealt with the dynamics of reactance. H6 predicted that there is a decay of reactance that takes place over time. Thus, in the context of these data, a negative linear effect of time on positive attitude (i.e., *recycling and good*) and behavioral intention (i.e., *recycling and me*) was tested. Univariate variance-adjusted ANOVAs were performed to test significance for the motion described in H6. To test the linear effect of time, an independent variable was created, in which the high threat at the immediate time condition was coded as 1, high threat at a one-minute-delay condition was coded as 2, and the high threat at a two-minute-delay condition was coded as 3. The dimension specific distances between *recycling and good* and *recycling and me* (adjusted for the variance accounted for by each dimension as described above) for each of the two dimensions were used as the dependent variables. When threat to freedom was high, the results of the univariate variance-adjusted ANOVAs for dimension one supported the negative (as determined from a significant negative correlation between time and each dependent variable) linear effect of time on both behavioral intention and positive attitude (see Table 18). For dimension two, a positive linear effect emerged for behavioral intention and an inverted-U-shaped effect was found for positive attitude. In the section below the results for H6 based on the Galileo analyses are discussed.

To interpret Galileo results of H6, the trajectories in the high threat to freedom condition had to be examined in the context of the trajectories in the low threat to freedom and the control conditions; therefore, Figures 15 through 18 include the time trajectories for the low threat and the control conditions. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). The results for behavioral intention (i.e., *recycling* and *me*) were examined first.

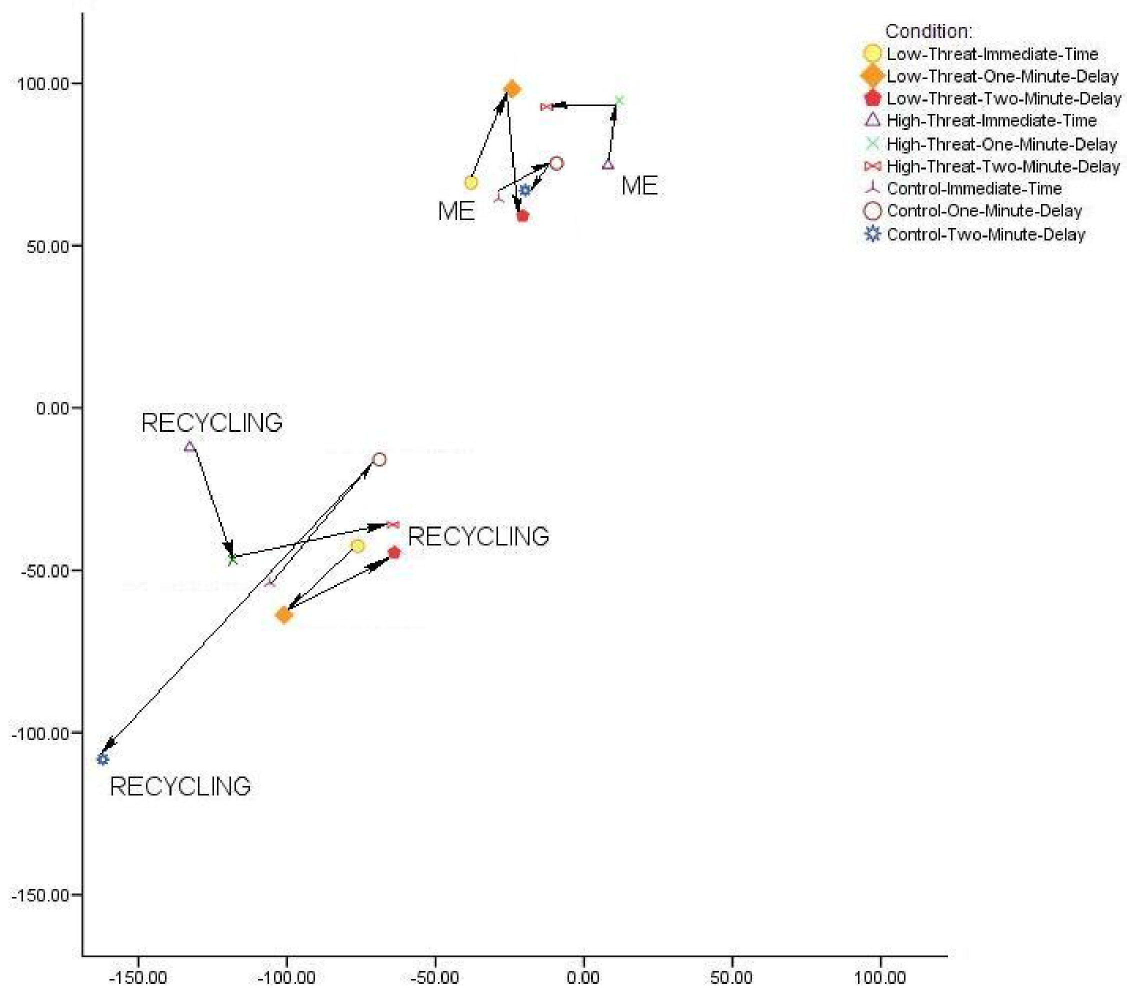


Figure 15. *Recycling* and *me* locations in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for H6 measured at three points in time across low threat, high threat and control conditions. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

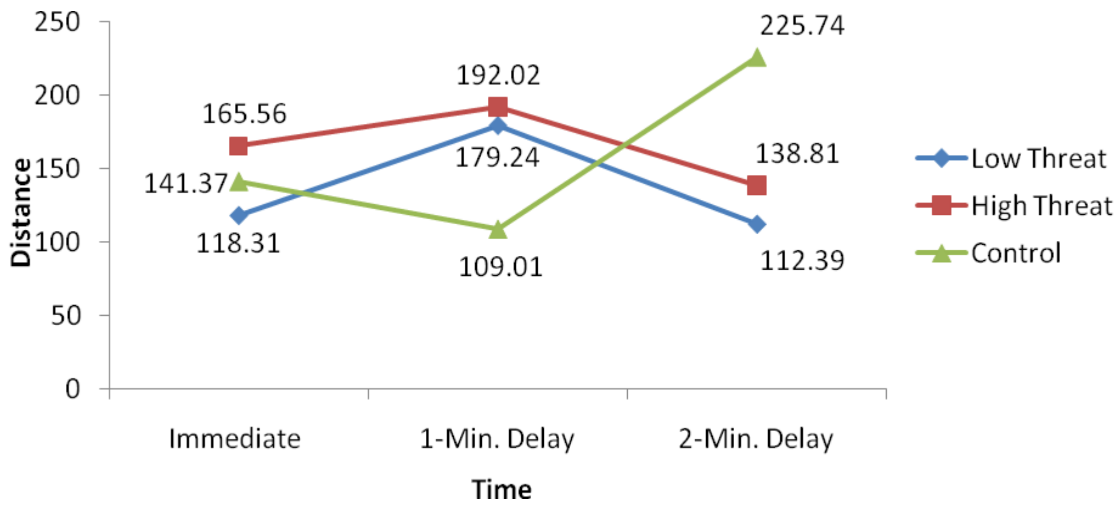


Figure 16. The distances for *recycling* and *me* (derived from the two-dimensional solution using the Galileo analyses) in the low threat, control, and high threat conditions at the immediate time measurement, one-minute, and two-minute delay (H6). Smaller numbers indicate greater less distance. Distances were anti-transformed.

For behavioral intention (see Figures 16 and 17), as predicted, the high threat to freedom induction yielded a boomerang effect at the immediate time measurement: The boomerang effect was inferred from *recycling* being located 24.19 units closer to *me* in the control at the immediate time condition (*D recycling, me* = 141.37) as compared to the high threat at the immediate time condition (*D recycling, me* = 165.56). The boomerang effect persisted and became more pronounced at a one minute delay, resulting in 83.01 units decrease in behavioral intention in the high threat condition (*D recycling, me* = 192.01) as compared to the control condition (*D recycling, me* = 109.01). At a two-minute delay the boomerang effect dissipated as determined from *recycling* being located 86.93 units closer to *me* in the high threat condition (*D recycling, me* = 138.81) as compared to the control condition (*D recycling, me* = 225.74). At a two-minute delay, the reduced persuasion effect was evident, with *recycling* being located 26.42 units closer to *me* in the low threat to freedom condition (*D recycling, me* = 112.39) as compared to the distance between these two concepts in the high threat condition (*D recycling, me* = 138.81). The distance between *recycling* and *me* (*D recycling, me* = 138.81) in the high threat condition measured at a two-minute delay was almost identical to the distance between these two concepts (*D recycling, me* = 141.37) in the control condition taken at the immediate time measurement.

In sum, the results in the high threat condition indicated a boomerang effect at the immediate time, an increase in boomerang effect at a one-minute delay, and a dissipation of the effect at a two-minute delay. At a two-minute delay the behavioral intention to recycle in the high threat condition was almost identical to the behavioral intention in the no-message condition at the immediate time measurement. However, at a two-minute delay the behavioral intention to recycle was still less in the high threat condition than in the low threat condition. Thus, for behavioral intention, H6 was partially supported.

For positive attitude (see Figures 18 and 19) at the immediate time measurement, the data revealed a reduced persuasion effect as determined from the distance between *recycling* and *good* in the high threat condition (*D recycling, me* = 120.54) being 56.07 units greater than in the low threat condition (*D recycling, me* = 64.47). However, there was no boomerang effect (the distances between *recycling* and *good* were almost identical in the high threat condition, *D recycling, me* = 120.54, and the control condition, *D recycling, me* = 118.80).[26] At a one-minute and a two-minute delay, the effects of reactance were reduced (i.e., the distances showed gradual change toward more positive attitude to recycling): In the high threat condition, the distance between *recycling* and *good* was 20.63 units larger at the immediate time measurement (*D recycling, me* = 120.54) as compared to the corresponding distance measured at a one-minute delay (*D recycling, me* = 99.91), and at a two-minute delay this distance reduced further by 4.21 units (*D recycling, me* = 95.70) as compared to the corresponding distance at a one-minute delay.[27] Although in the high threat condition there was an overall increase in positive attitude (as determined from a decrease in distance between *recycling* and *good*) over time, attitudes in the low threat condition across three points in time were always more positive than attitudes in the high threat condition, indicating that a reduced persuasion effect persisted across the three points in time. Overall, the results for attitude offer only partial support for H6.

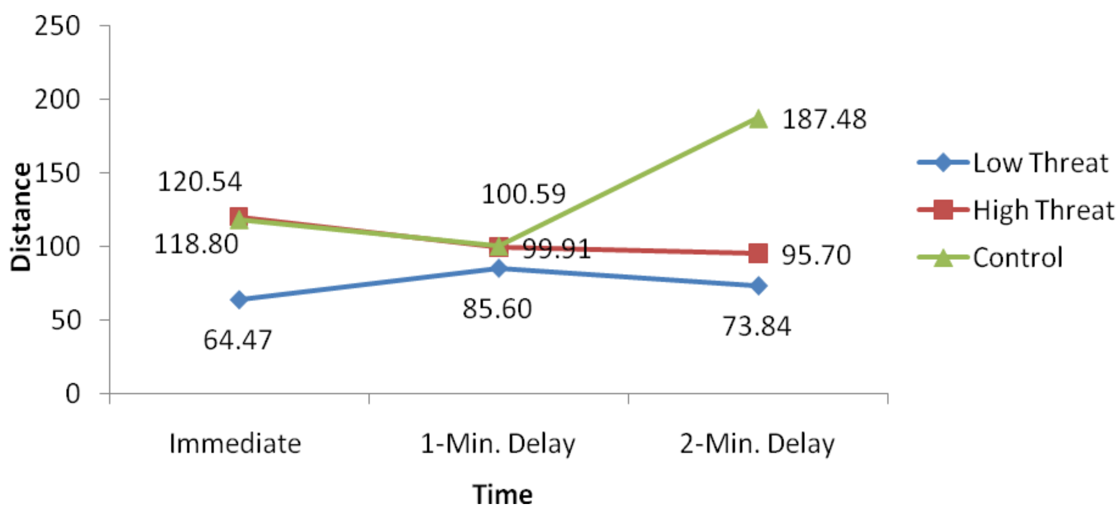


Figure 17. The distances between *recycling* and *good* (derived from the two-dimensional solution using the Galileo analyses) in the low threat, control, and high threat conditions at the immediate time measurement, one-minute, and two-minute delay (H5). Smaller numbers indicate less distance. Distances were anti-transformed.

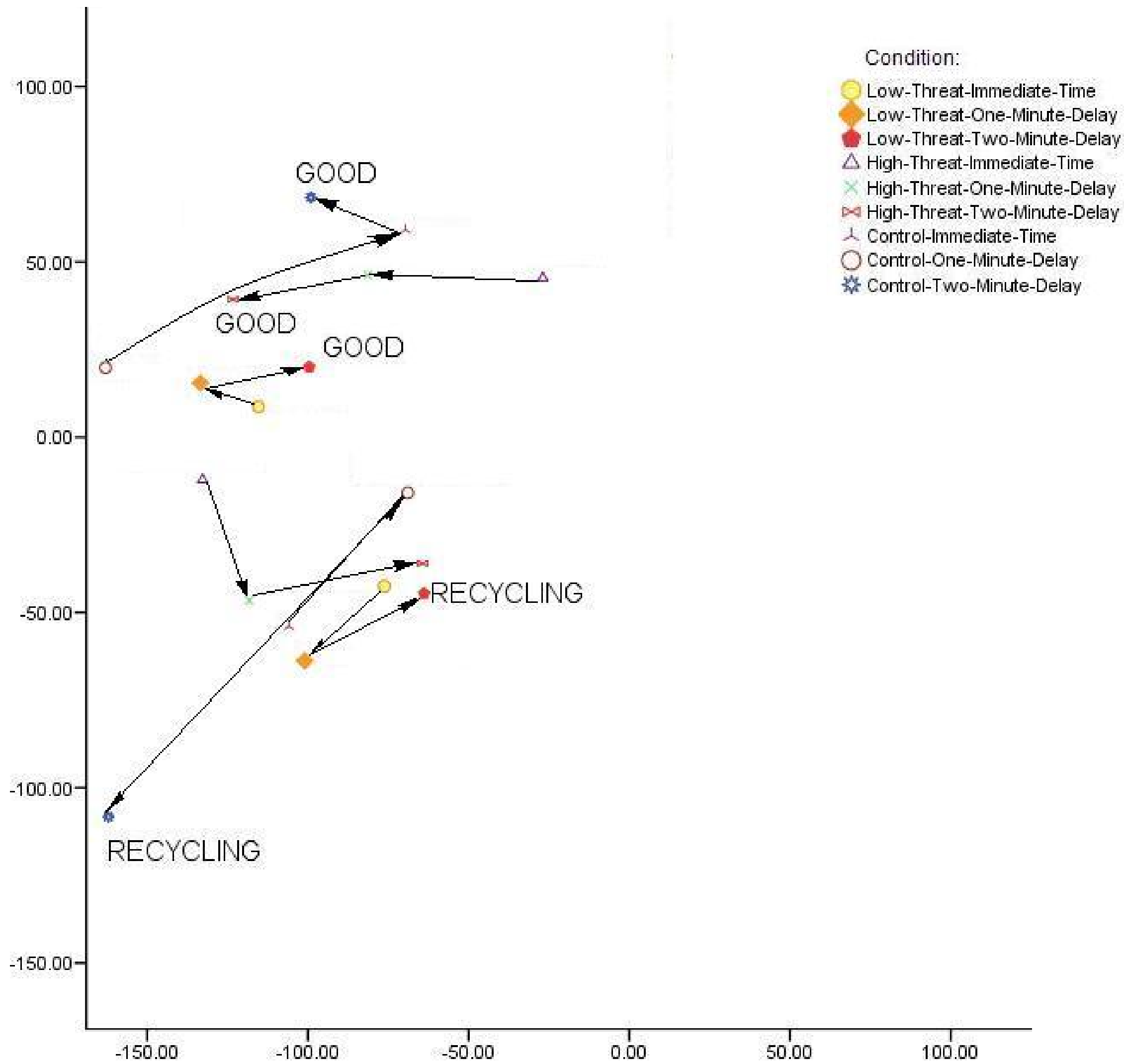


Figure 18. *Recycling* and *good* locations in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for H6 measured at three points in time across low threat, high threat and control conditions. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

Research Question 3

RQ3 asked about temporal trajectories in the target attitude concept as a result of restoration. To represent the linear effect of time, a variable was created in which the high threat at the immediate time condition was coded as 1, high threat at a one-minute delay condition was coded as 2, and the high threat at a two-minute delay condition was coded as 3; this variable was used as the independent variable. The dimension-specific distances between *recycling and me* and *recycling and good* were used as the dependent variables. First, temporal trajectories in the high threat with restoration condition across the three points in time were examined (see Table 19). The results of the univariate variance-adjusted ANOVAs revealed that for dimension one, there was a significant curvilinear (an inverted-U-shaped) effect of time on both dependent variables (i.e., *recycling and me* and *recycling and good*); for dimension two, there was a significant negative linear effect of time on both dependent variables. Second, temporal trajectories in the low threat with restoration condition were examined (see Table 20). The results of the ANOVAs revealed that on dimension one there was a significant positive linear effect of time on both dependent variables (i.e., *recycling and me* and *recycling and good*), and on dimension two there was a significant negative linear effect of time on both dependent variables. Based on the results of variance-adjusted ANOVAs, it was concluded that the differences in motion across the three points in time were statistically significant. The results of the Galileo analyses were examined next.

Based on Galileo results, first, the temporal effects in the high threat with restoration condition were examined. The patterns are presented in Figures 19 and 20. Recall that the data for Galileo analyses were anti-transformed (i.e., the distances reported below are in the original metric). The pattern in the high threat with restoration condition for *recycling* and *me* and *recycling* and *good* were similar and had a curvilinear (inverted-U) shape. When threat was high and the message was paired with a restoration postscript, there were more positive attitude toward *recycling* (*D recycling, good* = 60.52) and greater behavioral intention to recycle (*D recycling, me* = 130.22) at the immediate time measurement, as compared to one-minute delay condition: At a one-minute delay, the distance between *recycling* and *good* increased by 52.30 units (*D recycling, good* = 112.18) and the distance between *recycling* and *me* increased by 15.31 units (*D recycling, me* = 145.54). At a two-minute delay in the high threat with restoration condition, both *recycling* and *me* and *recycling* and *good* moved closer to each other: The distance between *recycling* and *good* decreased by 49.75 units (*D recycling, good* = 63.06), and the distance between *recycling* and *me* decreased by 18.04 units (*D recycling, me* = 127.50). It should be noted that at a two-minute delay in the high threat with restoration condition, the distance between *recycling* and *me* and *recycling* and *good* became almost identical to the distance between these concepts taken at the immediate time measurement.

Second, when a low threat message was paired with restoration postscript, trajectories for attitude and behavioral intention were not uniform as compared to the high threat with restoration condition. In the low threat with restoration condition, trajectories for behavioral intention were linear and flat: The distances between *recycling* and *me* were essentially identical at the immediate time measurement (*D recycling, me* = 132.36) and at a one-minute delay (*D recycling, me* = 132.34), and there was a 9-unit increase in distance at a two-minute delay (*D recycling, me* = 141.24).[28] Temporal trajectories for positive attitude in the low threat with restoration condition were U-shaped: At the immediate time measurement, the distance between *recycling* and *good* (*D* *recycling, good* = 107.28) was 12.04 units greater than at a one-minute delay (*D recycling, good* = 95.24); and the distance at a one-minute delay was 24.47 units smaller than at a two-minute delay (*D recycling, good* = 119.71).

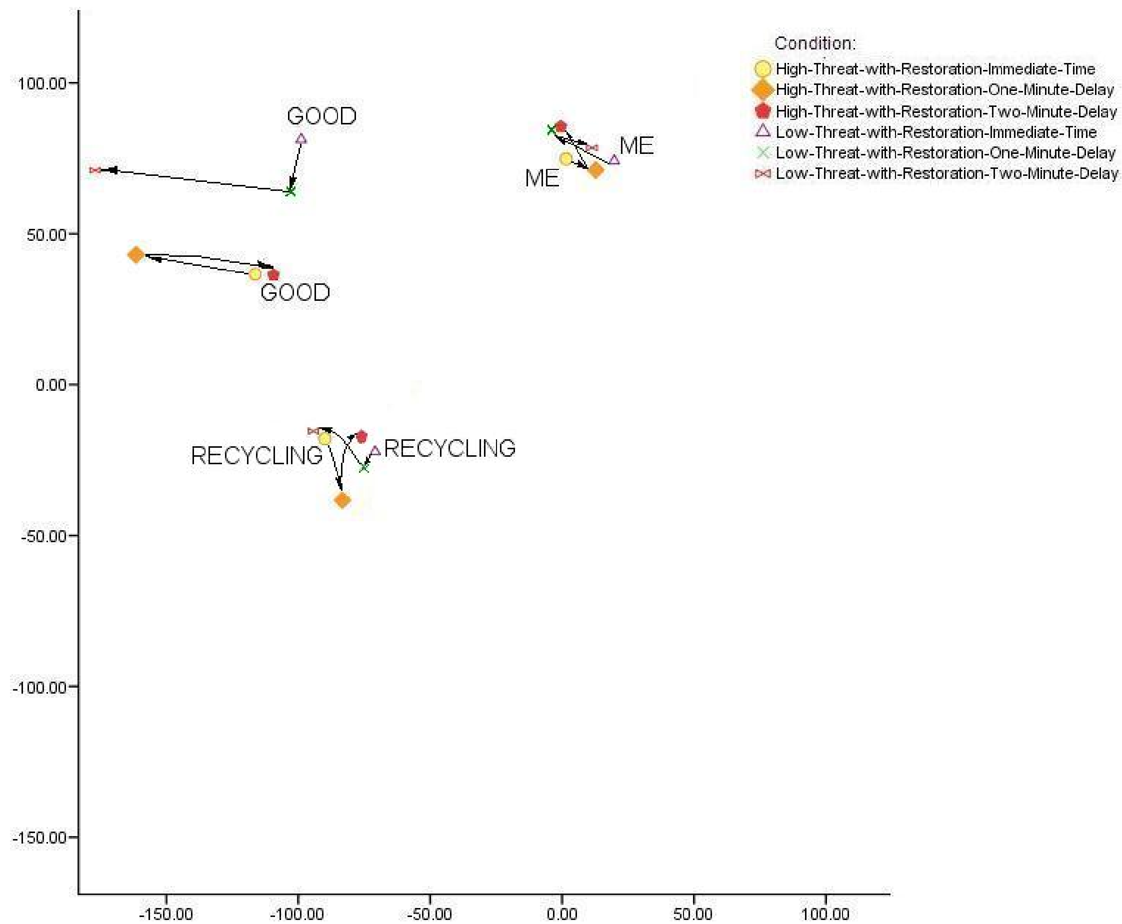


Figure 19. Concept locations in two-dimensional space (the X axis represents the first real dimension, and the Y axis represents the second real dimension) for RQ3 measured at three points in time across low threat with restoration and high threat with restoration conditions. The distances were derived from the two-dimensional solution using the Galileo analyses. Distances were anti-transformed.

In comparing the effect of restoration across the two threat to freedom conditions (low versus high), a few differences in dynamics are notable. For both attitude and behavioral intention, oscillatory patterns were present in the high threat with restoration condition. However, in the low threat with restoration condition, an oscillation was present only in the case of positive attitude, and a very small change was apparent across the three points in time in the case of the behavioral intention.

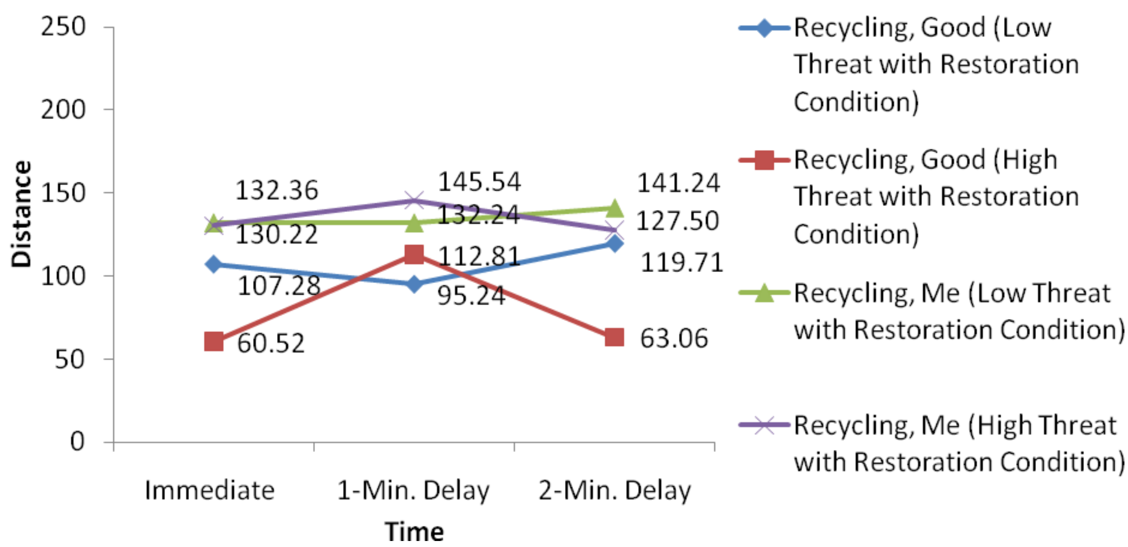


Figure 20. The distances for the listed pairs (derived from the two-dimensional solution using the Galileo analyses) in the low threat with restoration and high threat with restoration conditions at three points in time (RQ3). Smaller numbers indicate less distance. Distances were anti-transformed.

Chapter 5: Discussion

This dissertation examined the effects of freedom-limiting communication on attitude structures at three points in time. The results replicated the findings of the existing research on reactance by showing that at immediate time measurement when threat to freedom was high, a boomerang effect emerged leading to change in attitude and behavioral intention in the direction opposite to the one advocated in the message. This study also advanced the theory of reactance by documenting how threat to freedom affects both the focal attitude concept targeted by the message (here, *recycling*) as well as a related attitude concept (here, *energy conservation*). In addition, the effects of pairing different levels of threat to freedom with a restoration postscript were examined: The findings indicated that adding a restoration postscript to low threat to freedom messages might be detrimental to persuasion as compared to adding a restoration component when threat to freedom was high. Finally, the effects of threat to freedom and restoration over time were considered: The results suggest that reactance effects may not persist over time and may actually be undone to result in more persuasion. These results are further discussed below.

H1 through H4 tested traditional reactance predictions, focusing on reactance effects at an immediate time measurement. The results confirmed the existence of the reduced persuasion effect (H2): When threat to freedom was high, the distance between *recycling* and *me* and the distance between *recycling* and *good* increased as compared to when threat to freedom was low, indicating a significant reduction in positive attitude and behavioral intention to recycle as a result of freedom-threatening communication. Further, as compared to the control condition, the high threat induction also resulted in a boomerang effect (H3): When threat to freedom was high, the distance between *recycling* and *me* and the distance between *recycling* and *good* increased as compared to the control condition, indicating that freedom threat resulted in motion away from the initial attitude and behavioral intention regarding recycling. There was also an increase in persuasion in the low threat to freedom condition as compared to the control condition (H4): When threat to freedom was low, *recycling* and *me* and *recycling* and *good* moved closer to each other as compared to the control condition, indicating a significant increase in positive attitude and behavioral intention to recycle when low threat to freedom message was received. Interestingly, the magnitude of change in the low-threat condition (as compared to the control condition) was identical for both positive attitude (i.e., *recycling* and *good*) and behavioral intention (i.e., *recycling* and *me*).

Overall, a U-shaped effect of the threat to freedom induction on positive attitude and behavioral intention emerged (as predicted in H1): As a result of the threat to freedom induction, the least distance for *recycling* and *me* and for *recycling* and *good* was found when threat to freedom was low as compared to both the control condition and when threat to freedom is high. However, the distance between *recycling* and *me* and the distance between *recycling* and *good* was significantly greater when threat to freedom was high as compared to the control condition. Taken together, the results for positive attitude and behavior intention replicated the effects found in earlier research. Such replication is critical: It attests to the success of this study even though a novel method was used and it also supports the results of the past research on reactance, suggesting that reactance effects can be assessed with different methods. The section below discusses the effects of the reactance induction on the negatively valenced pairs of concepts.

Although in the traditional conceptualization of the reduced persuasion and boomerang effects, only positive attitude (here, the distance between *recycling* and *good)* and behavioral intention (here, the distance between *recycling* and *me*) are considered; the distances between *recycling* and *bad* and *recycling* and *anger* were also examined. The results indicated that when threat to freedom was high, *recycling* was not perceived more negatively than when threat to freedom was low (contrary to H2). Instead, *recycling* was viewed as substantially (64.39 units) less negative and somewhat (10.54 units) less angering when threat to freedom was high as compared to when threat to freedom was low. *Recycling* was also predicted to move closer to *bad* and *anger* in the high threat condition as compared to the control condition (H3). This prediction only held for *anger*, which, as predicted, was located closer to *recycling* in the high threat condition as compared to the control condition. However, contrary to H3 prediction, *recycling* moved further from *bad* when threat to freedom was high as compared to the control condition. A similar lack of support was also found for H4: Contrary to the predicted greater distance between *recycling* and *bad* and *recycling* and *anger* in the low threat condition as compared to the control condition, the opposite was observed as the distance between these concepts was smaller in the low threat condition as compared to the control condition.

These results indicate that despite the traditional conceptualization of *good* and *bad* as the end points of an evaluative continuum, this does not seem to hold for the present results. These data suggest that perceiving things as being not good does not always imply that those things are automatically evaluated as being bad (a similar observation is also reported in Woelfel & Fink, 1980, p. 79). Perhaps when measuring phenomena such as reactance, positive and negative attitudes about the concepts targeted in the message should be examined separately. In addition, it might be the case that reactance only persists for the concepts that are simultaneously evaluated as less positive and more negative, indicating that these concepts are perceived as equally bad across both positive (as determined from the distance between the *target concept* and *good*) and negative (as determined from the distance between the *target concept* and *bad*) evaluative dimensions; and reactance effects may be less stable for the concepts that are perceived less positively, but not more negatively. In addition to the effects of reactance, the effects of restoration on persuasion were examined. These results are discussed below.

In H5, the effects of a restoration postscript were proposed. H5 posited that at the immediate time measurement the amount of positive attitude (as determined from the distance between *recycling* and *good*) and behavioral intention (as determined from the distance between *recycling* and *me*) from least to most is: high threat to freedom without restoration condition, high threat to freedom with restoration condition, low threat to freedom without restoration condition, low threat to freedom with restoration condition. Simply put, a restoration postscript was expected to alleviate the effects of reactance in the high threat condition, and in the low threat condition, restoration was expected to reduce any effects of threat to freedom that may be due to persuasion (see Burgoon, Alvaro, Grandpre, et al.'s, 2002, contention than any persuasive attempt may be freedom threatening). Based on these data, the restoration postscript was indeed effective at reducing reactance in the high threat to freedom condition: When a restoration postscript was paired with a high threat message, the attitude to recycling and behavioral intention increased (as compared to when a restoration postscript was absent). Moreover, the effect of the high threat with restoration message became either closer to (as in the case of behavioral intention) or better (as in the case of attitude) than the effect of the low threat without restoration message.

However, pairing a restoration postscript with a low threat to freedom message reduced message effectiveness by reducing behavioral intention and making attitudes toward the target concept less positive as compared to the effects of low threat without restoration message. One possible explanation for these effects is that at high levels of threat, a simple acknowledgement that it is still up to the individuals to make up their minds alleviates the effects of reactance. However, at low levels of threat, the restoration postscript perhaps points to the fact that the message is trying to overtly influence people's opinions and as a result triggers greater reactance. These results are consistent with Bessarabova, Turner, and Fink (2007), who found that certain message components (e.g., including a guilt appeal in a message) may increase the realization that a message is manipulative and may subsequently result in reactance manifested as reduced persuasion. The results regarding the effects of reactance on the attitude concept related to the target concept are discussed below.

In addition to examining the effects of reactance on the target concept, changes in the location of the related concept (here, *energy conservation*) were examined. The rationale for these tests came from Dinauer and Fink's (2005) suggestion that there is more to attitude change than simply changes in the target attitude concept, and the motion of other concepts associated with the target attitude concept should be considered. A research question (RQ1) was posed about the motions at the immediate time measurement of *energy conservation* as a related concept. The results for RQ1 showed that the patterns found for the target attitude concept (i.e., *recycling*) were not found for the related concept (i.e., *energy conservation*). Instead of the boomerang effect evident for *recycling and me* and *recycling and good* at the high level of threat, there was a reduced persuasion effect for the intention to conserve energy (which resulted in an increased intention to conserve energy as compared to the control condition; i.e., there was no boomerang effect); and there was an increase in positive attitude to energy conservation (as compared to both the control condition and the low threat condition).

Overall, for behavioral intention, receiving a high threat message was better (in terms of pro-energy-conservation attitude change) than receiving no message; but receiving a low threat message was still better than receiving a high threat message. The positive attitude for energy conservation was most positive in the high threat condition, followed by the low threat and then the control conditions (but recall that the difference between the low threat condition and the control condition was not significant). These results suggest that the detrimental effects of reactance are only applicable to the target attitude concept, and other related concepts may instead show an increase in positive attitude and behavioral intention as a result of a reactance-inducing communication.

In sum, the results of RQ1 were consistent with Dinauer and Fink's (2005) findings showing that targeting some attitudes by persuasive messages led to changes in other related concepts despite the fact that the message did not explicitly target those related concepts. More research is needed to test these relationships. Because attitude structures appear to be sensitive to the changes in any of its components, it is likely that in addition to the effects of the threat to freedom, the inclusion of a restoration component will also lead to changes in the related attitude concept. These effects were examined in RQ2.

RQ2 asked about the effects of a restoration postscript on the related attitude concept *energy conservation* at the immediate time measurement. RQ2 results indicated that when threat to freedom was high, adding a restoration postscript affected *energy conservation* (i.e., the concept related to the target attitude concept) differently than *recycling* (i.e., the target concept): Instead of increasing positive attitude and behavioral intention (i.e., reducing reactance), a restoration postscript resulted in a decrease in positive attitude (i.e., an increase in reactance) and no change in behavioral intention. When threat to freedom was low, the effects of restoration for the related attitude concept were similar to the effects of restoration for the target concept: In the case of *energy conservation*, adding a restoration postscript resulted in some reduction in positive attitude (as determined from an increase in distance between *energy conservation* and *good*) and a substantial reduction in behavioral intention (as determined from an increase in distance between *energy conservation* and *me*), indicating an increase in reactance. Further, for the intention to conserve energy, adding a restoration postscript erased the differences between the low threat and high threat messages and made the magnitude of distance between *energy conservation* and *me* in the low and high threat with restoration conditions the largest as compared to other conditions (although the magnitude of difference in distances between the high threat without restoration and a high threat with restoration conditions was almost the same). These results indicate that a restoration postscript had adverse effects on the attitude concept related to the target attitude concept: Including a restoration postscript consistently resulted in a decrease in positive attitude toward energy conservation and behavioral intention to conserve energy, the magnitude of change for behavioral intention in the high threat with restoration condition as compared to the high threat without restoration condition suggests that the adverse effects of the restoration postscript in this case were rather small. The reasons for these adverse effects are unclear. Further research is required to understand the mechanisms leading to these effects.

The final set of analyses dealt with the dynamics of reactance. H6 predicted that there is a decay of reactance that takes place over time. For behavioral intention, as predicted, the high threat to freedom caused a boomerang effect at the immediate time measurement, but, contrary to prediction, the boomerang effect persisted and became more pronounced at a one-minute delay. At a two-minute delay the boomerang effect dissipated and only a reduced persuasion effect was present. These results indicate the presence of an oscillation in behavioral intention as a result of reactance-inducing communication: a boomerang effect at the immediate time measurement, an increase in boomerang effect at a one-minute delay, and a dissipation of the effect at a two-minute delay. At a two-minute delay the behavioral intention to recycle was almost identical to the behavioral intention in the no-message condition at the immediate time measurement. However, at a two minute delay the behavioral intention to recycle was still less in the high threat condition as compared to the low threat condition.

For positive attitude at the immediate time measurement, the data revealed a reduced persuasion effect, but not a boomerang effect. At a one-minute and a two-minute delay, the effects of reactance were gradually declining (i.e., the distances showed gradual movement toward more positive attitude to recycling). Although in the high threat condition there was an overall increase in positive attitude over time, attitudes in the low threat condition were always more positive than attitudes in the high threat condition, indicating that a reduced persuasion effect persisted across the three points in time.

RQ3 asked about temporal trajectories in the target attitude concept as a result of restoration. The patterns in the high threat with restoration condition for both attitude and behavioral intention were similar and curvilinear (U-shaped).[29] When threat to freedom was high and the message was paired with a restoration postscript, there were both a more positive attitude toward *recycling* (as determined from a decrease in distance between *recycling* and *good*) and a greater behavioral intention to recycle (as determined from a decrease in distance between *recycling* and *me*) at the immediate time measurement and at a two-minute delay as compared to the one-minute delay. At a two-minute delay in the high threat with restoration condition, the positive attitude and behavioral intention were almost identical to the positive attitude and behavior intention recorded at the immediate time measurement, suggesting that at a two-minute delay both attitude and behavioral intention returned to their initial position after an oscillation. When a low threat message was paired with a restoration postscript, temporal trajectories for attitude and behavioral intention were not uniform as compared to the high threat with restoration condition. In the low threat with restoration condition, temporal trajectories for behavioral intention were linear and somewhat flat, showing no change between the immediate time measurement and a one-minute delay, and then a decrease in behavioral intention at a two-minute delay. Temporal trajectories for positive attitude in the low threat with restoration condition were curvilinear (inverted-U-shaped), showing a more positive attitude to recycling (as determined from a dencrease in distance between *recycling* and *good*) at a one-minute delay and a less positive attitude (as determined from an increase in distance between *recycling* and *good*) at the immediate time measurement and a two-minute delay.[30]

Overall, across the two levels of threat to freedom (low vs. high), restoration (absent vs. present) and three points in time, attitudes to recycling were greater in magnitude as compared to behavioral intentions, indicating that attitudes may be more malleable and easier to change as compared to behavioral intentions. In addition, the magnitude of change was greater for attitudes as compared to the behavioral intentions. It is likely that when an individual’s attitudinal position is being considered, a greater number of possible attitudinal positions may come to mind, which makes greater fluctuations in attitudinal positions possible. An intention to perform a behavior might be more restricting, because it is more grounded in objective reality and involves specific steps of planning and implementation.

In addition to the hypothesis tests, another issue that merits discussion is the time of manipulation checks, specifically the time of manipulation check for anger. Although a pilot test (see Pilot Study 4) indicated that the threat manipulation was successful with regard to its anger-inducing ability, the traditional manipulation check for anger conducted in the main study did not yield a significant difference in anger for high threat versus low threat inductions. A potential explanation for this failure of the threat manipulation to affect perceived anger is the time when the manipulation check was administered in the main experiment. Traditionally, reactance research employs manipulation checks immediately after the threat induction (e.g., Dillard & Shen, 2005), but in this study the anger manipulation check was at least 10 minutes after reading the message. This delay was because the participants were asked to estimate pairwise dissimilarities between the concepts first, which made sense because individuals' attitudes structures were the focus of the study. It is likely that emotional states are more volatile as compared to the opinions regarding whether or not the participants felt pressured by the message. Moreover, the question was worded as *How angry do you feel after reading the message?*, which might have been interpreted as inquiring about participant's current emotional state. (Note that this wording is consistent with the wording typically used in manipulation check questions inquiring about emotional states; see, e.g., Mitchell, Brown, Morris-Villagran, & Villagran, 2001.)

It should be noted, however, that when the participants were asked how irritated they were at the message source, the results indicated that the manipulation check for the threat to freedom induction on perceived irritation was successful. A potential explanation for why this induction check was successful comes from the research on emotion indicating that angry people (as opposed to people in other emotional states) are always aware of the source of their anger (e.g., Nabi, 2002). Thus, connecting the source of the message with anger (or, in this case, irritation) became a better manipulation check item at a more delayed time point.

This lack of the effect of threat to freedom induction on anger measured 10 minutes after the receipt of the message also raises an interesting question regarding the persistence of reactance effects. The dynamics of reactance explored in this study indicate the reduction in reactance effects at a two-minute delay (as evident from the presence of a reduced persuasion effect, not a boomerang effect), but because only three points in time were used, there are not enough data to show further reduction in the effects of reactance. However, the difficulty in finding anger effects after 10 minutes may suggest that at least some of the effects of reactance may not persist. The implications of these effects are further discussed below.

Implications

This study has several important implications for future research directions. Although much research involving reactance begins with the discussion of adverse effects that are due to reactance, no attempts have been made to examine whether these effects persist beyond the initial measurement. The Galileo-derived trajectories explored in this study point to an overall decrease in reactance at a two-minute delay for both attitude and behavioral intention. These temporal patterns and the reduction of anger 10 minutes after the threat to freedom induction imply that although boomerang effects may be of concern at the immediate time, the over-time effects might not be as detrimental (i.e., leading to a reduction in positive attitudes and behavioral intentions) as the initial effects might suggest. Furthermore, the effect of the threat to freedom on the related attitude concept that resulted in more positive behavioral intention (as compared to no-message control) and the greatest amount of positive attitude (as compared to the low threat and the control conditions) suggest that for a related concept, receiving a freedom-threatening message may result in persuasion. The present results, however, only offer initial evidence of a reduction of reactance over time and is far from definitive: More time points (i.e., examining reactance at more than three time points) and longer time periods (i.e., examining reactance days and weeks after the induction) need to be explored in the future.

Based on the results of the anger manipulation, a question remains regarding the role of anger in reactance, particularly over time. Dillard and Shen (2005) proposed that anger and negative cognitions are an amalgam consisting of two different indicators (i.e., cognitive and affective) when measured immediately after the threat to freedom induction. The results of the manipulation checks indicate that perception of threat, negative cognitions, and irritation at the source of the message did persist for some time after the reactance induction, but feelings of anger were not reported after (approximately) a 10-minute delay. Even if reactance-related anger dissipates over time, the initial feeling of anger might increase message-consistent attitudes and behavior change. Because anger is argued to increase attention (Turner, 2007) and cognitive elaboration (e.g., Nabi, 1999, 2002), it likely that if a message advocates some specific behavior, those recommendations will be better remembered if there is a high threat to freedom message as compared to a low threat to freedom message. Examining the effects of anger over time will help shed light on the temporal effects of reactance. This study also offers insights regarding restoration effects on reactance, which are discussed next. The results of this study suggest that restorations should be used with caution because they may not yield the expected results. Undoubtedly, restorations achieved through the inclusion of additional information designed to restore individuals' freedoms are tempting techniques to use for researchers and practitioners alike: As C. H. Miller et al. (2007) noted, restorations are simple and seem to be an easy solution to reducing reactance. The results of this study offer mixed support for the effectiveness of restoration postscripts: In this study, a restoration postscript resulted in pro-recycling change (as determined from a decrease in distance between *recycling* and *good* and *recycling* and *me*) only when threat to freedom was high, but it led to less positive attitude (as determined from an increase in distance between *recycling* and *good*) and a decrease in behavioral intention (as determined from an increase in distance between *recycling* and *me*) when threat to freedom was low. Moreover, including a restoration postscript was detrimental to the related attitude concept (i.e., *energy conservation*) across both high and low threat to freedom conditions because it resulted in less positive attitude toward energy conservation and a decrease in behavioral intention to conserve energy (as compared to when high and low threat messages were not paired with restoration).[31] These results, however, only address one type of restorations; more research is needed to compare different types of restoration and to examine their effects on both the target and related attitude concept.

In addition to the theoretical implications, the results of this study are relevant for practitioners in the areas of message design and persuasion. First, this study suggests that exploring target audiences' attitudes in the context of cognitive structures is important because it allows for determining the effects of a persuasive message on other related concepts in those structures. Second, the study shows that practitioners should be cautious about including restoration components as a means of preemptive reactance control, because the effects of such restorations may lead to reduce persuasion or boomerang effects for both target concepts as well as other related concepts in the attitude structure.

Limitations

There are a few limitations of this dissertation that merit discussion. First, a single topic was used (see Jackson, 1992, for a discussion of the effects of a single-topic use on the generalizabilty of findings). Perhaps somewhat different effects would have been found had the topic been different. Although research reactance and resistance shows consistent effects across topics (see e.g., Dillard & Shen, 2005; Pfau et al., 2009; Rains & Turner, 2007), differences in message topic might lead to differences in persuasion. For example, Fink et al. (2006) examined the effect of topic on information integration: Different information integration approaches were found based on whether a topic was optative (i.e., indicating a desire, such as a tuition decrease) versus indicative (i.e., indicating a non-evaluative belief, such as global warming). Previous research on reactance has shown that a few requirements have to be met for a topic to be appropriate for a reactance induction: The topic has to be pro-attitudinal (Worchel & Brehm, 1970) and at least somewhat involving (S. S. Brehm & Brehm, 1981). Beyond these two concerns, differences in topic have not been explored. Based on Fink et al.'s (2006) results, examining the differences based on whether a topic represents a fact (i.e., is indicative) versus a desire (i.e., is optative) makes sense: It might be harder to induce reactance if a message deals with facts as opposed to desires.

Second, only one attitude object related to the target concept was explored in this dissertation. There may have been different results had a different concept been selected. In this study, a related concept equivalent to *recycling* was used. Rains and Turner (2007) provided some evidence that a different attitude concept might have been affected differently by reactance. One of the relationships that Rains and Turner examined was the effect of the magnitude of the request on reactance: Their results indicated that reactance increased when the request was large and reduced when the request was small. The authors suggested that an increase in reactance was due to a perceived imposition on individuals' time and resources when a request was large. Perhaps if a related concept was *organizing a pro-recycling rally* instead of *energy conservation,* the related attitude concept might have been more affected by reactance-inducing communication. Future research needs to systematically vary the features of a related attitude concept (including a magnitude of the request) to examine whether these features in a related attitude concept make as much difference as they make in the target attitude concept.

Finally, although analytical difficulties were successfully resolved in the present study, the analytical strategy used in this study is cumbersome. Collaboration between Galileo researchers and software developers is required to automate the process of significance testing to make it more user-friendly and to encourage further research in the realm of the Galileo theory and modeling.

In conclusion, this study was a successful attempt at examining the effects of freedom-limiting communication on attitude structures at three points in time. The results replicated the findings of the existing research on reactance. In addition, this study advanced the theory of reactance by examining threat to freedom effects on related concepts (in addition to the target concept). This study also contributed to reactance research by testing the effects of restoration on reactance. In sum, the present research is important for both theorists and practitioners of attitude change and resistance; however, further research is required to continue examination of reactance-related phenomena.

Endnotes

[1] There are many kinds of boomerang effects (for details, see Quick & Stephenson, 2007b).

[2] In the studies referred to in this sentence the effect of reactance was determined from the negative coefficients between reactance and the attitude concept.

[3] The association between concepts is assessed by the retrieval of concepts from memory; the faster the retrieval, the stronger the association (e.g., Anderson, 1983).

[4] The behaviors that people lack awareness of or lack the ability to execute are not free behaviors.

[5] In R. L. Miller's study, reactance was inferred from the reduced attitude ratings as compared to the control group's ratings.

[6] Explaining his findings, R. L. Miller mistakenly labeled his results in the overexposure condition a boomerang effect. However, the examination of his means suggests that attitude change in the direction opposite to the position advocated in the message did not occur.

[7] The scores derived from these averaged measures may have to be transformed depending on the extent to which the data meet the assumptions necessary for data analysis.

[8] For example, in the Pilot Study 4 one of the variables measuring anger (namely, *How irritated do you feel after reading the message?*) had a skewness value of 3.73 (SE = 0.37, n = 40), indicating that the assumption of normality appeared implausible. After transformation the skewness became 0.38 (SE = 0.37).

[9] Although people may differ in their beliefs regarding global warming, the majority of individuals in the U.S. do believe that global warming exists. The Pew Research Center for the People and the Press (2008) survey data from a large nationwide sample indicated that in the beginning of 2007 (when the data for this study were collected) 77% of Americans believed that "there is solid evidence of higher global temperatures" (p. 2).

[10] More topic-relevant concepts could have been generated. However, adding more concepts to the cognitive space may increase the dimensionality of that space; and completing all possible pairwise comparisons of a large number of concepts can be taxing for research participants. Therefore, it is reasonable to keep the overall number of concepts around 10.

[11] In Dillard and Shen (2005) as well as C. H. Miller et al. (2007), a three-item threat index was used. Based on the reliability analysis performed in this dissertation, the item asking participants how much the message threatened their freedom to make a decision themselves was not included into the final index.

[12] None of the cases were dropped as a result of the trimming.

[13] To take variance explained by a particular dimension into consideration at least three different approaches were possible: (1) using the total of eigenvalues for all dimensions in a particular space; (2) using the sum of positive eigenvalues only; or (3) using the sum of the eigenvalues for the two dimensions only. Any one of the three alternatives was appropriate. For this analysis, however, the first option was used. Using the total of eigenvalues for a particular space is a more conservative approach: Instead of assuming that the solution is two-dimensional or that only the dimensions with positive

eigenvalues are meaningful, the information from all dimensions was used.

[14] The estimate that these steps have to be repeated 60 times was determined by multiplying fifteen conditions total by four (i.e., three jackknifed subsamples and one sample including all the data that were transformed). To be able to generate spaces in the original metric (where 100 indicated moderate difference), the data had to be anti-transformed. Therefore, this fourth set of data necessary for the calculations of the pseudo-variability information could not have been derived from the previous analyses.

[15] This connection of anger with the particular source causing these angry feelings is also consistent with the research on emotion indicating that angry people (as opposed to people in other emotional states) are always aware of the source of their anger (see, e.g., Nabi, 2002).

[16] Recall that H1 proposed an inverted-U-shaped effect of the amount of threat on positive attitude and behavioral intention. (In terms of distances, this effect has a U-shape.)

[17] The same approach was applied here as in the case of variance-adjusted ANOVAs. Specifically, to remedy the lack of dimensionality information in the ANOVAs and *t* tests, an approach was developed allowing the amount of variance explained by each of the two dimensions to be taken into account. To do so, the transformed scores derived from the participants' pairwise dissimilarity estimates for a specific cognitive space (i.e., condition) were multiplied by the ratio of eigenvalue for that dimension to the total eigenvalues for all dimensions in that particular space. The same procedures were repeated for both dimensions for all conditions. The calculations for the eigenvalue formula are provided in Table 5.

[18] Recall that, as discussed in the method chapter, hypotheses in this dissertation were tested using the Pythagorean approach that allows calculating distances between concepts of interest in two-dimensional space. However, based on the significance-testing strategy reported in the method chapter, performing variance-adjusted ANOVAs and *t* tests determines significant motion of concepts across conditions for each of the two dimensions separately. A similar approach, in which the motion on each dimension is determined separately, was used in the modified jackknife procedure. Therefore, two pieces of evidence were considered to ascertain whether the motion across conditions was significant. First, it was established whether there was a statistically significant motion on at least one dimension as determined from the variance-adjusted ANOVAs and *t* tests. Second, the magnitude of the difference across conditions, as determined from the Pythagorean approach, was examined: A 10-unit difference was selected as an arbitrary cut-off point. If a difference between conditions was less than 10 units and the motion on neither dimension was not significant, such difference was considered not significant. In the case of contradictory results (e.g., a lack of significance on either dimension as determined from the variance-adjusted ANOVAs and *t* tests, but a substantial magnitude of difference based on the Pythagorean approach), the Pythagorean approach results was given more weight. Note that this issue arose only once in this dissertation when RQ1 was tested. Because the magnitude of difference based on the Pythagorean approach was substantial (i.e., 50.08 units), this difference was considered significant.

[19] The figures for H1 (i.e., Figure 4 and Figure 5) are the only two figures that are represented on a different scale. Specifically, Figure 4 showing concept location in two-dimensional space ranges from -100 to 200 on both X and Y axes, as compared to other

figures of the same type, which range from -150 to 100 on both X and Y axes. This change in range is because including negatively valenced concepts such as *bad* and *anger* required that the scale be expanded to represent these concepts (which were located further away from other concepts in this study). Presenting other figures showing concept location in two-dimensional space on the same scale as Figure 4 was problematic because changing the scale substantially decreased the readability of these graphs. The parameters for Figure 5 are represented in the note below.

[20] As noted above, the scale for Figure 5, representing distances between the concepts of interest, has a different scale as compared to other figures of the same type. Specifically, the scale for the dependent variable (i.e., Y axis) in Figure 5 ranges from 0 to 400, as compared to other figures of the same type, which range from 0 to 250 on Y axis. This change in range is because including negatively valenced concepts such as *bad* and *anger* required that the scale be expanded to be able to include these concepts (which were located further away from other concepts in this study). Presenting other figures showing distances between the concepts of interests on the same scale as Figure 5 was problematic because changing the scale substantially decreased the readability of these graphs.

[21] Variance-adjusted *t* tests were performed to examine whether this 9.25-unit difference in distance was statistically significant. On dimension one, the mean distance between *recycling* and *me* in the low threat with restoration condition (M = 3.39; SD = 0.31; n = 28) was significantly different, $t(57) = 3.77$, $p < .001$, from the mean distance in the low threat without restoration condition (M = 3.70; SD = 0.32; n = 31). On dimension two, the mean distance between *recycling* and *me* in the low threat with restoration

condition (*M* = 3.13; *SD* = 0.20; *n* = 28) was also significantly different, $t(57) = 2.08$, $p = .04$, from the mean distance in the low threat without restoration condition (*M* = 2.03; *SD* = 0.17; *n* = 31). Thus, it was concluded that the 9.25-unit difference in distance between *recycling* and *me* across the low threat with restoration and the low threat without restoration conditions was statistically significant.

[22] Recall that based on variance-adjusted *t* tests, changes in distances between *energy conservation* and *me* and *energy conservation* and *good* across the low threat and control conditions were not significant. The magnitude of change (50.08 units) derived from the Galileo-based analyses makes this finding noteworthy. The discrepancy in the results is likely because somewhat different approaches were used to calculate statistical significance.

[23] Two pieces of evidence were used to determine whether the change of 11.94 units was meaningful: (1) the magnitude of change, which was small (less than 12% of a moderate difference as determined by the yardstick used in this study); and (2) the results of variance-adjusted *t* tests, which indicated that the differences in distances across the two conditions on were not significant on either dimension one or dimension two. Based on this information it was concluded that this change was not statistically significant.

[24] Due to a rather small magnitude of change for the behavioral intention, the change in distance between *energy conservation* and *me* across the high threat without restoration and high threat with restoration conditions should not be given much weight.

[25] Variance-adjusted *t* tests were performed to examine whether this 9.11-unit difference was statistically significant. On dimension one, the mean distance between *energy conservation* and *good* in the low threat with restoration condition (*M* =3.14; *SD* =

0.42; *n* = 28) was not significantly different, *t*(57) = 1.40, from the mean distance in the low threat without restoration condition (*M* = 3.29; *SD* = 0.40; *n* = 31). However, on dimension two, the mean distance between *energy conservation* and *me* in the low threat with restoration condition (*M* = 1.97; *SD* = 0.26; *n* = 28) was significantly different, *t*(57) = 2.56, *p* = .01, from the mean distance in the low threat without restoration condition (*M* = 1.81; *SD* = 0.22; *n* = 31). Thus, it was concluded that the 9.11-unit difference in distance between *energy conservation* and *me* across the low threat with restoration and the low threat without restoration conditions should be taken into account.

[26] This finding is inconsistent with the results found for H1 and H4. The difference is likely because different rotations were performed to test H1 and H4 versus H6: For H1 and H4, rotations across different levels of threat to freedom were performed, and for H6 time-series rotations were conducted.

[27] Due to its rather small magnitude, the difference of 4.21 units should not be given much weight.

[28] Variance-adjusted *t* tests were performed to examine whether the 9.00-unit difference in distance between *recycling* and *me* was statistically significant. On dimension one, the mean distance between *recycling* and *me* in the low threat with restoration condition measured at a one-minute delay (*M* = 3.76; *SD* = 0.39; *n* = 30) was significantly different, *t*(58) = 7.35, *p* < .001, from the mean distance in the low threat with restoration condition measured at a two-minute delay (*M* = 4.51; *SD* = 0.40; *n* = 30). On dimension two, the mean distance between *recycling* and *me* in the low threat with restoration condition measured at a one-minute delay (*M* = 1.55; *SD* = 0.18; *n* = 30) was not significantly different, *t*(58) = 1.98, than the mean distance in the low threat without

restoration condition (*M* = 1.65; *SD* = 0.21; *n* = 30). Thus, it was concluded that 9.00-unit difference in distance between *recycling* and *me* across the low threat with restoration and the low threat without restoration conditions should be taken into account.

[29] In the results section the opposite effect is reported (i.e., an inverted-U-shaped effect). This is because when reporting distances, a *smaller* distance indicates *greater* amount of attitude, and the opposite is true for attitudes and behavioral intentions.

[30] See above.

[31] With regard to behavioral intention, the magnitude of change in the high threat with restoration condition as compared to the high threat without restoration condition suggests that the effects of the restoration postscript were in the same direction (i.e., indicating a reduction in behavioral intention), but this change is rather small and should not be considered significant.

Table 1. *Means, Standard Deviations, Skewness, and Kurtosis for All Pilot Study 3 Variables Before and After Transformations*

	Untransformed				Transformed[a]			
Concept Pair	*M*	*SD*	Skew-ness[b]	Kur-tosis[c]	*M*	*SD*	Skew-ness[b]	Kur-tosis[c]
Ice and Al Gore	181.27	189.36	1.60	2.78	5.45	0.60	0.39	-0.67
Ice and Temperature	45.60	81.00	2.24	5.06	4.88	0.42	1.43	1.24
Ice and CO2	88.50	82.25	0.82	-0.19	5.15	0.42	0.26	-1.13
Ice and Energy Conservation	99.57	96.83	1.57	2.55	5.20	0.43	0.49	-0.06
Ice and Recycling	150.67	163.29	1.46	1.37	5.36	0.57	0.59	-0.53
Ice and Me	218.50	193.10	1.75	4.14	5.61	0.55	0.21	-0.16
Ice and Good[d]	248.67	218.34	1.95	4.78	5.69	0.57	-0.02	0.41
Ice and Bad	111.30	152.79	1.76	2.27	5.16	0.59	0.87	-0.17
Ice and My Freedom	283.67	205.62	0.97	0.77	5.81	0.55	-0.24	-0.34
Ice and Anger	239.67	201.94	1.00	0.55	5.66	0.61	-0.11	-0.72
Al Gore and Temperature	181.67	156.33	0.89	-0.35	5.50	0.54	0.25	-1.08
Al Gore and CO2	124.83	110.85	0.84	-0.21	5.30	0.48	0.18	-1.08
Al Gore and Energy Conservation	85.70	82.76	1.29	1.29	5.14	0.41	0.47	-0.42
Al Gore and Recycling	101.47	90.37	0.72	-0.47	5.21	0.44	0.14	-1.18
Al Gore and Me	299.17	202.41	1.11	1.21	5.87	0.48	0.26	-1.04
Al Gore and Good	174.73	191.92	2.27	6.26	5.45	0.56	0.72	0.34
Al Gore and Bad	145.67	86.53	0.45	-0.68	5.44	0.37	-0.28	-0.21

Al Gore and My Freedom	243.67	167.66	0.72	0.21	5.72	0.51	-0.18	-0.78
Al Gore and Anger	165.67	108.49	0.21	-0.88	5.49	0.45	-0.49	-0.60
Temperature and CO2[d]	113.00	114.40	2.74	10.90	5.26	0.44	0.59	1.13
Temp. and Energy Conservation	113.83	101.65	1.33	1.45	5.27	0.43	0.47	-0.42
Temperature and Recycling	132.50	116.20	1.24	0.37	5.35	0.45	0.61	-0.40
Temperature and Me	158.17	115.75	1.00	0.92	5.46	0.44	0.04	-0.40
Temperature and Good	246.67	233.57	1.87	3.45	5.68	0.57	0.53	0.13
Temperature and Bad	100.90	119.22	1.99	4.22	5.18	0.49	0.81	0.28
Temperature and My Freedom	270.00	174.00	0.95	1.48	5.80	0.49	-0.35	-0.05
Temperature and Anger	192.17	156.64	0.98	0.52	5.54	0.54	-0.05	-0.69
CO2 and Energy Conservation	176.33	138.70	0.72	-0.40	5.50	0.52	-0.09	-0.83
CO2 and Recycling	200.90	204.10	1.59	3.31	5.51	0.63	0.25	-0.81
CO2 and Me	170.83	186.91	2.49	7.45	5.45	0.52	0.98	0.85
CO2 and Good[d]	475.83	284.55	0.90	-0.52	6.25	0.47	0.25	-0.73
CO2 and Bad	21.87	54.64	2.72	6.62	4.74	0.32	2.43	4.82
CO2 and My Freedom[d]	225.00	197.72	2.19	7.28	5.64	0.54	0.15	0.16
CO2 and Anger	137.50	88.02	0.61	-0.52	5.40	0.38	-0.14	-0.23
Energy Conserv. and Recycling	57.17	77.61	1.32	0.40	4.96	0.42	0.97	-0.52
Energy Conservation and Me	80.83	65.17	0.71	-0.43	5.14	0.35	0.17	-0.95
Energy Conservation and Good	15.33	42.24	3.47	13.05	4.71	0.26	2.84	8.09
Energy Conservation and Bad[d]	403.33	264.55	1.15	0.54	6.09	0.52	-0.31	1.24
Energ. Conserv. and My Freedom[d]	202.50	211.76	2.35	6.72	5.54	0.57	0.55	0.52
Energy Conservation and Anger	217.50	133.77	0.40	-0.40	5.66	0.47	-0.57	0.01
Recycling and Me	71.17	69.51	1.01	0.43	5.07	0.38	0.37	-0.83
Recycling and Good	27.83	96.87	4.47	21.04	4.74	0.38	3.59	13.41

Recycling and Bad[d]	408.33	262.64	0.76	-0.04	6.09	0.58	-0.81	1.20
Recycling and My Freedom[d]	203.73	188.31	2.73	10.55	5.58	0.51	0.41	0.97
Recycling and Anger[d]	299.17	196.14	1.63	4.48	5.88	0.48	-0.27	1.03
Me and Good	56.00	108.53	2.96	9.82	4.91	0.47	1.71	2.71
Me and Bad[d]	253.50	230.83	1.67	3.05	5.70	0.58	0.37	-0.37
Me and My Freedom	49.72	65.88	2.02	6.21	4.93	0.37	0.82	0.21
Me and Anger	216.50	135.48	0.33	-0.31	5.65	0.49	-0.65	-0.20
Good and Bad[d]	468.33	314.72	0.67	-0.79	6.19	0.58	-0.15	-0.94
Good and My Freedom	25.86	46.92	2.32	5.96	4.79	0.29	1.66	2.17
Good and Anger[d]	289.31	200.78	1.83	4.88	5.85	0.48	-0.10	1.11
Bad and My Freedom[d]	297.90	189.22	1.77	5.83	5.89	0.47	-0.42	1.40
Bad and Anger	64.66	106.76	2.99	10.12	4.98	0.44	1.62	2.92
My Freedom and Anger[d]	269.03	226.86	1.96	4.45	5.76	0.55	0.07	0.78

Note. N_{min} = 29, N_{max} = 30.

[a]The transformation used for all of these variables was: transformed variable = ln(trimmed original variable + 100).

[b]The standard error of skewness was 0.43.

[c]The standard error of kurtosis ranged from 0.83 to 0.85.

[d]These pairs were trimmed. Maximum score = 1000.

Table 2. *Means, Standard Deviations, Skewness, and Kurtosis for All Pilot Study 4 Variables Before and After Transformations*

	Untransformed				Transformed[a]			
Variables	*M*	*SD*	Skewness[b]	Kurtosis[c]	*M*	*SD*	Skewness[b]	Kurtosis[c]
Irritated	93.88	220.16	3.73	13.94	2.25	2.45	0.38	-1.54
Angry	41.38	158.73	5.94	36.55	1.27	2.00	1.22	0.12
Annoyed	89.50	222.76	3.67	13.50	1.92	2.46	0.69	-1.25
Aggravated	53.33	176.40	4.61	22.82	1.19	2.10	1.47	0.71
Manipulate	122.20	234.51	2.92	8.81	2.75	2.45	0.08	-1.55
Pressure	110.78	184.71	3.29	13.63	3.09	2.29	-0.27	-1.46

Note. $N = 40$. None of the variables in Pilot Study 4 were trimmed.

[a]The transformation used for all of these variables was: item transformed = ln(original item + 1).

[b]The standard error of skewness was 0.37.

[c]The standard error of kurtosis was 0.73.

Table 3. *Means, Standard Deviations, Skewness, and Kurtosis for All Main Experiment Variables Before and After Transformations*

	Trimmed Untransformed[a]					Transformed[b]			
Variable/Concept Pair	*M*	*SD*	Trim Value	Skew-ness[c]	Kur-tosis[d]	*M*	*SD*	Skew-ness[c]	Kur-tosis[d]
Care	176.02	95.54	500.00	0.47	-0.76	5.56	0.36	-0.20	-0.43
EPA & Ice	205.32	163.58	500.00	0.76	-0.76	4.82	0.61	0.23	-1.01
EPA & Al Gore	65.94	60.16	400.00	1.05	0.09	4.65	0.53	0.18	-1.13
EPA & Temperature	89.94	60.45	300.00	0.55	-0.70	4.65	0.51	0.19	-1.05
EPA & CO2	97.68	62.71	400.00	0.36	-0.98	4.65	0.52	0.25	-1.00
EPA & Energy Conservation	133.08	92.16	250.00	0.52	-0.85	4.42	0.44	0.36	-1.28
EPA & Recycling	227.28	154.13	200.00	0.61	-0.84	4.35	0.41	0.49	-1.24
EPA & Me	175.65	152.26	600.00	0.96	-0.20	5.20	0.56	-0.16	-0.38
EPA & Good	214.02	153.50	300.00	0.72	-0.65	4.44	0.45	0.24	-1.39
EPA & Bad	330.95	218.56	665.00	0.39	-1.03	5.69	0.66	-0.49	-0.23
EPA & My Freedom	301.05	194.58	600.00	0.25	-1.25	5.34	0.71	-0.01	-0.67
EPA & Anger	169.67	154.53	700.00	1.04	-0.08	5.63	0.69	-0.31	-0.46
Ice & Al Gore	163.79	154.21	500.00	1.12	0.07	5.33	0.67	-0.07	-0.95
Ice & Temperature	98.85	91.68	300.00	1.07	0.02	4.63	0.48	0.34	-0.88
Ice & CO2	97.44	84.69	400.00	0.92	-0.32	4.84	0.45	-0.19	-0.75
Ice & Energy Conservation	200.92	148.56	300.00	0.94	-0.30	4.90	0.46	-0.35	-0.70
Ice & Recycling	117.70	92.77	500.00	0.88	-0.38	5.07	0.54	-0.29	-0.73

Ice & Me	220.52	154.25	500.00	0.73	-0.74	5.46	0.61	-0.38	-0.34
Ice & Good	246.06	183.53	600.00	0.70	-0.70	5.19	0.69	-0.06	-0.83
Ice & Bad	268.94	205.34	700.00	0.91	-0.31	5.40	0.63	-0.33	-0.37
Ice & My Freedom	71.44	60.84	700.00	0.92	-0.11	5.73	0.71	-0.78	0.14
Ice & Anger	62.21	47.17	600.00	0.50	-0.89	5.66	0.69	-0.75	-0.07
Al Gore & Temperature	93.79	76.79	700.00	0.86	-0.43	5.15	0.70	0.11	-0.95
Al Gore & CO2	152.40	118.33	700.00	0.92	-0.20	5.12	0.70	0.18	-0.93
Al Gore & Energy Conserv.	129.41	91.42	500.00	0.66	-0.60	4.83	0.58	0.25	-0.89
Al Gore & Recycling	150.51	115.77	500.00	0.93	-0.12	4.84	0.56	0.16	-0.94
Al Gore & Me	261.00	195.71	500.00	0.57	-1.00	5.36	0.59	0.03	-0.58
Al Gore & Good	233.02	172.41	500.00	0.68	-0.81	4.97	0.55	0.01	-0.72
Al Gore & Bad	75.56	63.01	500.00	0.83	-0.38	5.43	0.60	-0.29	-0.25
Al Gore & My Freedom	74.73	62.84	600.00	0.84	-0.40	5.48	0.68	-0.32	-0.55
Al Gore & Anger	162.31	148.24	700.00	1.20	0.41	5.55	0.67	-0.17	-0.49
Temperature & CO2	250.18	188.51	300.00	0.67	-0.86	4.68	0.48	0.17	-0.90
Temp. & Energy Conservation	102.34	97.75	230.00	0.95	-0.31	4.63	0.43	-0.05	-1.11
Temperature & Recycling	277.67	232.24	400.00	1.13	0.28	4.83	0.52	0.11	-0.89
Temperature & Me	250.14	210.27	500.00	0.99	-0.17	5.14	0.60	-0.13	-0.54
Temperature & Good	50.31	48.96	500.00	0.85	-0.48	5.05	0.54	-0.30	-0.50
Temperature & Bad	112.76	89.87	500.00	0.92	-0.17	5.14	0.59	-0.15	-0.47
Temperature & My Freedom	50.36	64.76	600.00	1.35	0.60	5.51	0.72	-0.41	-0.60
Temperature & Anger	371.31	286.53	554.00	0.77	-0.64	5.44	0.67	-0.32	-0.53
CO2 & Energy Conservation	224.81	180.87	300.00	0.91	-0.37	4.71	0.49	0.10	-0.95
CO2 & Recycling	308.38	239.53	300.00	0.89	-0.34	4.70	0.49	0.15	-0.97
CO2 & Me	87.17	60.69	700.00	0.60	-0.55	5.13	0.68	0.06	-0.67

CO2 & Good	41.87	62.92	600.00	1.66	1.48	5.49	0.69	-0.32	-0.57
CO2 & Bad	365.95	229.78	500.00	0.21	-1.28	4.83	0.63	0.16	-1.06
CO2 & My Freedom	246.54	210.55	800.00	1.02	-0.11	5.54	0.73	-0.19	-0.39
CO2 & Anger	343.82	250.52	700.00	0.71	-0.75	5.46	0.73	-0.14	-0.60
Energy Conserv. & Recycling	52.37	48.31	201.70	0.97	0.72	4.50	0.47	0.31	-1.14
Energy Conservation & Me	262.03	239.08	500.00	1.25	0.37	4.94	0.55	-0.03	-0.66
Energy Conservation & Good	35.93	40.07	300.00	0.67	-1.21	4.44	0.55	0.75	-0.75
Energy Conservation & Bad	186.02	155.00	900.00	0.95	-0.26	5.78	0.77	-0.44	-0.31
Energy Conserv. & My Freed.	460.14	370.95	600.00	0.43	-1.38	5.40	0.68	-0.14	-0.60
Energy Conservation & Anger	51.95	63.06	800.00	1.26	0.52	5.65	0.72	-0.31	-0.34
Recycling & Me	301.48	212.86	400.00	0.56	-1.01	4.82	0.46	-0.22	-0.66
Recycling & Good	389.92	288.61	250.00	0.70	-0.80	4.35	0.54	1.09	-0.10
Recycling & Bad	62.09	63.35	700.00	1.02	-0.02	5.83	0.71	-0.87	0.28
Recycling & My Freedom	293.60	222.40	700.00	0.71	-0.77	5.44	0.73	-0.11	-0.67
Recycling & Anger	99.13	94.24	800.00	1.02	-0.11	5.75	0.72	-0.46	-0.15
Me & Good	69.85	64.75	200.00	0.86	-0.38	4.52	0.46	0.14	-1.02
Me & Bad	69.50	63.19	807.00	0.89	-0.26	5.48	0.73	0.13	-0.57
Me & My Freedom	70.24	64.86	300.00	0.93	-0.32	4.35	0.44	0.43	-1.46
Me & Anger	41.46	41.77	500.00	0.73	-0.90	5.25	0.67	-0.08	-0.71
Good & Bad	34.44	37.16	1000.00	0.80	-0.86	5.89	0.91	-0.42	-0.87
Good & My Freedom	160.28	116.47	300.00	0.89	-0.25	4.46	0.54	0.62	-0.90
Good & Anger	44.32	43.56	671.00	0.62	-1.03	5.65	0.69	-0.44	-0.35
Bad & My Freedom	309.23	208.59	900.00	0.50	-1.07	5.84	0.75	-0.51	-0.13
Bad & Anger	214.15	185.85	300.00	1.02	-0.22	4.57	0.53	0.34	-1.08
My Freedom & Anger	296.92	219.15	700.00	0.71	-0.77	5.61	0.72	-0.35	-0.51

Irritated	40.87	41.32	200.00	0.42	-1.49	3.17	1.30	-0.15	-1.71
Angry	14.28	23.98	100.00	1.45	0.55	2.32	1.05	0.98	-0.80
Annoyed	37.20	40.65	200.00	0.61	-1.29	3.07	1.28	-0.01	-1.70
Aggravated	25.09	36.27	150.00	1.21	-0.11	2.65	1.22	0.58	-1.37
Threat 1	87.79	82.03	500.00	0.69	-0.68	5.60	2.31	0.00	-1.25
Threat 2	35.73	50.47	200.00	1.24	0.15	4.01	1.85	0.81	-0.88
Threat 3	79.04	82.40	400.00	0.90	-0.38	5.33	2.33	0.23	-1.22
Threat 4	96.67	96.14	500.00	0.89	-0.30	5.74	2.48	0.13	-1.16
Relevant Negative Thoughts	1.30	1.73	n/a	1.26	-0.76	0.96	0.51	0.69	-0.99
Irritated at Message Source[e]	28.21	38.74	150.00	0.99	-0.76	n/a	n/a	n/a	n/a

Note. N_{min} = 437, N_{max} = 439.

[a] Because some of untransformed values were quite large, means, standard deviations, skewness, and kurtosis for the untransformed data were performed on the variables that were trimmed to a lower value (see text).

[b] For specific transformations see text.

[c] The standard error of skewness ranged from 0.12 to 0.13.

[d] The standard error of kurtosis ranged from 0.23 to 0.26.

[e] The *N* for this variable was 354, because the questions regarding whether the participants were irritated at the message source was only included in the experimental, but not in the control conditions.

Table 4. *Determining the Number of Dimensions*

Space Number/Condition	Σ of All Positive Eigenvalues	*k* - 1[a]	Average[b]	Dimension 1 Eigenvalues	Dimension 2 Eigenvalues
1. Low Threat without Restoration at the Immediate Time	192579.74	5	38515.95	101245.70	55577.13
2. Low Threat without Restoration at a One-Minute Delay	253636.17	5	50727.23	121208.50	86292.30
3. Low Threat without Restoration at a Two-Minute Delay	125408.38	6	20901.40	63641.82	33407.09
4. Low Threat with Restoration at the Immediate Time	165662.08	6	27610.35	79096.98	49661.88
5. Low Threat with Restoration at a One-Minute Delay	216281.82	5	43256.36	122811.10	54756.39
6. Low Threat with Restoration at a Two-Minute Delay	245603.85	6	40933.98	148788.70	61332.10
7. High Threat without Restoration at the Immediate Time	192741.92	6	32123.65	108514.50	50123.65
8. High Threat without Restoration at a One-Minute Delay	235480.83	6	39246.81	116495.00	77378.10
9. High Threat without Restoration at a Two-Minute Delay	188426.78	6	31404.46	96800.38	56299.10
10. High Threat with Restoration at the Immediate Time	184292.95	5	36858.59	83635.64	64769.43
11. High Threat with Restoration at a One-Minute Delay	182847.00	5	36569.40	103574.30	37571.09
12. High Threat with Restoration at a Two Minute Delay	184836.61	6	30806.10	86826.94	61309.27
13. Control at the Immediate Time	220175.80	7	31453.68	112388.60	65744.88

14. Control at a One-Minute Delay	175939.70	7	25134.24	120645.70	29335.35
15. Control at a Two-Minute Delay	309513.70	5	61902.74	151298.00	105345.00

[a] *k* is a number of dimensions with positive eigenvalues.

[a] (Σ all positive Eigenvalues / *k* – 1), where *k* is a number of dimensions with positive eigenvalues.

Table 5. *Determining the Eigenvalue Ratio for Significance Calculations*

Space Number/Condition	Dimension 1 Eigenvalue	Dimension 2 Eigenvalue	The Σ of Eigenvalues for All Dimensions	The Ratio of the Dimension 1 Eigenvalue to the Σ of All Eigenvalues	The Ratio of the Dimension 2 Eigenvalue to the Σ of All Eigenvalues
1. Low Threat without Restoration at the Immediate Time	101245.70	55577.13	135646.70	0.75	0.41
2. Low Threat without Restoration at a One-Minute Delay	121208.50	86292.30	182873.10	0.66	0.47
3. Low Threat without Restoration at a Two-Minute Delay	63641.82	33407.09	87933.30	0.72	0.38
4. Low Threat with Restoration at the Immediate Time	79096.98	49661.88	111888.90	0.71	0.44
5. Low Threat with Restoration at a One-Minute Delay	122811.10	54756.39	154053.50	0.80	0.36
6. Low Threat with Restoration at a Two-Minute Delay	148788.70	61332.10	161095.80	0.92	0.38
7. High Threat without Restoration at the Immediate Time	108514.50	50123.65	126020.00	0.86	0.40
8. High Threat without Restoration at a One-Minute Delay	116495.00	77378.10	166774.00	0.70	0.46
9. High Threat without Restoration at a Two-Minute Delay	96800.38	56299.10	130398.10	0.74	0.43

10. High Threat with Restoration at the Immediate Time	83635.64	64769.43	122509.60	0.68	0.53
11. High Threat with Restoration at a One-Minute Delay	103574.30	37571.09	117397.50	0.88	0.32
12. High Threat with Restoration at a Two-Minute Delay	86826.94	61309.27	130512.50	0.67	0.47
13. Control at the Immediate Time	112388.60	65744.88	151870.90	0.74	0.43
14. Control at a One-Minute Delay	120645.70	29335.35	120517.30	1.00	0.24
15. Control at a Two-Minute Delay	151298.00	105345.00	179021.30	0.85	0.59

Table 6. *Overall Variance-Adjusted ANOVAs and Correlations for H1-H4*

Dependent Variable[a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Recycling and Me D1	2, 84	2.35	20.60	< .01	0.33	0.31	.55**
Recycling and Me D2	2, 84	0.25	7.91	< .01	0.16	0.14	-.38**
Recycling and Good D1	2, 84	1.97	10.60	< .01	0.20	0.18	.36**
Recycling and Good D2	2, 84	0.34	6.47	< .01	0.13	0.11	-.35**
Recycling and Bad D1	2, 84	6.64	30.01	< .01	0.42	0.40	.53**
Recycling and Bad D2	2, 84	0.32	5.00	< .01	0.11	0.09	-.26**
Recycling and Anger D1	2, 84	3.32	12.60	< .01	0.23	0.21	.39**
Recycling and Anger D2	2, 84	0.53	7.29	< .01	0.15	0.13	-.38**

Note. The bivariate correlations reported in this table are between the independent variable (i.e., amount of threat to freedom) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

** $p < .01$ level, 2-tailed.

Table 7. Variance-Adjusted t Tests for Significance Calculations in H4

Dependent Variable [a]	Means being compared: control condition vs. low threat conditions	*t*	df	*p*[b]
Recycling and Me D1	3.56 (*SD* = 0.30; *n* = 28) vs. 3.70 (*SD* = 0.32; *n* = 31)	1.73	57	.09
Recycling and Me D2	2.08 (*SD* = 0.17; *n* = 28) vs. 2.03 (*SD* = 0.17; *n* = 31)	1.13	57	.26
Recycling and Good D1	3.31 (*SD* = 0.42; *n* = 28) vs. 3.25 (*SD* = 0.41; *n* = 31)	0.55	57	.58
Recycling and Good D2	1.94 (*SD* = 0.24; *n* = 28) vs. 1.78 (*SD* = 0.23; *n* = 31)	2.61	57	.01
Recycling and Bad D1	4.40 (*SD* = 0.41; *n* = 28) vs. 4.34 (*SD* = 0.55; *n* = 31)	0.47	57	.64
Recycling and Bad D2	2.58 (*SD* = 0.24; *n* = 28) vs. 2.38 (*SD* = 0.30; *n* = 31)	2.81	57	.01
Recycling and Anger D1	4.29 (*SD* = 0.46; *n* = 28) vs. 4.24 (*SD* = 0.51; *n* = 31)	0.39	57	.70
Recycling and Anger D2	2.51 (*SD* = 0.27; *n* = 28) vs. 2.33 (*SD* = 0.28; *n* = 31)	2.51	57	.02

[a] D stands for dimension.

[b] Because the comparisons for H1 through H4 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for these analyses was (.05/3) or .017.

Table 8. *Calculations for Jackknife Procedures to Test Significances in H1-H4: Coordinates for the Concepts of Interest on Dimension One*

	Low Threat_all[a]	Control_all[a]	Low Threat_jk1[b]	Control_jk1[b]	Low Threat_jk2[b]	Control_jk2[b]	Low Threat_jk3[b]	Control_jk3[b]
Recycling	-76.22	-90.41	-129.83	-137.39	-132.89	-136.95	-93.21	-120.22
Me	-38.06	-33.61	-80.02	-64.58	-88.82	-77.06	-126.60	-92.36
Good	-191.11	-168.03	-196.14	-189.23	-191.93	-171.59	-208.82	-200.07
Bad	321.62	325.25	322.18	330.74	317.78	313.43	308.24	295.37
Anger	270.39	265.57	265.94	263.12	280.98	265.68	254.86	257.94

[a]Notation *all* indicates that the data from all participants in a particular condition was used.

[b]Notation *jk* indicates that the data from two-thirds of the participants in a particular condition was used. A number next to *jk* indicates which two thirds were used.

Table 9. *Calculations for Jackknife Procedures to Test Significance of H1-H4: Coordinates for the Concepts of Interest on Dimension Two*

	Low Threat_all[a]	Control_all[a]	Low Threat_jk1[b]	Control_jk1[b]	Low Threat_jk2[b]	Control_jk2[b]	Low Threat_jk3[b]	Control_jk3[b]
Recycling	-83.74	-71.32	-102.99	-97.46	-91.29	-95.17	-104.03	-112.20
Me	201.48	209.85	198.60	211.85	209.18	195.84	175.12	186.00
Good	88.42	104.31	82.90	94.39	82.77	90.92	26.63	80.62
Bad	21.45	20.14	34.69	20.53	50.45	47.83	80.01	90.25
Anger	112.04	121.11	135.76	135.14	115.27	133.29	148.45	177.04

[a]Notation *all* indicates that the data from all participants in a particular condition was used.

[b]Notation *jk* indicates that the data from two-thirds of the participants in a particular condition was used. A number next to *jk* indicates which two thirds were used.

Table 10. *Calculations for Jackknife Procedures to Test Significance of H1-H4: Calculating Significances for the Concepts of Interest on Dimension One*

	(control – low-threat) $_{all…jk3}$ [a]				3(difference_all) - 2(difference_jk$_j$) [b]							t|2df|	t|2df|	
	all	jk1	jk2	jk3	jk1	jk2	jk3	*M*	$\sqrt{N}$ [c]	*SD*	*SE* [d]	at .05	**SE* [e]	Range
Recycle	-14.19	-7.55	-4.06	-27.01	-27.45	-34.44	11.47	-16.81	1.73	24.73	14.28	4.30	61.40	44.60-78.21
Me	4.45	15.44	11.77	34.24	-17.51	-10.17	-55.13	-27.60	1.73	24.12	13.92	4.30	59.87	32.27-87.48
Good	23.07	6.91	20.34	8.75	55.4	28.54	51.72	45.22	1.73	14.56	8.41	4.30	36.15	81.37-9.07
Bad	3.62	8.56	-4.35	-12.87	-6.25	19.58	36.61	16.65	1.73	21.58	12.46	4.30	53.58	70.23-(-36.94)
Anger	-4.83	-2.82	-15.29	3.09	-8.85	16.11	-20.65	-4.46	1.73	18.77	10.84	4.30	46.60	42.13-(-51.06)

[a] In this step differences in locations for a concept of interest between the two conditions in dimension one were calculated. These procedures were repeated for the three jackknifed subsamples and the full data set. The results of these calculations were used as a proxy for standard deviations.

[b] Following Mosteller and Tukey's (1977) procedure, the following formula can be used to calculate a pseudo-mean for each concept of interest on the first dimension: $[N (y_{all})] – [(N -1) (y_{jk})]$, where N is the number of all jackknifed subsamples, y_{all} is the location difference for the concept of interest on dimension one between the two conditions using the transformed data derived from all the participants, and y_{jk} is the location difference on dimension one between the two conditions of interest for the concept of interest using the coordinates

derived from each jackknifed subsample. To obtain the mean for the concept of interest, the outcome of this formula for each jackknifed subsample has to be averaged.

[c] *N* is a number of jackknifed subsamples ($N = 3$).

[d] To obtain a pseudo standard error, the following formula was used: $SD/\sqrt{N}$.

[e] A confidence interval was computed, where the *t* value with appropriate degrees of freedom and alpha level was used.

Table 11. *Calculations for Jackknife Procedures to Test Significance of H1-H4: Calculating Significances for the Concepts of Interest on Dimension Two*

	(control – low-threat) $_{all\ldots jk3}$ [a]				3(difference_all) - 2(difference_jk$_j$) [b]			*M*	√*N*[c]	*SD*	*SE*[d]	t|2df| at .05	t|2df| **SE*[e]	Range
	all	jk1	jk2	jk3	jk1	jk2	jk3							
Recycling	12.42	5.53	-3.88	-8.17	26.19	45.01	53.59	41.60	1.73	14.01	8.09	4.30	34.79	76.39-6.80
Me	8.37	13.25	-13.34	10.87	-1.39	51.79	3.36	17.92	1.73	29.42	16.99	4.30	73.05	90.97-(-55.13)
Good	15.89	11.49	8.14	53.98	24.68	31.37	-60.30	-1.42	1.73	51.10	29.51	4.30	126.87	125.45-(-128.29)
Bad	-1.31	-14.16	-2.63	10.25	24.38	1.32	-24.42	0.42	1.73	24.41	14.09	4.30	60.61	61.03-(-60.18)
Anger	9.07	-0.62	18.02	28.59	28.45	-8.83	-29.97	-3.45	1.73	29.58	17.08	4.30	73.43	69.99-(-76.88)

[a] In this step differences in locations for a concept of interest between the two conditions on dimension two were calculated. These procedures were repeated for the three jackknifed subsamples and the full data set. The results of these calculations were used as a proxy for standard deviations.

[b] Following Mosteller and Tukey's (1977) procedure, the following formula can be used to calculate a pseudo-mean for each concept of interest on the second dimension: $[N\,(y_{all})] – [(N-1)\,(y_{jk})]$, where N is the number of all jackknifed subsamples, y_{all} is the location difference for the concept of interest on dimension two between the two conditions using the transformed data derived from all the

participants, and y_{jk} is the location difference on dimension two between the two conditions of interest for the concept of interest using the coordinates derived from each jackknifed subsample. To obtain the mean for the concept of interest, the outcome of this formula for each jackknifed subsample has to be averaged.

[c] *N* is a number of jackknifed subsamples ($N = 3$).

[d] To obtain a pseudo standard error, the following formula was used: $SD/\sqrt{N}$.

[e] A confidence interval was computed, where the *t* value with appropriate degrees of freedom and alpha level was used.

Table 12. Variance-Adjusted t Tests for Significance Calculations in H2

Dependent Variable [a]	Means being compared: low threat condition vs. high threat condition	t	df	p^b
Recycling and Me D1	3.70 (*SD* = 0.32; *n* = 31) vs. 4.12 (*SD* = 0.40; *n* = 28)	4.47	57	< .01
Recycling and Me D2	2.03 (*SD* = 0.17; *n* = 31) vs. 1.90 (*SD* = 0.18; *n* = 28)	2.85	57	< .01
Recycling and Good D1	3.25 (*SD* = 0.41; *n* = 31) vs. 3.73 (*SD* = 0.46; *n* = 28)	4.24	57	< .01
Recycling and Good D2	1.78 (*SD* = 0.23; *n* = 31) vs. 1.72 (*SD* = 0.21; *n* = 28)	1.04	57	= .30
Recycling and Bad D1	4.34 (*SD* = 0.55; *n* = 31) vs. 5.21 (*SD* = 0.42; *n* = 28)	6.77	57	< .01
Recycling and Bad D2	2.38 (*SD* = 0.30; *n* = 31) vs. 2.40 (*SD* = 0.20; *n* = 28)	0.30	57	= .77
Recycling and Anger D1	4.24 (*SD* = 0.51; *n* = 31) vs. 4.85 (*SD* = 0.57; *n* = 28)	4.34	57	< .01
Recycling and Anger D2	2.33 (*SD* = 0.28; *n* = 31) vs. 2.24 (*SD* = 0.26; *n* = 28)	1.28	57	= .21

[a] D stands for dimension.

[b] Because the comparisons for H1 through H4 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for these analyses was (.05/3) or .017.

Table 13. Variance-Adjusted t Tests for Significance Calculations in H3

Dependent Variable [a]	Means being compared: control condition vs. high threat condition	t	df	p [b]
Recycling and Me D1	3.56 (SD = 0.30; n = 28) vs. 4.12 (SD = 0.40; n = 28)	5.93	54	< .01
Recycling and Me D2	2.08 (SD = 0.17; n = 28) vs. 1.90 (SD = 0.18; n = 28)	3.85	54	< .01
Recycling and Good D1	3.31 (SD = 0.42; n = 28) vs. 3.73 (SD = 0.46; n = 28)	3.57	54	< .01
Recycling and Good D2	1.94 (SD = 0.24; n = 28) vs. 1.72 (SD = 0.21; n = 28)	3.65	54	< .01
Recycling and Bad D1	4.40 (SD = 0.41; n = 28) vs. 5.21 (SD = 0.42; n = 28)	7.30	54	< .01
Recycling and Bad D2	2.58 (SD = 0.24; n = 28) vs. 2.40 (SD = 0.20; n = 28)	3.05	54	< .01
Recycling and Anger D1	4.29 (SD = 0.46; n = 28) vs. 4.85 (SD = 0.57; n = 28)	4.05	54	< .01
Recycling and Anger D2	2.51 (SD = 0.27; n = 28) vs. 2.24 (SD = 0.26; n = 28)	3.81	54	< .01

[a] D stands for dimension.

[b] Because the comparisons for H1 through H4 are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons in H1-H4, thus the significance level for these analyses was (.05/3) or .017.

Table 14. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in H5*

Dependent Variable [a]	df	Mean Square	F	Sig.	Partial Eta Squared	Adjusted Eta Squared	r
Recycling and Me D1	3, 111	3.77	29.67	< .01	.45	.43	.42**
Recycling and Me D2	3, 111	2.31	47.61	< .01	.56	.55	-.05
Recycling and Good D1	3, 111	3.00	17.33	< .01	.32	.30	.38**
Recycling and Good D2	3, 111	2.09	33.35	< .01	.47	.46	-.02

Note. The bivariate correlations reported in this table are between the independent variable (i.e., conditions coded linearly) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

** $p < .01$ level, 2-tailed.

Table 15. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in RQ1*

Dependent Variable [a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Energy Conservation and Me D1	2, 84	2.29	13.05	< .01	.24	.22	.43**
Energy Conservation and Me D2	2, 84	0.34	7.06	< .01	.14	.12	-.38**
Energy Conservation and Good D1	2, 84	2.11	11.18	< .01	.21	.19	.38**
Energy Conservation and Good D2	2, 84	0.30	5.61	< .01	.12	.10	-.33**

Note. The bivariate correlations reported in this table are between the independent variable (i.e., amount of threat to freedom) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

** p < .01 level, 2-tailed.

Table 16. *Variance-Adjusted t Tests for Significance Calculations in RQ1*

Conditions being compared:	Dependent Variable[a]	Means being compared:	*t*	df	*p*[b]
Control vs. high threat	Energy Conservation and Me D1	*M* = 3.67 (*SD* = 0.42; *n* = 28) vs. *M* = 4.17 (*SD* = 0.47; *n* = 28)	4.20	54	< .01
	Energy Conservation and Me D2	*M* = 2.15 (*SD* = 0.24; *n* = 28) vs. *M* = 1.93 (*SD* = 0.22; *n* = 28)	3.58	54	< .01
	Energy Conservation and Good D1	*M* = 3.33 (*SD* = 0.46; *n* = 28) vs. *M* = 3.78 (*SD* = 0.45; *n* = 028)	3.70	54	< .01
	Energy Conservation and Good D2	*M* = 1.95 (*SD* = 0.27; *n* = 28) vs. *M* = 1.75 (*SD* = 0.21; *n* = 28)	3.09	54	< .01
High vs. low threat	Energy Conservation and Me D1	*M* = 4.17 (*SD* = 0.47; *n* = 28) vs. *M* = 3.69 (*SD* = 0.36; *n* = 31)	4.43	57	< .01
	Energy Conservation and Me D2	*M* = 1.93 (*SD* = 0.22; *n* = 28) vs. *M* = 2.02 (*SD* = 0.20; *n* = 31)	1.65	57	= .11
	Energy Conservation	*M* = 3.78 (*SD* = 0.45; *n* = 28) vs. *M* = 3.29 (*SD* = 0.40; *n* = 31)	4.43	57	< .01

	and Good D1				
	Energy Conservation and Good D2	*M* = 1.75 (*SD* = 0.21; *n* = 28) vs. *M* = 1.81 (*SD* = 0.22; *n* = 31)	1.07	57	= .29
Control vs. low threat	Energy Conservation and Me D1	*M* = 3.67 (*SD* = 0.42; *n* = 28) vs. *M* = 3.69 (*SD* = 0.36; *n* = 31)	.20	57	= .85
	Energy Conservation and Me D2	*M* = 2.15 (*SD* = 0.24; *n* = 28) vs. *M* = 2.02 (*SD* = 0.20; *n* = 31)	2.27	57	= .03
	Energy Conservation and Good D1	*M* = 3.33 (*SD* = 0.46; *n* = 28) vs. *M* = 3.29 (*SD* = 0.40; *n* = 31)	.35	57	= .72
	Energy Conservation and Good D2	*M* = 1.95 (*SD* = 0.27; *n* = 28) vs. *M* = 1.81 (*SD* = 0.22; *n* = 31)	2.19	57	= .03

[a] D stands for dimension.

[b] Because the comparisons are nonorthogonal, a Bonferroni correction was used that adjusts the significance level for the number of comparisons to be made. There were three planned comparisons, thus the significance level for these analyses was (.05/3) or .017.

Table 17. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in RQ2*

Dependent Variable [a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Energy Conservation and Me D1	3, 111	3.72	22.73	< .01	.38	.36	.38**
Energy Conservation and Me D2	3, 111	2.39	40.22	< .01	.52	.51	-.06
Energy Conservation and Good D1	3, 111	2.89	16.23	< .01	.31	.29	.37**
Energy Conservation and Good D2	3, 111	2.27	34.23	< .01	.48	.47	-.03

Note. The bivariate correlations reported in this table are between the independent variable (i.e., conditions coded linearly) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

** $p < .01$ level, 2-tailed.

Table 18. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in H6*

Dependent Variable [a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Recycling and Me D1	2, 85	4.37	37.15	< .01	.47	.45	-.50**
Recycling and Me D2	2, 85	0.83	22.62	< .01	.35	.33	.27*
Recycling and Good D1	2, 85	4.26	30.38	< .01	.42	.40	-.49**
Recycling and Good D2	2, 85	0.56	13.13	< .01	.24	.22	.17

Note. The bivariate correlations reported in this table are between the independent variable (i.e., time) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

* $p < .05$ level, 2-tailed. ** $p < .01$ level, 2-tailed.

Table 19. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in RQ3 (High Threat with Restoration Condition)*

Dependent Variable [a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Recycling and Me D1	2, 84	8.71	66.74	< .01	.61	.61	-.08
Recycling and Me D2	2, 84	8.20	162.07	< .01	.79	.79	-.23*
Recycling and Good D1	2, 84	8.70	52.15	< .01	.55	.54	-.09
Recycling and Good D2	2, 84	6.29	105.42	< .01	.72	.71	-.24*

Note. The bivariate correlations reported in this table are between the independent variable (i.e., time) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

* $p < .05$ level, 2-tailed.

Table 20. *Overall Variance-Adjusted ANOVAs and Correlations for Significance Calculations in RQ3 (Low Threat with Restoration Condition)*

Dependent Variable [a]	df	Mean Square	*F*	Sig.	Partial Eta Squared	Adjusted Eta Squared	*r*
Recycling and Me D1	2, 85	9.48	68.58	< .01	.62	.61	.77**
Recycling and Me D2	2, 85	1.47	46.15	< .01	.52	.51	-.42**
Recycling and Good D1	2, 85	6.26	32.54	< .01	.43	.42	.66**
Recycling and Good D2	2, 85	1.12	25.11	< .01	.37	.36	-.43**

Note. The bivariate correlations reported in this table are between the independent variable (i.e., time) and the dependent variable listed in the first column of this table.

[a] D stands for dimension.

** $p < .01$ level, 2-tailed.

Appendices

Appendix A: The Questionnaire for Pilot Study 1

Department of Communication, University of Maryland

Researchers at the University of Maryland are studying what issues young people on campus perceive to be exposed to. The word **"EXPOSED"** in this context means that **you hear about them from parents, media, your friends, or other sources**. We would like you to answer the question that follow to help us to learn about those issues. There are no right or wrong answers; we are interested in your views.

Part 1. Please list the issues below:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

Part 2: Please fill out the questions below.

1. My age is ____________ years.

2. I am MALE FEMALE (circle one)

3. Please indicate your ethnicity:

___________	AFRICAN AMERICAN, AFRICAN, BLACK
___________	HISPANIC, LATINO, MEXICAN AMERICAN, CUBAN AMERICAN, PUERTO RICAN
___________	ASIAN/CHINESE/JAPANESE AMERICAN, PACIFIC ISLANDER, CHINESE, JAPANESE
___________	AMERICAN INDIAN, NATIVE AMERICAN
___________	CENTRAL ASIAN, INDIAN, PAKISTANI
___________	ARAB, ARAB AMERICAN
___________	JEWISH
___________	WHITE, EUROPEAN AMERICAN NON-JEWISH
___________	OTHER: ________________________________ (PLEASE SPECIFY)

4. Please indicate what year you are in college (CIRCLE ONE):

FRESHMAN SOPHOMORE JUNIOR SENIOR MASTERS DOCTORAL
OTHER_______

<u>THANK YOU FOR YOUR HELP!</u>

Appendix B: The Questionnaire for Pilot Study 2

Department of Communication

University of Maryland

Part 1: WORD ASSOCIATION EXERCISE:

Instructions: Think about the phrase "GLOBAL WARMING." Write down whatever associations come to mind when you hear this phrase. Please use a WORD or a SHORT PHRASE for each answer. You have 1 minute to write down your list of thoughts and associations.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________
11. ______________________________
12. ______________________________
13. ______________________________
14. ______________________________
15. ______________________________

PLEASE TURN THE PAGE ⇒

<u>Part 2</u>: Please fill out the questions below.

1. My age is ____________ years.

2. I am MALE FEMALE (circle one)

3. Please indicate your ethnicity:

___________	AFRICAN AMERICAN, AFRICAN, BLACK
___________	HISPANIC, LATINO, MEXICAN AMERICAN, CUBAN AMERICAN, PUERTO RICAN
___________	ASIAN/CHINESE/JAPANESE AMERICAN, PACIFIC ISLANDER, CHINESE, JAPANESE
___________	AMERICAN INDIAN, NATIVE AMERICAN
___________	CENTRAL ASIAN, INDIAN, PAKISTANI
___________	ARAB, ARAB AMERICAN
___________	JEWISH
___________	WHITE, EUROPEAN AMERICAN NON-JEWISH
___________	OTHER: ____ (PLEASE SPECIFY)

4. Please indicate what year you are in college (CIRCLE ONE):

FRESHMAN SOPHOMORE JUNIOR SENIOR MASTERS DOCTORAL
OTHER_______

<u>THANK YOU FOR YOUR HELP!</u>

Appendix C: The Questionnaire for Pilot Study 3

<u>Instructions type 1:</u> Measuring distances using **<u>SOCIAL INCHES.</u>**

We'd like you to estimate differences between pairs of concepts. Differences can be measured in **social inches**. To help you to know how big a social inch is, think of the moderate distance between two concepts as 100 social inches.

Considering the pairs of concepts below, please remember the following. The more different you think the concepts are from each other, the larger the number of social inches between them. If you think that these concepts are more different than the difference between two moderately different concepts, then write a number greater than 100. If you think that they are less different than moderately different concepts, use a number smaller than 100. If you think there is no difference between them, write zero (0). You can use any number from zero on up, such as 18, 193, or 347. Thus,

These two concepts are identical = 0
These two concepts are <u>moderately</u> different = 100
Use any number from zero on up

Please keep in mind that there is no correct answer; do your best when answering the questions.

<u>Example</u>: Please indicate the difference (distance in <u>social inches</u>) between the following pairs of concepts:

write your number here

A local bar and the campus student union		<u>social inches</u> different

write your number here

A local bar and me		<u>social inches</u> different

Instructions type 2: **<u>OPINIONS</u>**

We would like to know how knowledgeable you are about world history. To answer this question use a number from 0 (zero) to infinity. Zero means you are not knowledgeable at all, and higher numbers represent greater levels of knowledge. If you are moderately knowledgeable, rate your knowledge as 100. If your knowledge is twice as much as moderate knowledge level, rate your knowledge as 200; if your knowledge is half of moderate knowledge level, rate your knowledge as 50. **You can use any number from zero on up, such as 18, 193, or 347.** Thus,

I have no knowledge on this issue at all = 0
I have moderate knowledge on this issue = 100
Use any number from zero on up

Questions	**Instructions**	write your number here:
1. How **knowledgeable** are you about world history?	I have no knowledge about world history = 0 I have moderate knowledge about world history = 100 Use any number from zero on up	
2. How much do you **care** about world history?	I do not care about world history at all = 0 I moderately care about world history = 100 Use any number from zero on up	

Department of Communication

University of Maryland

<u>Part 1:</u> In the section below you will be asked to estimate differences of pairs of concepts. Please answer the questions below, following the instructions provided.

<u>Instructions</u>: We'd like you to estimate differences between pairs of concepts. Differences can be measured in social inches. To help you to know how big a social inch is, think of the moderate distance between two concepts as 100 social inches.

Considering the pairs of concepts below, please remember the following. The more different you think the concepts are from each other, the larger the number of social inches between them. If you think that these concepts are more different than the difference between two moderately different concepts, then write a number greater than 100. If you think that they are less different than moderately different concepts, use a number smaller than 100. If you think there is no difference between them, write zero (0). You can use any number from zero on up, such as 18, 193, or 347.

	write your number here	
Melting ice and Al Gore are		social inches different
Melting ice and rising temperature		social inches different
Melting ice and pollution (carbon dioxide: CO_2)		social inches different
Melting ice and conservation of energy		social inches different
Melting ice and recycling		social inches different
Melting ice and me		social inches different
Melting ice and good		social inches different

Melting ice and bad		social inches different
Melting ice and my freedom		social inches different
Melting ice and anger		social inches different
Al Gore and rising temperature		social inches different
Al Gore and pollution (carbon dioxide: CO_2)		social inches different
Al Gore and conservation of energy		social inches different
Al Gore and recycling		social inches different
Al Gore and Me		social inches different
Al Gore and Good		social inches different
Al Gore and bad		social inches different
Al Gore and my freedom		social inches different
Al Gore and anger		social inches different
Rising temperature and pollution		social inches different
Rising temperature and conservation of energy		social inches different
Rising temperature and recycling		social inches different

Rising temperature and me		social inches different
Rising temperature and good		social inches different
Rising temperature and bad		social inches different
Rising temperature and my freedom		social inches different
Rising temperature and anger		social inches different
Pollution (CO_2) and conservation of energy		social inches different
Pollution (carbon dioxide: CO_2) and recycling		social inches different
Pollution (carbon dioxide: CO_2) and me		social inches different
Pollution (carbon dioxide: CO_2) and good		social inches different
Pollution (carbon dioxide: CO_2) and bad		social inches different
Pollution (carbon dioxide: CO_2) and my freedom		social inches different
Pollution (carbon dioxide: CO_2) and anger		social inches different
Conservation of energy and recycling		social inches different
Conservation of energy and me		social inches different
Conservation of energy and good		social inches different

Conservation of energy and bad		social inches different
Conservation of energy and my freedom		social inches different
Conservation of energy and anger		social inches different
Recycling and me		social inches different
Recycling and good		social inches different
Recycling and bad		social inches different
Recycling and my freedom		social inches different
Recycling and anger		social inches different
Me and good		social inches different
Me and bad		social inches different
Me and my freedom		social inches different
Me and anger		social inches different
Good and bad		social inches different
Good and my freedom		social inches different
Good and anger		social inches different

Bad and my freedom		social inches different

Bad and anger		social inches different

My freedom and anger		social inches different

Part 2: Please answer the question below. We would like to know how much you believe in global warming. To answer this question use a number from 0 (zero) to infinity. Zero means you do not believe in global warming at all, and higher numbers represent greater levels of belief in global warming. If you moderately believe in global warming, rate your belief as 100. If you believe in global warming twice as much as moderate level of belief, rate your belief as 200; if your belief in global warming is half of moderate belief level, rate your belief as 50. **You can use any number from zero on up, such as 18, 193, or 347.** Thus,

If you do not believe this source at all = 0
If you believe this source moderately = 100
There's no highest number: **Use any number from zero on up (e.g., 37, 59, 223).**

Questions	**Instructions**	write your number here:
1. How much do you believe in **global warming**?	I don't believe in global warming at all = 0 I moderately believe in global warming = 100 Use any number from zero on up	

Part 3: Please fill out the questions below.

1. My age is ____________ years.

2. I am MALE FEMALE (circle one)

3. Please indicate your ethnicity:

___________	AFRICAN AMERICAN, AFRICAN, BLACK
___________	HISPANIC, LATINO, MEXICAN AMERICAN, CUBAN AMERICAN, PUERTO RICAN
___________	ASIAN/CHINESE/JAPANESE AMERICAN, PACIFIC ISLANDER, CHINESE, JAPANESE
___________	AMERICAN INDIAN, NATIVE AMERICAN
___________	CENTRAL ASIAN, INDIAN, PAKISTANI
___________	ARAB, ARAB AMERICAN

___________	JEWISH
___________	WHITE, EUROPEAN AMERICAN NON-JEWISH
___________	OTHER: ______________________________________ (PLEASE SPECIFY)

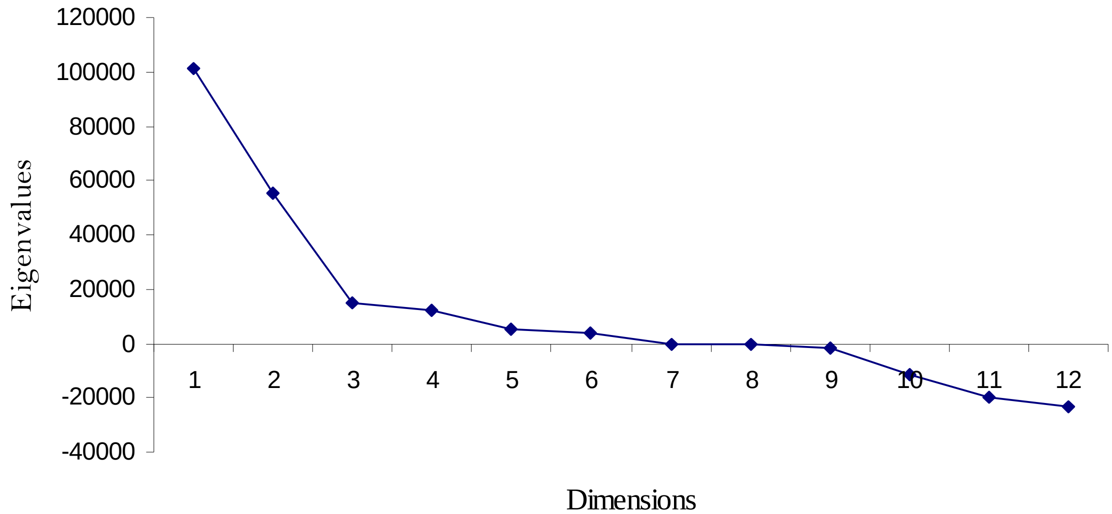
4. Please indicate what year you are in college (CIRCLE ONE):

FRESHMAN SOPHOMORE JUNIOR SENIOR MASTERS DOCTORAL OTHER_______

THANK YOU FOR YOUR HELP!

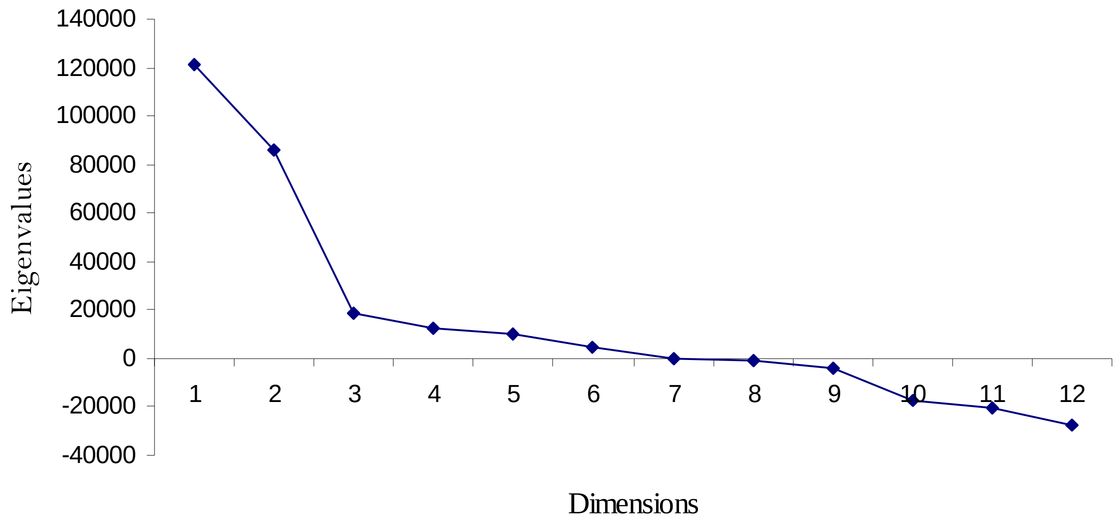
Appendix D. Determining Dimensions: Scree Plot for Eigenvalues for All Conditions

Figure D-1. *Scree Plot of Eigenvalues for Space 1 (Low Threat without Restoration at the Immediate-Time Condition)*



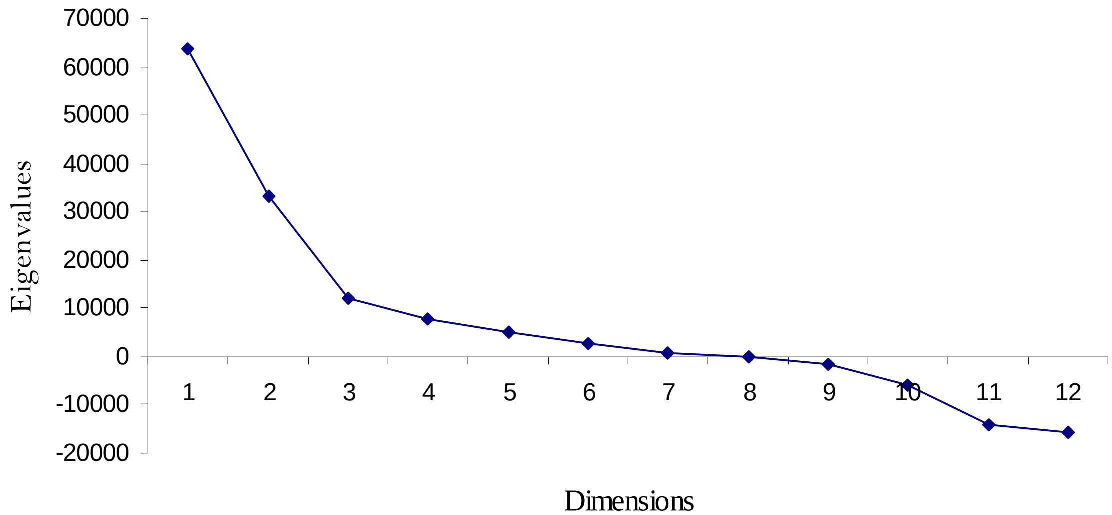
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-2. *Scree Plot of Eigenvalues for Space 2 (Low Threat without Restoration at a One-Minute-Delay Condition)*



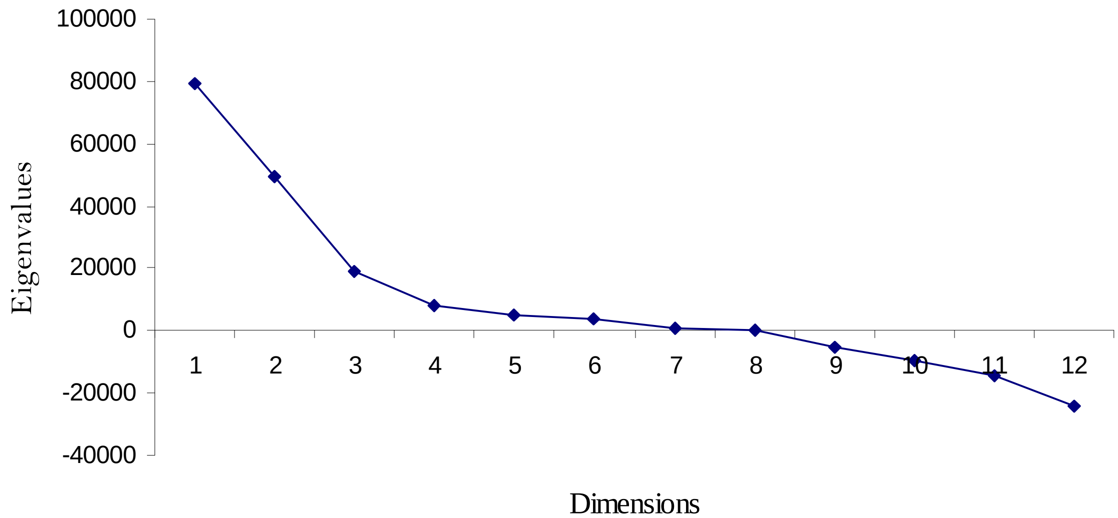
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-3. *Scree Plot of Eigenvalues for Space 3(Low Threat without Restoration at a Two-Minute-Delay Condition)*



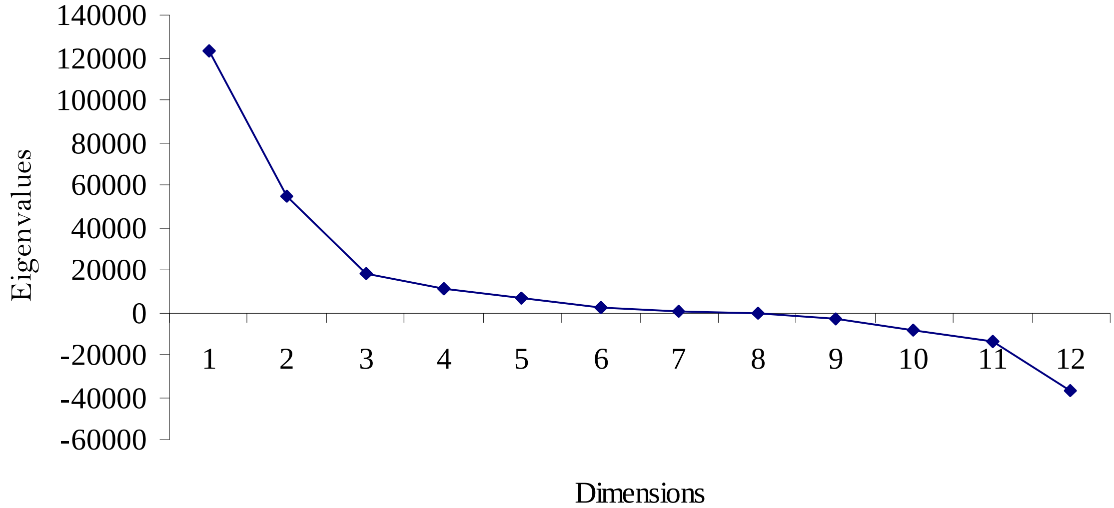
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-4. *Scree Plot of Eigenvalues for Space 4 (Low Threat with Restoration at the Immediate-Time Condition)*



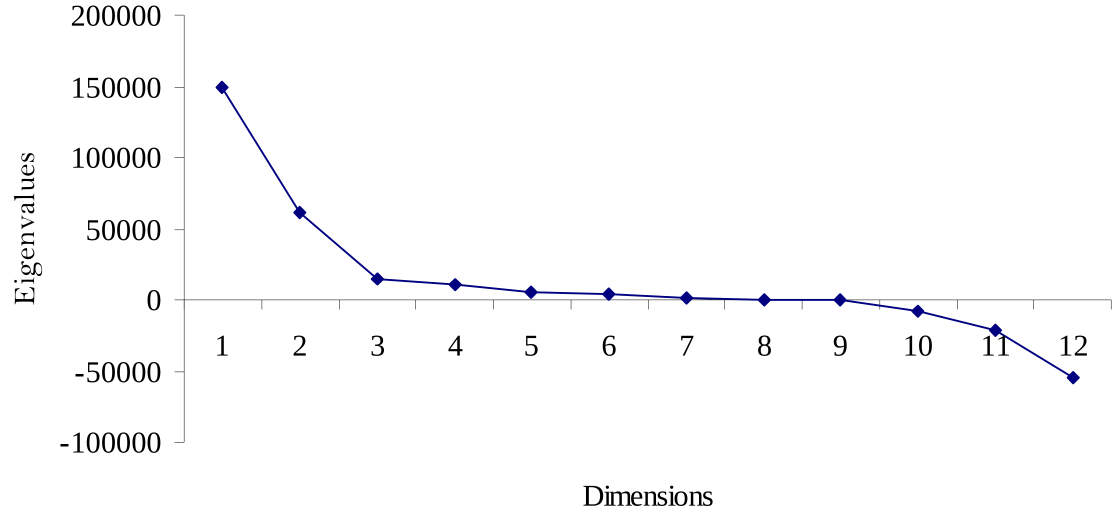
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-5. *Scree Plot of Eigenvalues for Space 5 (Low Threat with Restoration at a One-Minute-Delay Condition)*



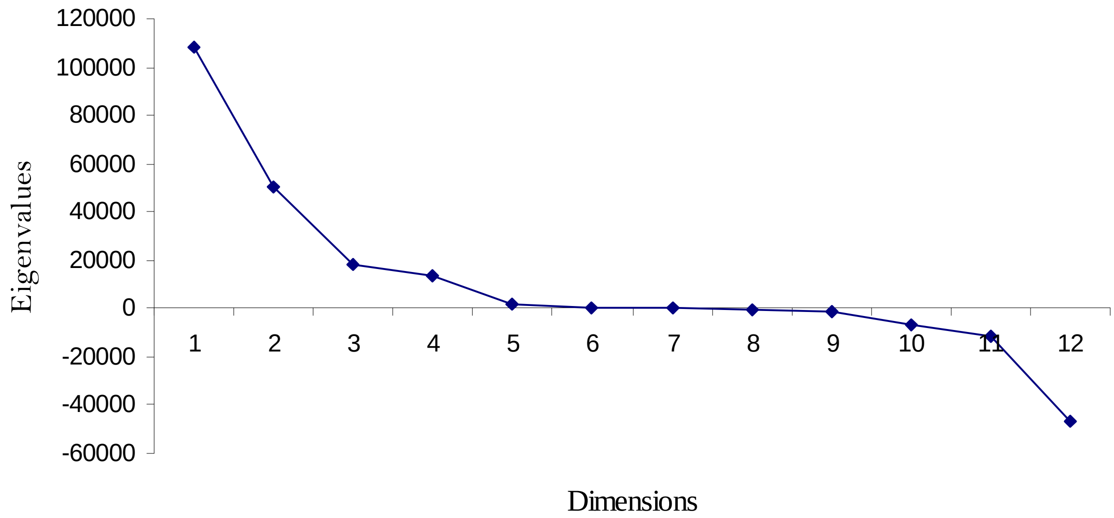
Note. The eigenvalues were obtained after rotating the maps in the time series fashion within each appropriate experimental condition.

Figure D-6. *Scree Plot of Eigenvalues for Space 6 (Low Threat with Restoration at a Two-Minute-Delay Condition)*



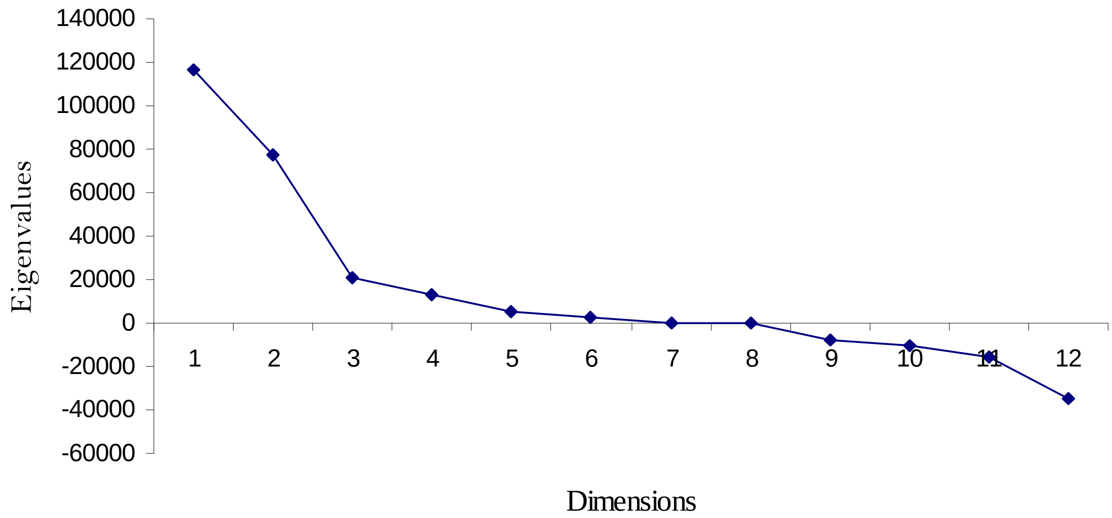
Note. The eigenvalues were obtained after rotating the maps in the time series fashion within each appropriate experimental condition.

Figure D-7. *Scree Plot of Eigenvalues for Space 7 (High Threat without Restoration at the Immediate-Time Condition)*



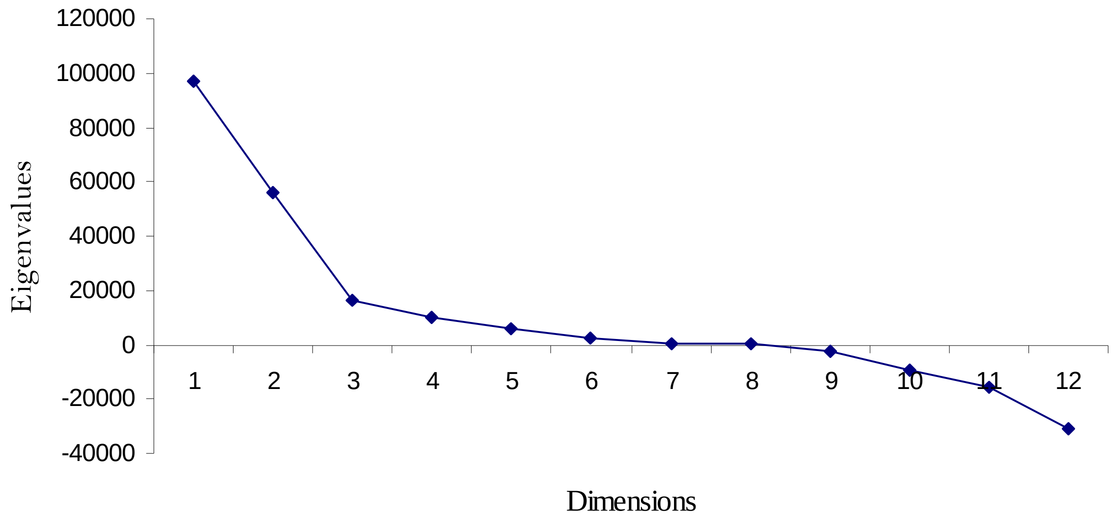
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-8. *Scree Plot of Eigenvalues for Space 8 (High Threat without Restoration at a One-Minute-Delay Condition)*



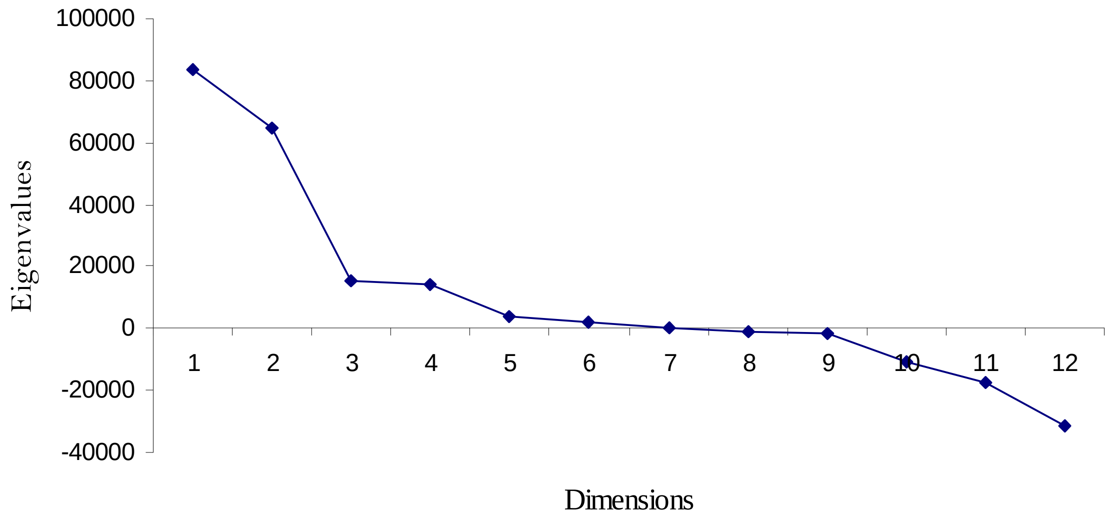
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-9. *Scree Plot of Eigenvalues for Space 9 (High Threat without Restoration at a Two-Minute-Delay Condition)*



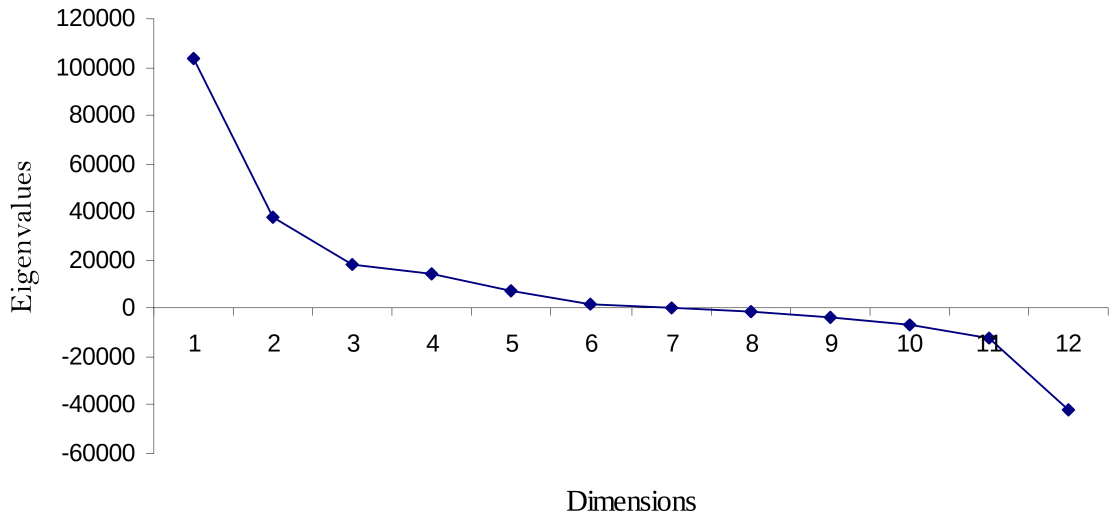
Note. The eigenvalues were obtained after rotating the maps in the time series fashion within each appropriate experimental condition.

Figure D-10. *Scree Plot of Eigenvalues for Space 10 (High Threat with Restoration at the Immediate-Time Condition)*



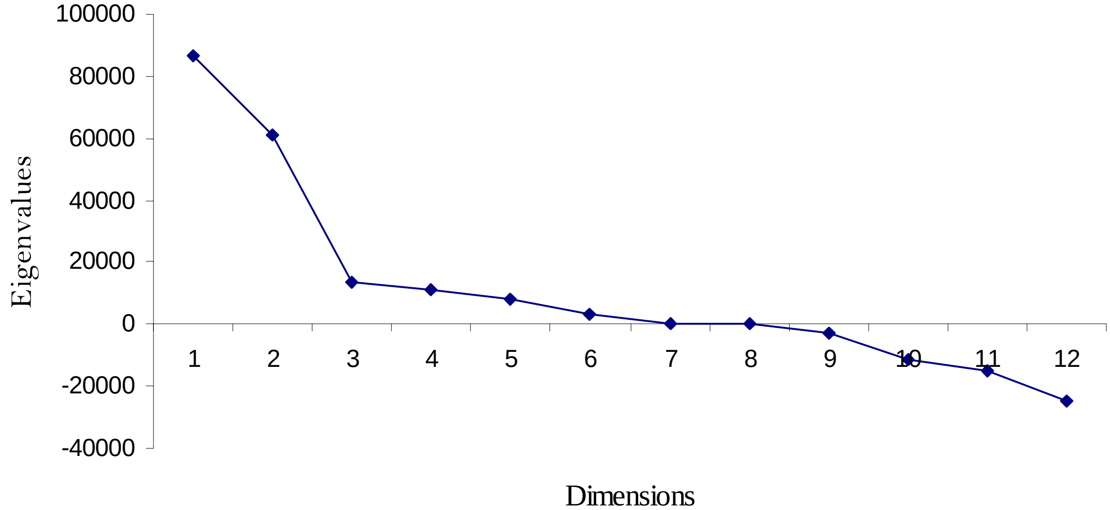
Note. The eigenvalues were obtained after rotating the maps in the time series fashion within each appropriate experimental condition.

Figure D-11. *Scree Plot of Eigenvalues for Space 11 (High Threat with Restoration at a One- Minute-Delay Condition)*



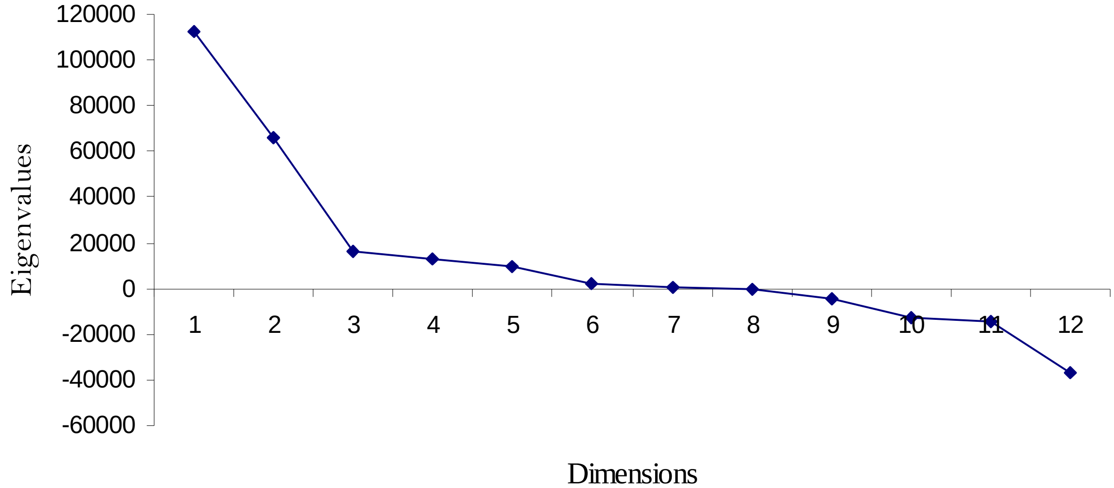
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-12. *Scree Plot of Eigenvalues for Space 12 (High Threat with Restoration at a Two- Minute-Delay Condition)*



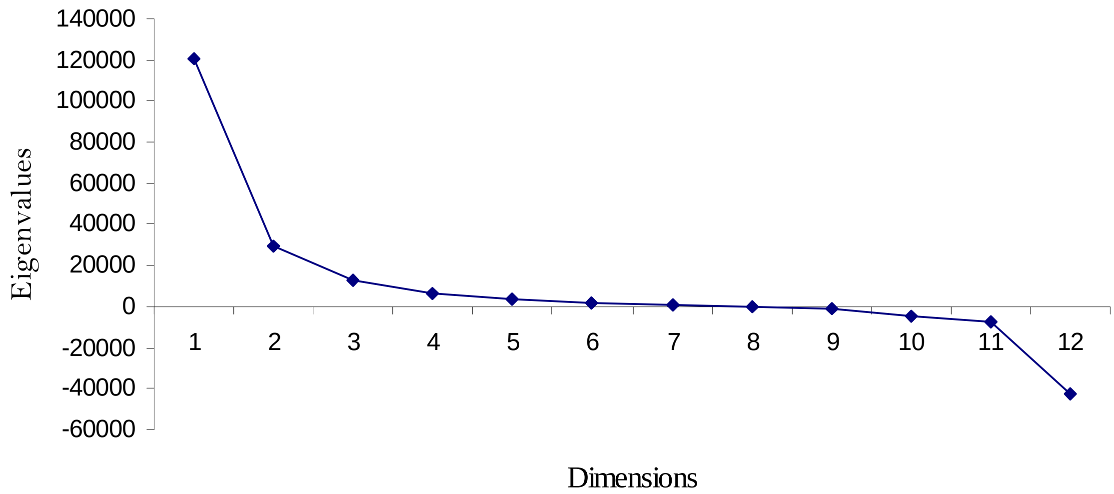
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-13. *Scree Plot of Eigenvalues for Space 13 (Control at the Immediate-Time Condition)*



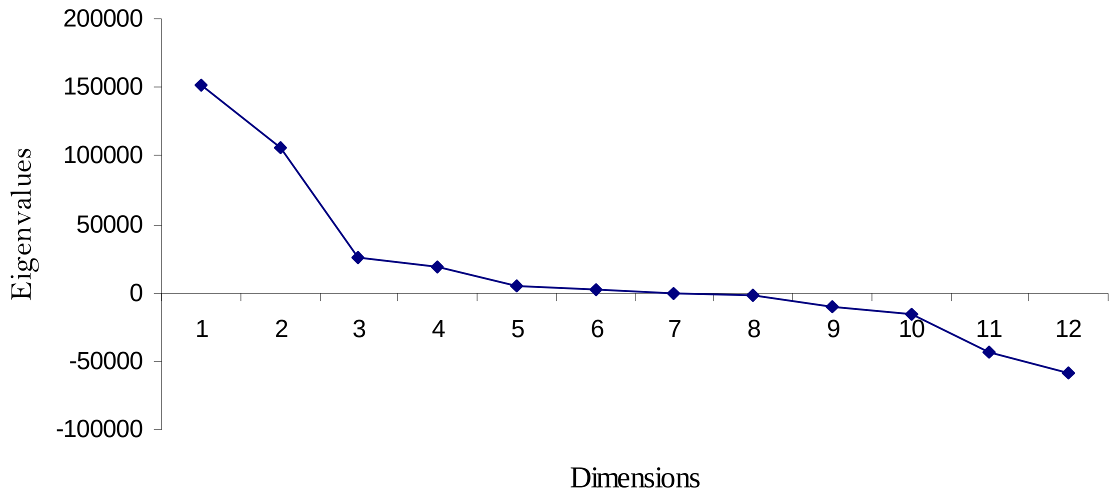
Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-14. *Scree Plot of Eigenvalues for Space 14 (Control at a One-Minute-Delay Condition)*



Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

Figure D-15. *Scree Plot of Eigenvalues for Space 15 (Control at the Two-Minute-Delay Condition)*



Note. The eigenvalues were obtained after rotating the maps in a time-series fashion within each appropriate experimental condition.

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