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Reactance, Restoration, and Cognitive Structure: Comparative Statics

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This study (N = 143) examined the effects of freedom threat on cognitive structures, using recycling as its topic. The results of a 2(Freedom Threat: low vs. high) × 2(Postscript: restoration vs. filler) plus 1(Control) experiment indicated that, relative to the control condition, high freedom threat created a boomerang effect for the targeted attitude (recycling) as the attitude and behavioral intention changed in the opposite direction to the one advocated in the message. For the associated but untargeted attitude (energy conservation), reactance effects were less pronounced. Furthermore, a restoration postscript was examined as a reactance mitigation strategy. The restoration postscript was effective for high- but not low-threat messages.

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In attitude change research, there are instances of persuasive campaigns that have failed to induce change in the direction advocated (e.g., Backer, Rogers, & Sopory, 1992; Hornik, 2002). Moreover, some campaigns have resulted in attitude change directly opposite to the position advocated (e.g., Hornik et al., 2001), producing boomerang effects. One theory explaining these adverse effects is the theory of psychological reactance (TPR; J. W. Brehm, 1966). The TPR posits that freedom-threatening messages lead to reactance, which negatively affects persuasion. Research examining the effects of freedom-limiting messages (e.g., Rains & Turner, 2007) suggests that the failure of many campaigns can, indeed, be attributed to reactance.

A new direction in the TPR has been the examination of restoration, defined as a strategy designed to reduce the perception of freedom threat, or, in other words, to obviate the effects of reactance (e.g., Miller, Lane, Deatrick, Young, & Potts, 2007). A simple restoration postscript, suggesting that individuals still have the freedom to make a decision, has been found to reduce the perception of the freedom threat (Miller et al., 2007). However, the relationship between restoration postscripts and persuasion has not been examined.

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Another unexplored area in the TPR is reactance effects beyond the attitudes and behaviors targeted by the reactance-inducing message. There is evidence (Dinauer & Fink, 2005) that messages can affect concepts associated with the targeted attitudes and behaviors even when such concepts are not mentioned in the message. (In what follows, we refer to the concept targeted by the message as the *target concept* and a concept associated with the target concept as an *associated concept*.) Examining reactance effects on associated concepts is critical to the TPR: When people focus freedom restoration on the target concept, the effects on associated attitudes may not be the same. Instead of negative attitudes and reduced behavioral intentions, positive views of the associated concept may emerge.

We used Galileo theory (Woelfel & Fink, 1980) to examine the effects of reactance on multiple concepts in cognitive structures. Applying a systemic approach to demonstrate the effects of freedom threat and restoration on relevant cognitive structures is new for the TPR. In their review of new research directions in communication, Shapiro, Hamilton, Lang, and Contractor (2003) suggested that scholars should be using more systemic approaches to examine attitude change; this article is an example of moving in the direction proposed by these authors.

The theory of psychological reactance

The TPR is a motivational theory of resistance to persuasion (Eagly & Chaiken, 1993). The theory posits that individuals value their freedom to choose among different options (S. S. Brehm & Brehm, 1981). When freedoms are threatened, reactance is induced, motivating people to restore the threatened freedom (J. W. Brehm, 1966). Four components are central to the reactance process: freedom, threat to freedom, reactance, and restoration of freedom (Dillard & Shen, 2005).

Determinants of reactance

Causes of reactance include language intensity (e.g., Miller et al., 2007) and intent to persuade (e.g., Dillard & Shen, 2005). Language intensity is defined in terms of message explicitness: Explicit messages "convey a single meaning and leave little doubt as to the source's intentions" and are often characterized by the use of imperatives such as *should* and *must* (Miller et al., 2007, p. 223; cf. Hamilton & Hunter, 1998). Intent to persuade causes reactance by creating a perception that a message is manipulative (Bessarabova, Turner, & Fink, 2007). Using explicit language (Miller et al., 2007), perceived intent to persuade (Bensley & Wu, 1991; Kohn & Barnes, 1977) or the combination of these factors (Dillard & Shen, 2005) creates effects consistent with the TPR.

Mitigating reactance

Freedom threats can be alleviated by providing alternative ways to restore the threatened freedoms. Restoration involves giving back a "sense of autonomy and self-determination" (Miller et al., 2007, p. 224). Freedom restoration can be achieved directly by engaging in a behavior opposite to the one advocated in the message (which is a boomerang effect; J. W. Brehm, 1966) or indirectly by derogating the message or the message source (Burgoon, Alvaro, Broneck, et al., 2002; Quick & Considine, 2008).

Miller et al. (2007) used a restoration postscript to counteract the effects of a high threat to freedom. In their study, the postscript restored participants' freedom by suggesting that it was up to them to decide whether to perform the behavior (exercise) advocated in the message. These authors suggested that a restoration postscript "offers an uncomplicated, direct, and apparently effective way to help avert ... boomerang effects" (p. 234) and also can be used to "disguise the overt nature of a persuasive message" (p. 225). Thus, postscripts are likely to be effective at both low and high threat because, in the former case, they ameliorate the mild threat to freedom present in any persuasive message (Burgoon, Alvaro, Grandpre, & Voulodakis, 2002), and in the latter case, they reduce reactance effects.

Miller et al. (2007) showed that a restoration postscript reduced the perception of freedom threat; however, they did not assess the effects of restoration on attitudes. The link between restoration and persuasion is critical for the TPR and needs to be further evaluated. Moreover, no attempts have been made to examine the effects of the restoration postscripts on reactance within the context of relevant cognitive structures.

Examining cognitive structures: Galileo theory

In attitude change research, there have been many attempts to understand the relationships between persuasion and cognitive structure (e.g., Rosenberg, 1956). Persuasive messages can be viewed as disturbances that initiate movement within cognitive structures (McGuire, 1985). These structures consist of interconnected attitudes and beliefs stored in memory (Tourangeau, Rasinski, & D'Andrade, 1991); thus, activating one element of a structure can also retrieve associated attitudes and beliefs (Judd, Drake, Downing, & Krosnick, 1991). Despite the centrality of cognitive structures for persuasion, only a few attempts have been made to integrate a structural approach to attitudes within the study of persuasion (e.g., Dinauer & Fink, 2005; Hunter, Levine, & Sayers, 1976).

One theory focusing on cognitive structures and persuasion is Galileo theory (hereinafter Galileo; Woelfel & Fink, 1980; Woelfel & Saltiel, 1988). This theory allows the examination of global attitude structures (Gordon, 1988) and provides an elegant method to represent them. Galileo suggests that concepts can be represented in cognitive space. Within a given space, attitudes can be inferred from the position of a concept relative to evaluative terms such as *good* and *bad*: The closer the concept is to *good* and the further from *bad*, the more positive the attitude is; the closer the concept is to *bad* and the further from *good*, the more negative the attitude is. Similarly, behavioral intentions can be inferred from the location of a self-referent term (e.g., *me*) and a behavioral concept. Thus, if *me* is located close to *voting*, an intention to vote is likely. Overall, understanding concepts' locations and the distances between them allows designing persuasive appeals, attempting to shorten the distance between the self-referent (*me*), positive evaluative terms (e.g., *good*), and the concept targeted in the message.

Galileo's approach to measuring attitudes and behavioral intentions is a combination of well-known measurement and analytical techniques. It is based on multidimensional scaling (MDS; Torgerson, 1958) and, like semantic-differential scaling, allows for the exploration of individuals' cognitive maps in a multidimensional space. To generate a map, individuals can be asked to estimate the pairwise differences between the concepts of interest (Gillham & Woelfel, 1977). The evidence for the validity of the MDS approach is substantial (e.g., Barnett & Kincaid, 1983; Dinauer & Fink, 2005; Fink, Monahan, & Kaplowitz, 1989; Gordon, 1988; Kincaid, Yum, & Woelfel, 1983), demonstrating the "precision, stability, and equivalence" of MDS to traditional measures (Gillham & Woelfel, 1977, p. 222).

Galileo allows capturing changes in location and distances between relevant concepts. Similar ideas have been tested in hierarchical models of attitude change (e.g., Poole & Hunter, 1979). Both approaches agree that there are downward influences in hierarchical cognitive structures (Dinauer & Fink, 2005), but contrary to hierarchical models, Galileo also predicts upward and lateral influences. Consistent with this idea, Dinauer and Fink (2005) found that concepts directly targeted by a message "exhibit less attitude change than related concepts to which the focal concept appears to be linked" (p. 1). Similar processes are likely for reactance: Associated concepts may be indirectly affected by a reactance-inducing message. Because people focus on restoring freedoms related to the target concept, more positive attitude change may occur regarding an associated concept.

Present research and hypotheses

We examined the effects of freedom threat and restoration on the relevant cognitive structures to understand the effect of reactance-related processes on attitudes and behavioral intentions. To illustrate spatial configurations at different levels of threat, we present H1 (see also Fink et al., 1989) in Figure 1, where a positive attitude is inferred from the distance between the target concept and *good*; a negative attitude is inferred from the distance between the target concept and *bad*; a behavioral intention is inferred from the distance between the target concept and *me*; and anger toward the target concept is inferred from the distance between the target concept and *anger*.

The initial set of predictions only addresses the target concept. Studies of the TPR consistently demonstrate that high threat causes reactance and subsequently reduces persuasion (Rains, 2013). J. W. Brehm (1966), however, proposed that the effect of reactance can be so substantial that it may lead to a change in the direction opposite to the position advocated, resulting in a boomerang effect.[1] To determine if there is a boomerang effect, comparing a high-threat message to a baseline or a no-message control condition is required (Kumkale & Albarracín, 2004). Reduced persuasion or a boomerang effect caused by reactance implies that a low-threat message

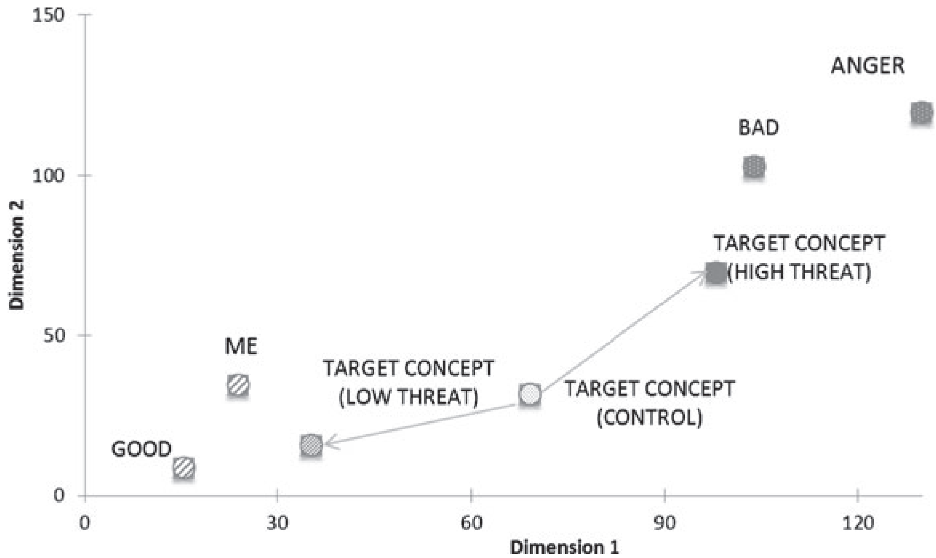

Figure 1 Representation of H1: Reduced persuasion, boomerang, and increased persuasion effects.

(vs. a no-message control condition) should result in persuasion (i.e., a change in the direction of the position advocated). Thus, the following hypothesis is proposed:

H1: There is a main effect of threat on persuasion: (a) A high (vs. low) freedom threat reduces persuasion; (b) a high freedom threat (vs. a control condition) causes a boomerang effect; (c) a low freedom threat (vs. a control condition) leads to persuasion.

In spatial terms (see Figure 1), H1a indicates that at high threat, distances between the *target concept* and *me*, and the *target concept* and *good*, are greater, and distances between the *target concept* and *bad*, and the *target concept* and *anger*, are smaller than at low threat. H1b predicts that when threat is high, distances between the *target concept* and *me*, and the *target concept* and *good*, are greater, and distances between the *target concept* and *bad*, and the *target concept* and *anger*, are smaller than in the control condition. Finally, H1c states that at low threat, distances between the *target concept* and *me*, and the *target concept* and *good*, are smaller, and distances between the *target concept* and *bad*, and the *target concept* and *anger*, are greater than in the control condition.

Hypothesis 2 predicts the effects of restoration on persuasion. We argued above that restoration should be effective for both high- and low-threat messages (Miller et al., 2007). On the basis of prior research, the least positive attitude and weakest behavioral intention are expected at high threat, and adding a restoration postscript should help alleviate the effects of reactance (Miller et al., 2007), leading to a more positive attitude. If restoration has the same ameliorative effect at both low and high threat, then a high-threat-with-restoration message will be less persuasive than a low-threat-with-restoration message. Further, because the effect of freedom threat is substantial, restoration added at high threat is unlikely to reduce reactance effects to the levels of low-threat messages; thus, a high-threat-with-restoration message will be less persuasive than a low-threat message. This reasoning results in the following prediction:

H2: The magnitude of positive attitude and behavioral intention, from least to most, is: high threat, high threat with restoration, low threat, and low threat with restoration.

In spatial terms, H2 means that the distance between the *target concept* and *good*, and the *target concept* and *me*, from least to most, is: low threat with restoration, low threat, high threat with restoration, and high threat.

Finally, based on Dinauer and Fink's (2005) findings that persuasion may have more impact on associated concepts than on the target concept, we ask the following:

RQ1: What is the effect of a threat to freedom on an associated concept?

RQ2: What is the effect of a restoration postscript on an associated concept?

Method

Unless otherwise specified, all variables were winsorized by recoding the extreme scores to a lower value; then they were transformed to help meet the normality assumption required for tests based on the general linear model (Fink, 2009). In the formulas below a constant was added to the winsorized value because some transformations cannot be performed on values of zero.[2]

Pilot Studies

Pilot Study 1

We conducted four pilot studies, with college students as participants. To induce reactance, we needed an involving (S. S. Brehm & Brehm, 1981) and proattitudinal topic (see Worchel & Brehm, 1970, for the view that having counterattitudinal beliefs on an issue serves as an exercise of freedom). On the basis of Pilot Study 1 ($N = 45$), we chose global warming as the topic. Participants reported this issue to be important and indicated that they believed in global warming (see also Pew Research Center, 2008, for evidence of overwhelming belief in the existence of global warming on college campuses at the time of data collection).

Pilot Study 2

In Pilot Study 2 ($N = 43$), we determined concepts to be used for the cognitive maps. Participants were given 1 minute to make a list of associations (words or short phrases) with the term *global warming*. The most frequent concepts were: *melting ice*, *rising temperature*, CO_2, *Al Gore*, *energy conservation*, and *recycling*. We chose *recycling* as the target concept (i.e., a prorecycling message was chosen for the main study) and *energy conservation* as the associated concept (i.e., energy conservation was not advocated in the message, but we assessed participants' views about it in the main study).

Pilot Study 3

In Pilot Study 3 ($N = 29$), Galileo software (Woelfel, 1993) was used to help generate a message strategy. To increase intention to recycle by connecting *recycling* with *me*, we calculated the potential links (using all concepts from Pilot Study 2) to be mentioned in a message to increase the probability of connecting these two concepts. The results indicated that the *melting ice*, *rising temperature*, CO_2, and *good* should be included in the message to bring *recycling* and *me* closer together; these six concepts were used in our messages.

Pilot Study 4

In Pilot Study 4 ($N = 33$), the messages (see below) were tested for their ability to induce reactance by assessing the perceived threat, anger, and negative cognitions that they induced. Magnitude scales, with lower bounds of 0 and no upper bound, were used for all measures of threat and anger, with 0 = *none of an attribute* and 100 = *a moderate amount of an attribute*. Perceived threat was measured with three items ($\alpha = .81$; e.g., How much do you feel that the message tried to manipulate you?; Dillard & Shen, 2005). *Anger* was measured with four items ($\alpha = .90$; e.g., angry; Dillard & Shen, 2005). Each item of the perceived threat and anger indices was transformed to ln(original item + 1), where ln is the natural logarithm. Both indices were formed by saving the first unrotated principal component of the items ($M = 0.00$, $SD = 1.00$). Negative thoughts (e.g., responses disagreeing with the message or derogating the message or the source) were obtained through a thought-listing task. Thoughts were coded ($M = 1.31$, $SD = 1.40$; Scott's $pi = .80$ for two coders) using the approach described by Dillard and Shen (2005, pp. 153–154) and then counted; this measure did not require transformation.[3]

Three univariate analyses of covariance (ANCOVAs) were conducted with threat (low vs. high) and postscript (restoration vs. filler) entered as the independent variables, and perceived threat, anger, and negative thoughts entered separately as dependent variables. Involvement was transformed to ln(original item + 1) and was used as a covariate in these ANCOVAs.

The high-threat message ($M = 0.52$, $SD = 0.78$) was perceived to be significantly more freedom threatening, $F(1, 27) = 28.33$, $p < .001$, $\eta^2 = .47$, $R^2 = .55$, $R^2_{adj} = .49$, than the low-threat message ($M = -0.63$, $SD = 0.76$). The effect of involvement was also significant, $F(1, 27) = 7.77$, $p = .01$, $\eta^2 = .13$. Similarly, the high-threat message ($M = 0.50$, $SD = 1.08$) elicited significantly more anger, $F(1, 27) = 7.35$, $p = .01$, $\eta^2 = .21$, $R^2 = .25$, $R^2_{adj} = .14$, than the low-threat message ($M = -0.38$, $SD = 0.71$). The high-threat message ($M = 1.87$, $SD = 1.41$) also resulted in significantly more negative thoughts, $F(1, 26) = 4.97$, $p = .04$, $\eta^2 = .15$, $R^2 = .19$, $R^2_{adj} = .07$, than the low-threat message ($M = 0.69$, $SD = 1.14$). The effect of the covariate was not significant for either anger or negative cognitions. For all three analyses, the effects of restoration and the threat by restoration interaction were not significant. In summary, the threat induction was successful.

Participants

In exchange for extra credit, a sample of 143 students was recruited from undergraduate communication courses at the University of Maryland. Thirty-four percent ($n = 48$) were male. The mean age was 20.13 years ($SD = 3.07$, range: 18–46). Fifty-six percent were White, 15% were Black, 14% were Asian, 6% were Hispanic, and 9% self-identified themselves as "other."

Design, procedure, and study materials

A 2(Freedom Threat: low vs. high) × 2(Postscript: restoration vs. filler) plus 1 (No-Message Control Condition) between-subjects design was employed. The data were collected using laptops with MediaLab software (Jarvis, 2004). After signing consent forms, participants were randomly assigned to experimental conditions. Then they completed an MDS practice exercise. Next, the participants (except for those in the control condition) read statements about recycling. Threat was induced through a combination of language intensity and intent to persuade. The U.S. Environmental Protection Agency (EPA) was selected as the high credibility message source (based on Fink, Bessarabova, & Cai's, 2006, pilot test). The messages appear below, with alternate wording in brackets (low-threat wording first, high-threat wording last):

> [It is important to know about the benefits of recycling:/The information <u>you must know</u> about the benefits of recycling:] Recycling is good and, [moreover,] it works!
>
> **[Recycle! Recycle! Recycle! Recycle!/There's really no choice when it comes to recycling: You simply have to do it!]**
>
> [Below is some important information about the benefits of recycling that we would like you to consider: / 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.
>
> **[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!/<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, participants received either a restoration or a filler postscript (Miller et al., 2007) written in a smaller font. 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 the 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.

Each threat message had 118 words; each postscript had 53 words. Next, all participants estimated the pairwise dissimilarities between the 12 concepts (see below), responded to demographic questions, and were debriefed about the purpose of the study.

Instrumentation

MDS comparison pairs

Participants were asked to estimate the pairwise dissimilarities between all possible pairs of 12 concepts: *melting ice*, *Al Gore*, *rising temperature*, *CO_2*, *energy conservation*, *recycling* (derived from Pilot Study 2) and *me*, *good*, *bad*, *angry*, *my freedom*, and *the EPA*, creating 66 comparison pairs in all. All items were transformed to ln(winsorized original variable + 50). Participants were told that comparisons are like distances measured in social inches, where the moderate distance between two concepts is 100 social inches, and the more different the concepts are, the larger the number of social inches between them. Next, they were guided through a practice exercise.

Analytic strategy

Generating coordinates

We averaged the transformed pairwise estimates in each condition, and then antitransformed them to preserve the original metric.[4] Next, we entered the antitransformed means into Galileo software and obtained the coordinates for the 12 concepts' locations in the cognitive space. To ensure that the coordinates could be used for comparisons across conditions, we performed a rotation to congruence (Woelfel, 1990).[5]

Determining distances between concepts across spaces

First, we established that two real dimensions accounted for the majority of the real variance across all cognitive spaces.[6] Distances between concepts across cognitive spaces were computed using only these two dimensions. In what follows, *Dm* stands for dimension, and $D_{i,j}$ is the distance between concepts *i* and *j*. The distance between two concepts was found by the Pythagorean formula:

$$D_{i,j}^2 = (\text{concept } i's \text{ location in space A on } Dm1 - \text{concept } j's \text{ location in space A on } Dm1)^2 + (\text{concept } i's \text{ location in space A on } Dm2 - \text{concept } j's \text{ location in space A on } Dm2)^2.$$

Once the distance between two concepts was calculated in one space (condition), similar calculations were performed for the distance between the same set of concepts in another space. A simple subtraction was used to determine the difference of the distances across two spaces.

Significance testing

To take into account the size of the dimensions that were used, the transformed scores derived from the participants' MDS estimates for a specific cognitive space (condition) were multiplied by the ratio of eigenvalue for that dimension to the total eigenvalues for all real dimensions in that space. These procedures were repeated for both dimensions for all conditions. Each estimated distance was used in a *t* test as a dependent variable (see Table 1).

To cross-validate this approach, we used a modified jackknife procedure (Mosteller & Tukey, 1977) on data from the entire space for each condition, as described in Fink and Chen (1995). This procedure entailed selecting three subsamples containing two-thirds of the data and generating psuedovalues. The essence of significance testing based on this procedure involves estimating how much a concept's location is different on each of the two dimensions across the conditions of interest, and then, based on psuedovariability values, calculating pseudo-*t* tests. For cross-validation, we examined distances between the low-threat and the control conditions (H1c).[7] The jackknife procedures are cumbersome and time consuming; the Galileo software does not automate these procedures. Thus, the jackknife approach was only used to cross-validate the results derived from the procedure that adjusts for the amount of variance explained by a given dimension described above. Importantly, the jackknife procedure produced results that were consistent with the results reported based on the statistical tests that adjusted for the amount of explained variance. (Means, standard deviations, and correlations for the variables adjusted for the amount of explained variance appear in Table 2).

Significant differences in distances are indicated by asterisks (for *t* tests, see Table 1). One asterisk (*) denotes significance of less than .05 but greater than .01 (two-tailed), and two asterisks (**) denote significance less than .01 (two-tailed). Because the data had a two-dimensional solution, an asterisk indicates a significant difference on at least one dimension. Significance information based on linear effects is provided below; asterisks were not used here because these contrasts only determined the overall significance of the predicted effect.

Table 1 Means, Standard Deviation, and Significance Tests for Distance Differences for H1 and RQ1

Hs	Transformed Distance	*M*s (*SD*s) in Threat Conditions Being Compared	t^a	p^b	η^2
H1a	*Recycling & me, Dm*1	Low: 3.70 (0.32) vs. high: 4.12 (0.40)	4.47	<.01	.26
	*Recycling & me, Dm*2	Low: 2.03 (0.17) vs. high: 1.90 (0.18)	2.85	<.01	.12
	*Recycling & good, Dm*1	Low: 3.25 (0.41) vs. high: 3.73 (0.46)	4.24	<.01	.24
	*Recycling & good, Dm*2	Low: 1.78 (0.23) vs. high: 1.72 (0.21)	1.04	=.30	
	*Recycling & bad, Dm*1	Low: 4.34 (0.55) vs. high: 5.21 (0.42)	6.77	<.01	.45
	*Recycling & bad, Dm*2	Low: 2.38 (0.30) vs. high: 2.40 (0.20)	0.30	=.77	
	*Recycling & anger, Dm*1	Low: 4.24 (0.51) vs. high: 4.85 (0.57)	4.34	<.01	.25
	*Recycling & anger, Dm*2	Low: 2.33 (0.28) vs. high: 2.24 (0.26)	1.28	=.21	
H1b	*Recycling & me, Dm*1	Control: 3.56 (0.30) vs. high: 4.12 (0.40)	5.93	<.01	.39
	*Recycling & me, Dm*2	Control: 2.08 (0.17) vs. high: 1.90 (0.18)	3.85	<.01	.22
	*Recycling & good, Dm*1	Control: 3.31 (0.42) vs. high: 3.73 (0.46)	3.57	<.01	.19
	*Recycling & good, Dm*2	Control: 1.94 (0.24) vs. high: 1.72 (0.21)	3.65	<.01	.20
	*Recycling & bad, Dm*1	Control: 4.40 (0.41) vs. high: 5.21 (0.42)	7.30	<.01	.50
	*Recycling & bad, Dm*2	Control: 2.58 (0.24) vs. high: 2.40 (0.20)	3.05	<.01	.15
	*Recycling & anger, Dm*1	Control: 4.29 (0.46) vs. high: 4.85 (0.57)	4.05	<.01	.23
	*Recycling & anger, Dm*2	Control: 2.51 (0.27) vs. high: 2.24 (0.26)	3.81	<.01	.21
H1c	*Recycling & me, Dm*1	Control: 3.56 (0.30) vs. low: 3.70 (0.32)	1.73	.09	.05
	*Recycling & me, Dm*2	Control: 2.08 (0.17) vs. low: 2.03 (0.17)	1.13	.26	
	*Recycling & good, Dm*1	Control: 3.31 (0.42) vs. low: 3.25 (0.41)	0.55	.58	
	*Recycling & good, Dm*2	Control: 1.94 (0.24) vs. low: 1.78 (0.23)	2.61	.01	.11
	*Recycling & bad, Dm*1	Control: 4.40 (0.41) vs. low: 4.34 (0.55)	0.47	.64	
	*Recycling & bad, Dm*2	Control: 2.58 (0.24) vs. low: 2.38 (0.30)	2.81	.01	.12
	*Recycling & anger, Dm*1	Control: 4.29 (0.46) vs. low: 4.24 (0.51)	0.39	.70	
	*Recycling & anger, Dm*2	Control: 2.51 (0.27) vs. low: 2.33 (0.28)	2.51	.02	.10
RQ1	*E. conserv. & me, Dm*1	Control: 3.67 (0.42) vs. high: 4.17 (0.47)	4.20	<.01	.25
	*E. conserv. & me, Dm*2	Control: 2.15 (0.24) vs. high: 1.93 (0.22)	3.58	<.01	.19
	*E. conserv. & me, Dm*1	High: 4.17 (0.47) vs. low: 3.69 (0.36)	4.43	<.01	.20
	*E. conserv. & me, Dm*2	High: 1.93 (0.22) vs. low: 2.02 (0.20)	1.65	=.11	
	*E. conserv. & me, Dm*1	Control: 3.67 (0.42) vs. low: 3.69 (0.36)	.20	=.85	
	*E. conserv. & me, Dm*2	Control: 2.15 (0.24) vs. low: 2.02 (0.20)	2.27	=.03	.08
	*E. conserv. & good, Dm*1	Control: 3.33 (0.46) vs. low: 3.29 (0.40)	.35	=.72	
	*E. conserv. & good, Dm*2	Control: 1.95 (0.27) vs. low: 1.81 (0.22)	2.19	=.03	.08
	*E. conserv. & good, Dm*1	High: 3.78 (0.45) vs. low: 3.29 (0.40)	4.43	<.01	.26
	*E. conserv. & good, Dm*2	High: 1.75 (0.21) vs. low: 1.81 (0.22)	1.07	=.29	
	*E. conserv. & good, Dm*1	Control: 3.33 (0.46) vs. high: 3.78 (0.45)	3.70	<.01	.19
	*E. conserv. & good, Dm*2	Control: 1.95 (0.27) vs. high: 1.75 (0.21)	3.09	<.01	.14

Note: Dm stands for dimension. *E. Conserv*. stands for energy conservation.
[a]For these analyses, $df = 54$ or 57. [b]Based on Bonferroni correction, the significance level for these analyses was .02.

Table 2 Means, Standard Deviations, and Correlations of Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. *Recycling & good, Dm*1	3.38	0.60	1.00											
2. *Recycling & good, Dm*2	1.83	0.41	.30**	1.00										
3. *Recycling & me, Dm*1	3.75	0.59	.71**	−.07	1.00									
4. *Recycling & me, Dm*2	2.03	0.43	−.04	.78**	.08	1.00								
5. *Recycling & anger, Dm*1	4.47	0.78	.37**	−.28**	.52**	−.24*	1.00							
6. *Recycling & anger, Dm*2	2.42	0.59	−.21*	.47**	−.19*	.58**	.35**	1.00						
7. *Recycling & bad, Dm*1	4.54	0.82	.31**	−.38**	.56**	−.26**	.67**	−.02	1.00					
8. *Recycling & bad, Dm*2	2.45	0.57	−.29**	.38**	−.17	.58**	.02	.67**	.31**	1.00				
9. *E. conserv. & good, Dm*1	3.46	0.62	.81**	.15	.61**	−.12	.40**	−.16	.26**	−.32**	1.00			
10. *E. conserv. & good, Dm*2	1.87	0.42	.12	.84**	−.17	.69**	−.24**	.51**	−.42**	.35**	.31**	1.00		
11. *E. conserv. & me, Dm*1	3.85	0.66	.68**	−.06	.73**	−.11	.55**	−.12	.47**	−.21*	.72**	−.01	1.00	
12. *E. conserv. & me, Dm*2	2.08	0.46	−.04	.74**	−.12	.79**	−.18	.60**	−.30**	.51**	.04	.81**	.17	1.00

Note: All variables were transformed and adjusted for the amount of variance explained by each dimension. *E. conserv.* stands for energy conservation.

* $p < .05$ (two-tailed). ** $p < .01$ (two-tailed).

Results

Hypothesis testing

Recall that *D* stands for distance. The figures below were generated on the anti-transformed data; thus all values are in the original units and 100 units represent a moderate difference. In panel (a) of the figures, the X axis is dimension one, and the Y axis is dimension two. For nonindependent comparisons (H1 and RQ1), a Bonferroni correction set the *p* value at .02 (see Table 1 for significance tests).

H1a: Reduced persuasion

H1a predicted that a high (vs. low) threat reduces persuasion: When threat is high (vs. low), distances between *recycling* and *me*, and *recycling* and *good*, are expected to be greater, and distances between *recycling* and *bad*, and *recycling* and *anger*, are expected to be smaller.

We found the predicted reduced persuasion effect: At high threat ($D = 167.77$), *recycling* was located 49.46** units further away from *me* than at low threat ($D = 118.31$). Similarly, at high threat ($D = 105.21$), *recycling* was located 40.73** units away from *good* than at low threat ($D = 64.47$). However, *recycling* was 64.39** units further away (not closer, as predicted) from *bad* at high threat ($D = 346.00$) than at low threat ($D = 281.62$). *Recycling* was also 10.54** units further away from *anger* at high threat ($D = 263.15$) than at low threat ($D = 252.61$). In summary, a significant increase in distance between *recycling* and *me*, and *recycling* and *good*, due to high (vs. low) threat indicates reduced persuasion; because distances between *recycling* and *bad*, and *recycling* and *anger* increased at high threat, H1a was partially supported.

H1b: A boomerang effect

H1b proposed that high freedom threat (vs. the control condition) causes a boomerang effect: At high threat (vs. the control condition), distances between *recycling* and *me*, and *recycling* and *good*, are expected to be greater, and distances between *recycling* and *bad*, and *recycling* and *anger*, are expected to be smaller. Consistent with H1b, *recycling* was located 24.98** units further away from *me* at high threat ($D = 167.77$) than in the control condition ($D = 142.79$). Similarly, the distance between *recycling* and *good* was 15.48** units greater at high threat ($D = 105.21$) than in the control condition ($D = 89.72$). Further, as predicted by H1b, the distance between *recycling* and *anger* was 19.37** units smaller at high threat ($D = 263.15$) than in the control condition ($D = 282.52$). However, contrary to H1b, the distance between *recycling* and *bad* was 27.33** units greater at high threat ($D = 346.00$) than in the control condition ($D = 318.68$). Overall, a significant increase in distances between *recycling* and *me*, and *recycling* and *good*, and a significant reduction in distance between *recycling* and *anger* at high threat (vs. the control condition) indicate the predicted boomerang effect, but because of the significant increase in distance between *recycling* and *bad*, H1b was only partially supported.

H1c: An increase in persuasion

H1c predicted that low freedom threat (vs. the control condition) leads to persuasion: When threat is low (vs. the control condition), distances between *recycling* and *me*, and *recycling* and *good*, are expected to be smaller, and distances between *recycling* and *bad*, and *recycling* and *anger*, are expected to be greater. Consistent with H1c, the distance between *recycling* and *me* was 24.48^{*} (one-tailed) units less at low threat ($D = 118.31$) than in the control condition ($D = 142.79$), and the distance between *recycling* and *good* at low threat ($D = 64.47$) was 25.25^{**} units less than in the control condition ($D = 89.72$). Contrary to H1c, the distance between *recycling* and *bad* was 37.06^{**} units less at low threat ($D = 281.62$) than in the control condition ($D = 318.68$); and the distance between *recycling* and *anger* at low threat ($D = 252.61$) was 29.91^{*} units less than in the control condition ($D = 282.52$). In summary, a significant decrease in distance between *recycling* and *me*, and *recycling* and *good*, in the low threat (vs. control) condition indicates that the message was persuasive; because the distances between *recycling* and *bad*, and *recycling* and *anger*, became significantly smaller, H1c was partially supported.

The results for H1 are depicted in Figure 2. In all figures, closer distances between concepts indicate greater association of those concepts (e.g., if *recycling* is closer to *good*, the more positive is the attitude toward recycling). Figure 2a shows the location of concepts across conditions in two-dimensional space. Notice that in Figure 2b, at high threat, all bars for *recycling* and *me*, and *recycling* and *good* are taller than in the control condition, and that the bars in the control condition are taller than these bars at low threat. This pattern indicates that at low threat the message pulled the concepts closer together, but high threat moved the concepts further apart in the direction opposite to the position advocated, away from the concepts' initial positions (i.e., the control condition).[8] This motion indicates a boomerang effect (based on Kumkale & Albarracín's, 2004, definition). Thus, for *recycling* and *me*, and *recycling* and *good*, these data provide strong evidence for the effects of reactance.

H2: Restoration effects

H2 proposed that the magnitude of positive attitude and behavioral intention, from least to most, is: high threat, high threat with restoration, low threat, and low threat with restoration. In spatial terms this prediction indicates that the distance between *recycling* and *good*, and *recycling* and *me*, from least to most, is: low threat with restoration, low threat, high threat with restoration, and high threat.

First, we determined whether the motion of concepts was linear and significant. The correlation between attitude (*recycling* and *good*) and the predicted linear order was significant for dimension one ($r = .38^{**}$) but not for dimension two ($r = -.02$). Similarly, the correlation between behavioral intention (*recycling* and *me*) and the predicted linear order was significant for dimension one ($r = .41^{**}$) but not for dimension two ($r = -.05$). We therefore concluded that the overall differences in distances were significant. Because the above results indicate only the overall

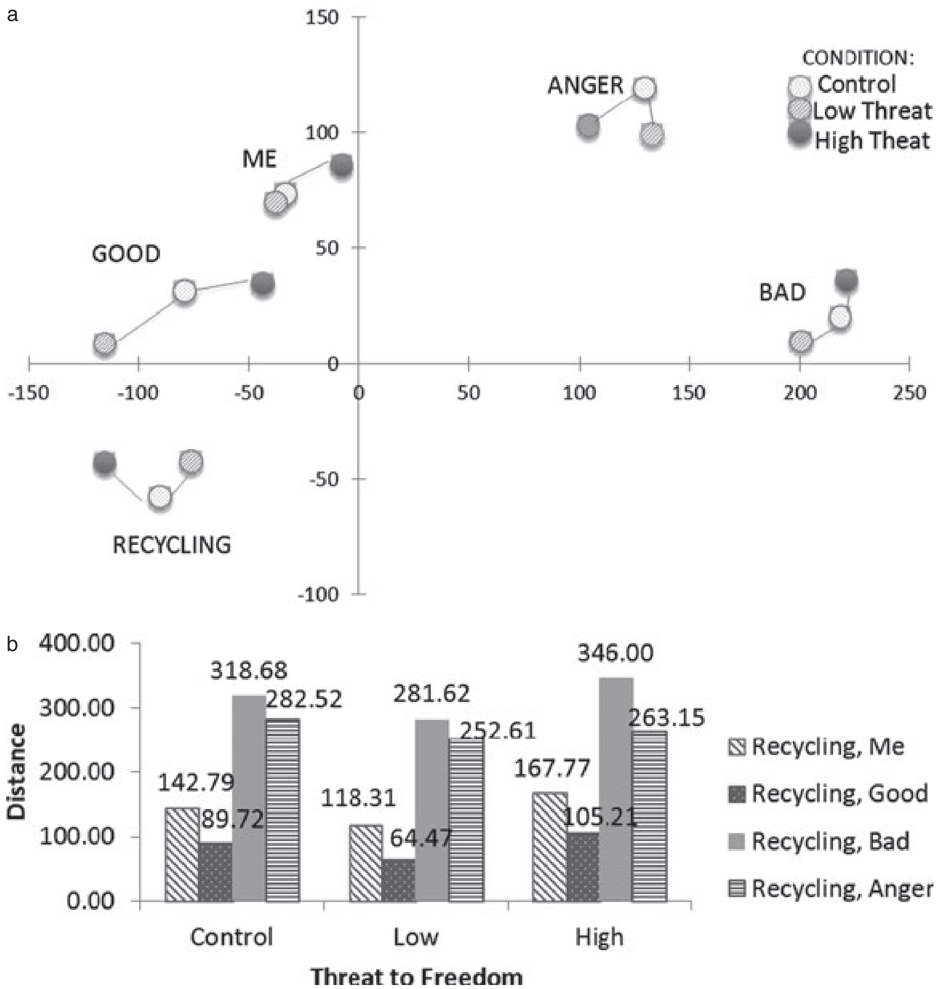

Figure 2 Concept location (a) and distances (b) across the three levels of threat (H1). Smaller numbers indicate greater positive attitude or behavioral intention.

significance for the predicted linear relationship, asterisks are not used to indicate significant differences for H2.

Second, we examined the Galileo results. At high threat with restoration ($D = 136.95$), the distance between *recycling* and *me* was 30.57 units less than at high threat ($D = 167.53$), but at low threat with restoration ($D = 132.36$), the distance between *recycling* and *me* was 9.25 units greater than at low threat ($D = 123.11$).[9] Similarly, at high threat with restoration ($D = 70.24$), the distance between *recycling* and *good* was 37.49 units less than at high threat ($D = 107.74$); at low threat with restoration ($D = 107.28$), the distance between *recycling* and *good* was 26.39 units greater than at low threat ($D = 80.89$). In summary, a restoration postscript

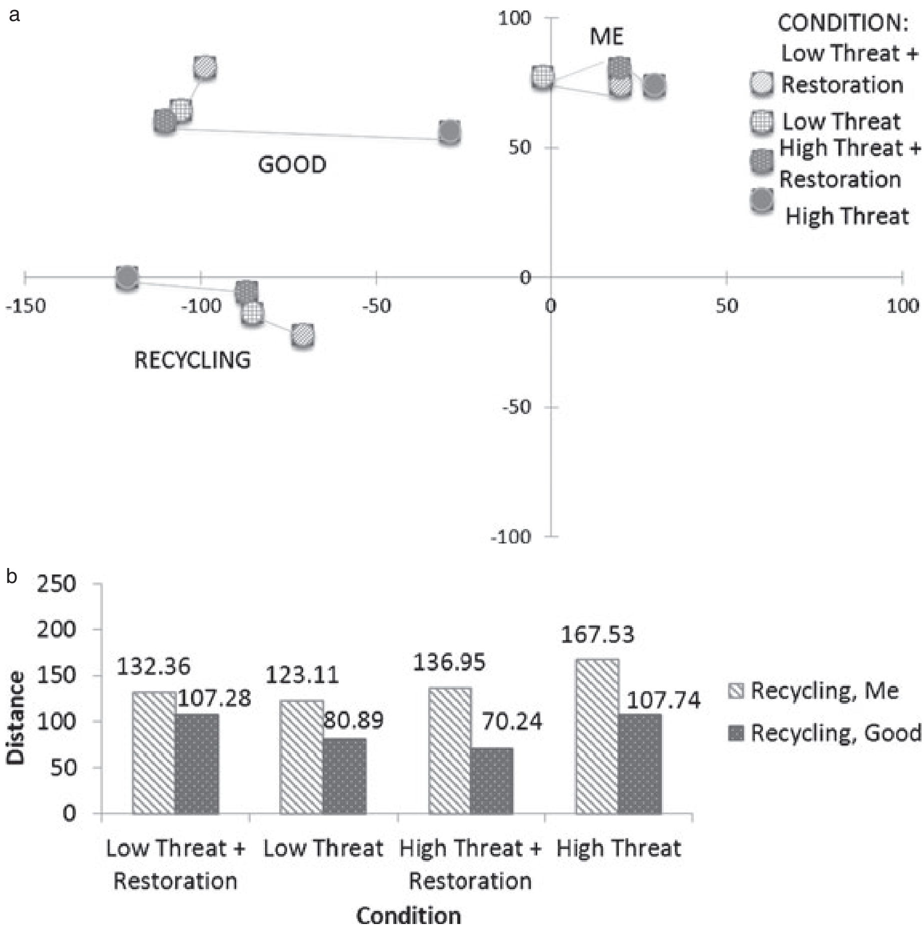

Figure 3 Concept location (a) and distances (b) across threat and restoration conditions (H2). Smaller numbers indicate greater positive attitude or behavioral intention.

reduced the effects of threat only in the high-threat condition, but it significantly decreased persuasion in the low-threat condition. Thus, H2 was partially supported.

The H2 results are depicted in Figure 3. Figure 3a shows concept location across conditions in two-dimensional space. Notice that in Figure 3b all bar heights for *recycling* and *me* decrease linearly (the bar height at high threat > the bar height at high threat with restoration > the bar height at low threat) until the low-threat-with-restoration condition, at which point an increase is observed. In other words, *recycling* and *me* are closer at high threat with restoration than at high threat, whereas *recycling* is further away from *me* at low threat with the restoration than at low threat. This pattern indicates that restoration mitigated the effects of freedom threat in the high-threat but not in the low-threat condition.

A similar pattern of restoration alleviating the effects of freedom threat at high but not low threat is evident for *recycling* and *good*. Notably, the bar for *recycling* and *good* at high threat with restoration is shorter than the bar at high threat and is also shorter that the bar at low threat; thus, adding a postscript at high threat reduced reactance effects and produced an even more positive attitude than a low-threat message. In summary, these results suggest that restoration postscripts may be beneficial at high threat and detrimental at low threat.

RQ1: The associated concept

RQ1 asked about the effects of freedom threat on an associated concept (*energy conservation*). Recall that for RQ1 analyses, p is set at .02 (see Table 1 for significance tests). A boomerang effect did not occur for behavioral intention: The distance between *energy conservation* and *me* at high threat ($D = 137.40$) was 11.21^{**} units less than in the control condition ($D = 148.61$). However, there was a reduced persuasion effect: At high threat ($D = 137.40$), the distance between *energy conservation* and *me* was 38.87^{**} units greater than at low threat ($D = 98.53$). Thus, freedom threat regarding the target concept reduced the behavioral intention for the associated concept, but it did not produce a boomerang effect.

Neither reduced persuasion nor a boomerang effect emerged for positive attitude: Instead of the largest distance between *energy conservation* and *good* being at high threat (vs. at the low-threat or the control conditions), it was the smallest: At high threat ($D = 76.88$), the distance between *energy conservation* and *good* was 11.94^{**} units less than at low threat ($D = 88.82$), and 20.18^{**} units less than in the control condition ($D = 97.06$). Thus, contrary to the pattern found for the target concept, the most positive attitude toward the associated concept was at high threat.

Finally, at low threat ($D = 98.53$), the distance between *energy conservation* and *me* was 50.08^{**} (one-tailed) units less than in the control condition ($D = 148.61$). A similar increase in positive attitude resulted for *energy conservation* and *good*, but to a much smaller degree: The distance between *energy conservation* and *good* at low threat ($D = 88.82$) was 11.94^{**} (one-tailed) units less than in the control condition ($D = 97.06$). These results indicate that a prorecycling message at low threat also resulted in changes in favor of energy conservation.

RQ1 results are depicted in Figure 4. Figure 4a shows concept location across conditions in two-dimensional space. Notice that in Figure 4b the bars for *energy conservation* and *me*, and *energy conservation* and *good*, at high threat are shorter than the bars in the control condition, indicating the absence of a boomerang effect. However, for *energy conservation* and *me*, the bars at low threat are shorter that the bars at high threat, indicating reduced persuasion. Contrary to the results for behavioral intention, the bar for *energy conservation* and *good* at high threat is the shortest (vs. all other conditions), indicating that the most positive attitude toward conserving energy occurred at high threat. Overall, this pattern suggests that the high-threat message about the target concept did not produce a boomerang effect on

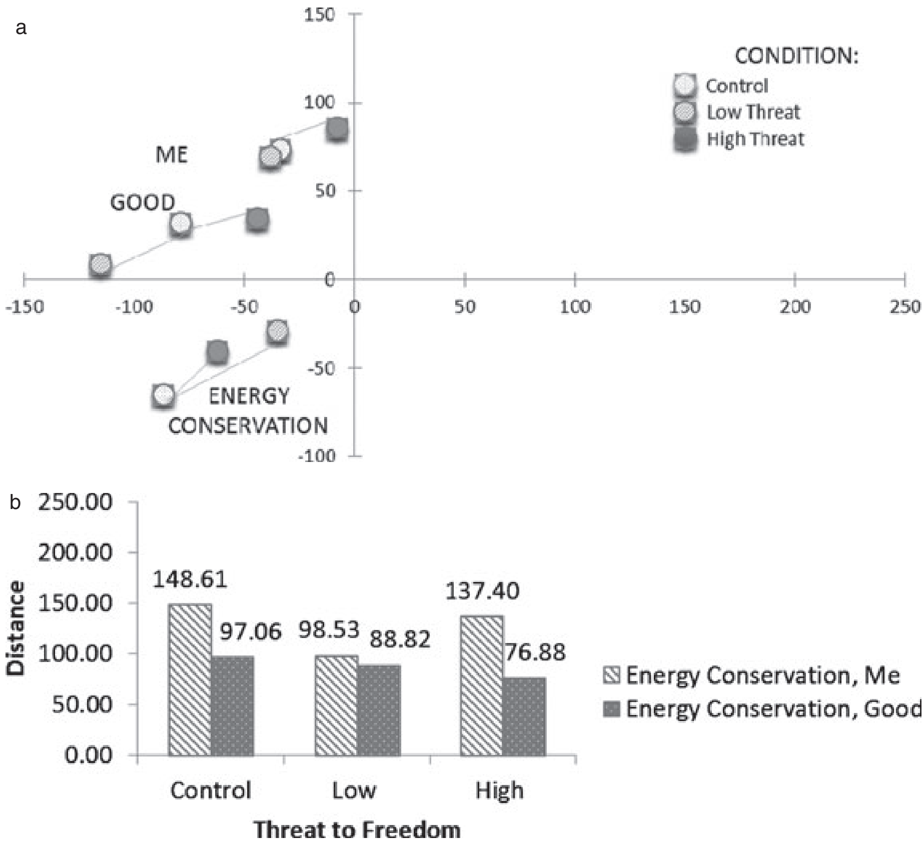

Figure 4 Concept location (a) and distances (b) across the three levels of threat (RQ1). Smaller numbers indicate greater positive attitude or behavioral intention.

the associated concept and also resulted in the most positive attitude change in the associated concept.

RQ2: The associated concept and restoration

RQ2 asked about the effects of a restoration postscript on *energy conservation*. First, we examined whether the motion of concepts was significant. Similar to H2, the correlation between attitude (*energy conservation* and *good*) and the linear order was significant for dimension one ($r = .37^{**}$) but not for dimension two ($r = -.03$); and the correlation between behavioral intention (*energy conservation* and *me*) and the linear order was also significant for dimension one ($r = .38^{**}$) but not for dimension two ($r = -.06$). We therefore concluded that the overall differences in distances were significant. Because the above results indicate only the overall significance for the predicted linear effect, asterisks are not used to mark significant differences in RQ2 results.

Adding restoration to a high-threat message decreased positive attitude and made no difference for behavioral intention: At high threat with restoration ($D = 95.22$), the distance between *energy conservation* and *good* was 12.50 units larger than at high threat ($D = 82.72$); the difference in distances at high threat with restoration ($D = 139.25$) versus high threat ($D = 135.63$) was only 3.63 units.

The effect of restoration added to a low-threat message were similar to that of *recycling*, because it resulted in a decrease in positive attitude and behavioral intention: The distance between *energy conservation* and *me* at low threat with restoration ($D = 134.04$) was 36.76 units larger than at low threat ($D = 97.28$); and the distance between *energy conservation* and *good* at low threat with restoration ($D = 105.16$) was 9.11 units larger than at low threat ($D = 96.05$).[10]

RQ2 results are depicted in Figure 5. Figure 5a shows concept location across conditions in two-dimensional space. Notice that in Figure 5b, contrary to what was observed for *recycling*, all bar heights for the *energy conservation* and *good* decrease linearly (the bar height at low threat with restoration > the bar height at low threat > the bar height at high threat with restoration > the bar height at high threat), indicating that the least positive attitude was at low threat with restoration, and the most positive attitude was at high threat.

Further, the bars for *energy conservation* and *me* at high threat and high threat with restoration are almost the same height, indicating that restoration added to a high-threat message about recycling did not make the intention to conserve energy more positive (as was observed for *recycling*; see Figure 3). The bars for *energy conservation* and *me* at low threat with and without restoration mirror the pattern shown for *recycling*: The bars at low threat with restoration are taller than the bars at low threat, indicating that adding a restoration postscript to a low-threat message negatively affects attitudes toward the associated concept.

Discussion

This study examined the effects of freedom threat on cognitive structure. Consistent with the TPR, when threat was high, a boomerang effect emerged leading to a change in attitude and behavioral intention in the direction opposite to the one advocated in the message. This study also advanced the TPR by showing that freedom threat affects both the concept targeted by the message (*recycling*) and an associated concept (*energy conservation*), albeit differently. In addition, the effects of pairing different levels of threat with a restoration postscript were examined. The results indicate that adding a restoration postscript to low-threat messages may be detrimental to persuasion. These findings are further discussed below.

The results of H1 demonstrated (a) a reduced persuasion effect (comparing the high-threat vs. low-threat conditions), indicating a significant reduction in positive attitude and behavioral intention due to freedom threat; (b) a boomerang effect (comparing the high-threat vs. control conditions), indicating that freedom threat resulted in a change away from the initial attitude and behavioral intention; and (c) an increase in persuasion (comparing the low-threat vs. the control conditions), yielding a significant increase in positive attitude and behavioral intention when the

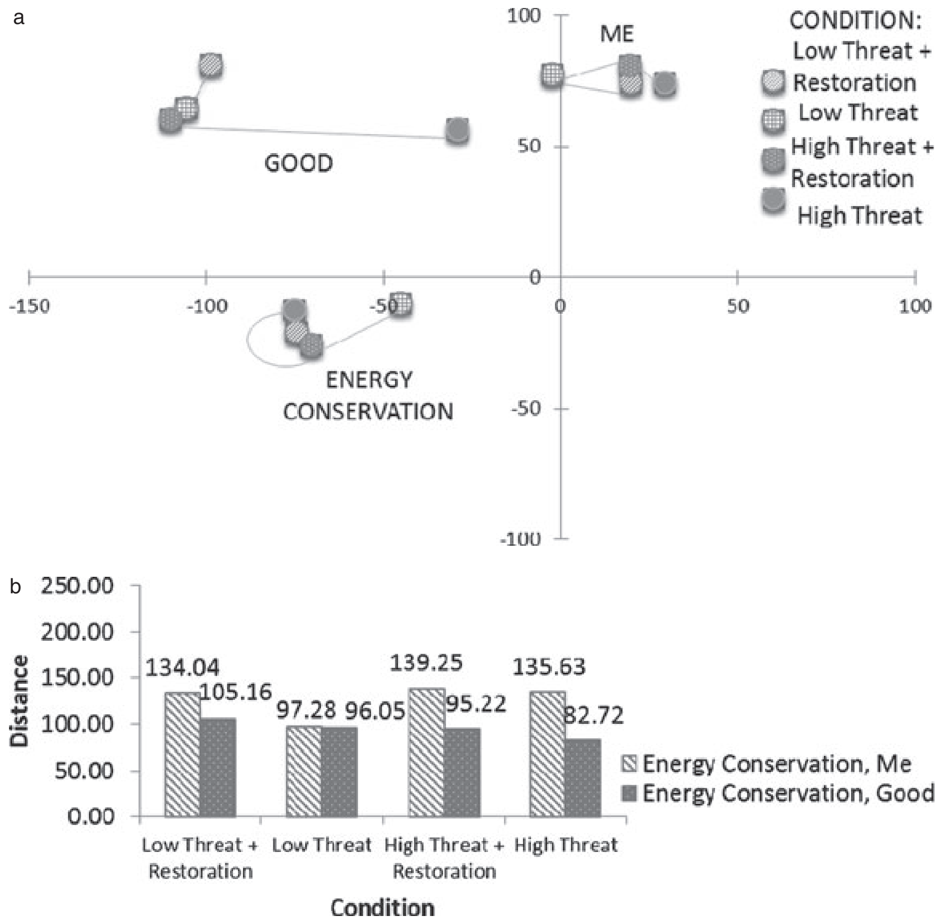

Figure 5 Concept location (a) and distances (b) across threat and restoration conditions (RQ2). Smaller numbers indicate greater positive attitude or behavioral intention.

low-threat message was received. These results are consistent with the findings of earlier research, which attests to the success of this study even though a novel method was used, and it also suggests that reactance effects can be detected with different methods.

Traditionally, reactance research only examines the effects of freedom threat on positive attitudes and not on negative attitudes (i.e., how much do you dislike the message you read?). In addition to positive attitude (*recycling* and *good*), we also examined a negative attitude (*recycling* and *bad*). Although we expected that freedom threat would cause the negative attitude to become even more negative, we found that freedom threat caused *recycling* to be viewed less negatively at high threat (vs. low threat or the control condition). Perhaps perceiving things as being not good does not always imply that they are also evaluated as being bad.

Hypothesis 2 focused on the effects of restoration. Restoration was expected to alleviate reactance effects at high threat, and at low threat it was expected to make the message's overt persuasive intent less apparent. In this study, restoration was effective at reducing reactance effects at high threat, resulting in an increase in positive attitude and behavioral intention. Moreover, the high-threat-with-restoration message became either as persuasive as the low-threat message (in the case of behavioral intention) or even more persuasive than the low-threat message (as in the case of attitude). This study is the first to confirm that restoration postscripts can alleviate reactance effects on attitude and behavioral intention. This crucial link was missing in the seminal study by Miller et al. (2007).[11]

Adding a restoration postscript to a low-threat message diminished message effectiveness by reducing behavioral intention and making the attitude toward the target concept less positive as compared to the effects of a low-threat message. One possible explanation for this result is that at high threat, a simple acknowledgement that it is still up to people to make up their minds alleviates the effects of reactance, but at low threat, the restoration postscript makes the persuasive intent of the message even more obvious and, as a result, triggers reactance (see Bessarabova et al., 2007, for a similar conclusion).

In addition to the effects of reactance on the target concept (*recycling*), differences in the location of the associated concept (*energy conservation*) were examined. The results for RQ1 indicated that at high threat, instead of the boomerang effect evident for *recycling* (in the case of both positive attitude and behavioral intention), only reduced persuasion was found for the intention to conserve energy: Receiving a high-threat message was better (in terms of pro-energy-conservation intention) than receiving no message but still worse than receiving a low-threat message. Moreover, the attitude toward energy conservation was most positive at high threat, not low threat or the control condition. Thus, the effects of reactance may be stronger for the target concept, and for associated concepts positive attitudes and greater behavioral intentions may instead occur due to reactance induced toward the target concept.

Finally, RQ2 asked about the effects of restoration on the associated concept. RQ2 results indicated that at high threat, restoration affected *energy conservation* differently than *recycling*, and instead of increasing positive attitude and behavioral intention (i.e., reducing reactance effects), it resulted in a decrease in positive attitude and no difference in behavioral intention. At low threat, the effects of restoration on the associated concept were similar to the effects on the target concept because it resulted in some reduction in positive attitude and a substantial reduction in behavioral intention, making participants as unwilling to conserve energy as those who received a high-threat message with or without restoration. In summary, restoration had adverse effects on the associated concept. The reasons for these effects are unclear and should be further studied to understand the mechanisms leading to these effects.

Overall, these results suggest that restorations should be used with caution. Undoubtedly, using restoration postscripts is tempting, because they are simple and seem to be an easy solution to reducing reactance (Miller et al., 2007). These data offer mixed support for the effectiveness of restoration postscripts: A postscript resulted in prorecycling change only at high threat, but it led to less positive attitude and a decrease in behavioral intention at low threat. Restoration was also detrimental to the associated concept regardless of a threat level because it resulted in less positive attitude toward energy conservation and a decrease or no difference in behavioral intention to conserve energy. This study, however, only addressed one type of restoration; more research is needed to examine different types of restorations and their effects.

There are a few limitations of this study that merit discussion. First, our study replicated the message strategy approach typical of other research on reactance (e.g., Dillard & Shen, 2005; Quick & Stephenson, 2007). However, the external validity of this approach is low. Future research should focus more on reactance induced in actual campaigns.[12]

Second, we only explored one associated concept. Rains and Turner's (2007) results suggest that a different concept might have been affected differently by reactance. In their study, reactance increased with the magnitude of the request (due to a perceived imposition on people's time and resources when a request was large). Perhaps if an associated concept was *organizing a prorecycling rally* (arguably a harder activity than simply switching off the lights in one's house) instead of *energy conservation*, the associated concept might have been more affected by reactance. The features of an associated concept need to be systematically varied to determine whether they lead to differences as a result of a freedom threat.

In conclusion, this study was a successful attempt at examining the effects of freedom-limiting messages on cognitive structure. The results demonstrated effects consistent with the TPR. This study also advanced the theory by examining reactance effects on an associated concept and by testing the effects of restoration on cognitive structures. Many of these results were possible because the MDS approach was used. This approach resulted in a more systemic understanding of reactance-related processes, because it allowed examining reactance effects on concepts untargeted by the message. This research is important for both theorists and practitioners of persuasion. Future research should continue examination of reactance-related phenomena in the context of cognitive structures.

Acknowledgments

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Notes

1 Although we predict a boomerang effect, we acknowledge that this effect is often elusive: Some studies have reported a boomerang effect (e.g., Wright, Wadley, Danner, & Phillips, 1992), but others have not (e.g., Dillard & Shen, 2005). The controversy about the effect is further exacerbated by the lack of clear explanation for it (Hamilton, Hunter, & Boster, 1993). As one of this article's anonymous reviewers pointed out, anger provides the best

explanation for why receivers would move away from the advocated position to "punish a source for limiting their attitudinal freedom." This idea makes sense and is consistent with research on anger, indicating its motivational properties (e.g., Nabi, 2002).

2 Means, standard deviations, and skewness and kurtosis values (before and after transformation) are available upon request from the first author. Winsorization was based on the variable's distribution. To deal with outliers in the main experiment, most variables were winsorized to the 90th percentile of their original value; 15% of the variables were winsorized to the 85th percentile, and 3% of the variables were winsorized to the 80th percentile. In the main experiment, the standard error of skewness for all our variables ranged from 0.12 to 0.13, but the mean skewness before winsorization was 16.96. After winsorization, the mean skewness became −0.43, which is still 3.31 times the standard error of skewness. Transformations reduced the mean skewness to −0.03, which indicates a substantial improvement in symmetry.

3 For these data, $r_{\text{anger and threat}} = .52$, $r_{\text{anger and neg. thoughts}} = .36$, $r_{\text{threat and neg. thoughts}} = .39$. These correlations were significant.

4 Antitransformation involved exponentiating the transformed value and subtracting 50.

5 The rotation to congruence involves selecting reference points (here, all concepts in a space in a particular condition) and rotating concepts in other spaces (here, other conditions) to the concepts in the reference space. Spaces were rotated to least-squares best fit (Woelfel, 1993). Rotation was performed based on the spaces of interest that were relevant to a given hypothesis.

6 For k concepts (here, $k = 12$) in a cognitive space, there are $k - 1$ possible dimensions. Some of these dimensions do not explain much variance, and some may be imaginary (Woelfel, 1990). To determine the number of real dimensions, we examined eigenvalue scree plots derived from our Galileo analyses, and then using a cutoff value (obtained by dividing the sum of all real eigenvalues by the number of all real dimensions), we determined which eigenvalues explained a large portion of variance; this procedure is conceptually similar to using an eigenvalue > 1 in factor analysis. Based on the examination of all spaces, two real dimensions accounted for the majority of the real variance (but see Barnett & Woelfel, 1979).

7 The calculations are available from the first author upon request.

8 Given random assignment, differences across conditions are discussed as motion.

9 The 9.25-unit difference was significant, $t_{\text{Dm1}}(57) = 3.77$, $p < .001$, $\eta^2 = .20$, and $t_{\text{Dm2}}(57) = 2.08$, $p = .04$, $\eta^2 = .07$.

10 The 9.11-unit difference was significant, $t_{\text{Dm1}}(57) = 1.40$, $p = .17$, and $t_{\text{Dm2}}(57) = 2.56$, $p = .01$, $\eta^2 = .10$.

11 Contrary to Miller et al. (2007), restoration did not reduce threat perceptions in our Pilot Study 4. Only the threat induction affected perceived threat and reactance, explaining a large portion of their variance (e.g., $\eta^2_{\text{perceived threat}} = .47$). Despite these strong effects found for the threat induction, our results for restoration and the threat by restoration interaction were underpowered (because $N_{Pilot\ 4} = 33$). Although restoration affected attitude and behavioral intention, the mechanism for these effects (i.e., whether it is a direct effect on attitudes or an effect mediated by perceived threat) needs to be studied further.

12 We wish to thank one of the anonymous reviewers for this suggestion.

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