The Effects of Frame, Appeal, and Outcome Extremity of Antismoking Messages on Cognitive Processing

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Research on the impact of antismoking advertisements in countermarketing cigarette advertising is equivocal. Although many studies examined how different message appeal types influence people’s attitudes and behavior, there have been few studies that have explored the mechanism of how individuals attend to and remember antismoking information. This study examined how message attributes of antismoking TV ads (frame, appeal type, and outcome extremity) interacted to influence people’s attention (secondary task reaction time) and memory (recognition). Antismoking public service announcements were chosen that were either loss- or gain-framed, had either a health or social appeal, or had either a more or less extreme outcome described in the message. Among the key findings were that loss-framed messages with more extreme outcomes required the most processing resources (i.e., had the slowest secondary task reaction times) and were the best remembered (i.e., were best recognized). These findings indicate ways that different message attributes affect individuals’ cognitive processing, and they are discussed in light of prior framing and persuasion research.

Smoking cessation and prevention programs are some of the most frequently addressed public health campaigns. Yet, tobacco-use prevention campaigns have had a mixed record of success. A recent review of the effects of antismoking advertising concluded that several factors influence the effectiveness of such messages, including parental communication, exposure to tobacco industry advertising, and type of appeal used in antismoking messages (Wakefield, Flay, Nichter, & Giovino, 2003). One possible explanation for the mixed record is that antismoking messages have been produced with limited understanding of how the intended audience cognitively and emotionally processes media messages. Understanding of cognitive and emotional processes underlying the effects of antitobacco messages is particularly limited (Roskos-Ewoldsen, Yu, & Rhodes, 2004).

Using the limited-capacity model of motivated mediated message processing (LC4MP; A. Lang, 2006), this study attempted to inquire how the message frame, type of appeal, and outcome extremity interact on how people process antismoking messages. We focus on cognitive processing of messages because many dual-processing models of persuasion (e.g., elaboration likelihood model, heuristic-systematic model) include both attention and memory as significant conditional processes in the persuasive impact of advertising messages (Klitzner, Gruenewald, & Bamberger, 1991). In addition to persuasion, focus on cognitive and emotional processing of antismoking messages can inform the construction of effective messages, especially when the goal of the message is awareness and knowledge gain (A. Lang, 2006). We briefly review the literature on message frames, appeal types, and outcome extremity in health communication. Then we review the relevant aspects of the LC4MP and attempt to apply the model to our message categories to generate our hypotheses.
MESSAGE FRAMING

Framing is based on Kahneman and Tversky’s prospect theory (Kahneman & Tversky, 1979), which at first, sought to explain people’s decisions regarding economic activities under risk situations. Prospect theory suggests that people are risk averse when presented with choices involving gains, and are risk seeking when presented choices involving losses, even though the gain and loss options represent the same probabilities (Stephenson & Witte, 2000). The message-framing postulate has been used as an approach to design health messages by emphasizing the gains or losses related to certain health behaviors. Gain-framed messages emphasize the advantages or benefits of certain behaviors, or the likelihood that one would gain something by adopting these behaviors. Loss-framed messages highlight the disadvantages or costs, or the odds that individuals will lose something or not be successful in taking certain actions (Meyerowitz & Chaiken, 1987; Stephenson & Witte, 2000).

Early research on the effectiveness of message framing led scholars to conclude that loss-framed messages were more effective than gain-framed messages. Meyerowitz and Chaiken (1987) examined framing in the context of breast cancer detection messages. In the loss-frame condition, participants read a pamphlet that told them they would have a decreased chance of finding a tumor if they did not do a breast self-exam. In the gain-frame condition, participants read a pamphlet that told them they would have an increased chance of finding a tumor if they did a breast self-exam. They found that participants in the loss-frame condition had more positive attitudes toward breast self-exams and more positive intentions to perform them. This study led researchers (e.g., Hale & Dillard, 1995) to conclude that loss frames were more effective than gain-frames.

However, subsequent research suggested that the type of recommended health behavior moderates the effects of message framing. Schneider et al. (2001) argued that detection behaviors (e.g., screening mammograms, breast self-exams, clinical skin examinations, HIV testing) could be considered to be more psychologically risky than prevention behaviors because there was the possibility of finding out that one was sick. Prevention behaviors (e.g., avoiding tobacco) reduce risk in that their adoption results in more certain outcomes (e.g., reduced risk of illness). Salovey and his colleagues (Rothman, Bartels, Wlaschin, & Salovey, 2006; Rothman, Salovey, Antone, Keough, & Martin, 1993; Salovey & Williams-Piehota, 2004; Schneider et al., 2001) conducted a number of studies that showed that gain frames were more effective for prevention behaviors, whereas loss frames were more effective for early-detection behaviors.

Several researchers tried to address the discrepancies in the message-framing literature by examining cognitive processing of information. For example, Smith and Petty (1996) tested message framing on the degree to which people elaborate, or systematically process, a message. They used gain- and loss-framed messages that promoted recycling and found that participants exposed to loss-framed messages engaged in more careful message processing (i.e., more cognitive thoughts) than those reading gain-framed messages. And yet, Millar and Millar (2000) tested the effects of message framing on safe-driving information and found that more cognitive thoughts were associated with gain-framed messages when individuals’ issue involvement was high. Among the few studies that examined the framing effects of antismoking messages on cognitive processing, Cheng and Cameron (2003) reported that on average, loss-framed antitobacco messages elicited more cognitive thoughts (coded from think-aloud protocols) than gain-framed messages among young smokers. The research on how message framing impacts cognitive processing thus far is nascent and idiosyncratic.

MESSAGE APPEAL TYPE

The variation in types of appeal in antitobacco advertising research is rather extensive, and it is difficult to articulate consistent theoretical message attributes that may impact outcomes on viewers. For example, Goldman and Glantz (1998) categorized antitobacco advertising strategies into eight themes: industry manipulation, secondhand smoke, addiction, cessation, youth access, short-term effects, long-term health effects, and romantic rejection. Pechmann and Reibling (2006) also categorized antitobacco messages into eight categories, although they differed substantially from the Goldman and Glantz (1998) approach: disease and suffering, dying parent, environmental tobacco smoke, selling disease and death, counterindustry activism, marketing tactics, acceptance of nonsmokers, and cosmetic effects. In his content analysis of 197 antismoking ads, Beaudoin (2002) extended the Goldman and Glantz typology to include length of consequence and five different types of appeals (humor, fear, dirtiness, sports/adventure, and sociability). Although any single ad could arguably be categorized based on these typologies, some of the categories are not mutually exclusive. For example, a short-term consequence is usually meant to have social implications, such as smelly clothes or yellow teeth, whereas a long-term consequence typically refers to health implications (e.g., disease, death).

We were interested in the category that Beaudoin (2002) called “consequence type,” which he defined as health or social, for three reasons. First, Beaudoin found that both social and health appeals existed in several statewide campaigns (i.e., California, Massachusetts, and Florida). Second, most ads that had a social appeal were determined to be aimed at youth, whereas health appeals tended to target adults. Given that our concern in this study focused on young adults, it made sense to include both social and health appeals in terms of their impact on attentional and memory processes. Third, social and health appeals could easily be
crossed with frames in our experiment and still maintain the integrity of the message.

Early literature suggested that emphasizing the social costs of smoking was effective among youth (Goldman & Glantz, 1998; Pechmann & Shih, 1999). Messages that focused on the health-related losses due to smoking were thought to be less effective among youth, presumably because youth do not feel vulnerable to the health risks of smoking, which may take several decades to manifest themselves. However, studies that evaluated antismoking campaigns concluded that such appeals were moderately effective among adults (Goldman & Glantz, 1998).

This belief is evident in antismoking ads that were produced in the 1990s. Beaudoin (2002) found that ads that focused on the health consequences of smoking targeted both youth and adults, but ads that depicted social consequences of smoking were three times more common for youth audiences than for adult. Nevertheless, the question of the effectiveness of health or social appeals is not yet settled for young adults, who were not specifically studied in this context. Also, it is plausible that young adults may be impacted by both types of appeals.

MESSAGE OUTCOME EXTREMITY

Outcome extremity refers to the degree of loss or gain, or threat or benefit, in a health communication message. The extremity of a perceived health threat is a central concept in theoretical models that explain how fear appeal messages are processed (e.g., Rogers & Prentice-Dunn, 1997; Witte, 1992). However, little research has examined the impact of messages that vary in the extremity of the benefits described. For a health threat, the threat of dying of smoking is a more extreme outcome than the threat of shortness of breath. For a health benefit, the focus on increased energy, stamina, and athletic performance is a more extreme outcome than the focus on normal heart and lung function or the ability to recover more quickly from a cold. For a social threat, the threat of social isolation is a more extreme outcome than the threat of smelly clothes. For a social benefit, the focus on social attractiveness and social belonging are more extreme benefits than the benefits of whiter teeth and better breath. Further, the extremity of the outcome, either a threat or benefit, should increase perceived arousal in viewers. Arousing messages have been found to impact how people attend to and remember media content (e.g., A. Lang, Dhillon, & Dong, 1995; Newhagen & Reeves, 1992).

LC4MP

The LC4MP is a theoretical model that can provide insight into how antismoking message content might be processed. This model was formally proposed by A. Lang (2000) and was recently updated to reflect the significant role of emotion and motivation in determining how messages are processed (A. Lang, 2006).

The foundational premise of the LC4MP is that humans have a limited amount of cognitive resources to allocate to the mental tasks involved in perceiving, comprehending, and remembering information they encounter in their environment. The mental tasks engaged during information processing can be broadly conceptualized as encoding, storage, and retrieval. These tasks are simultaneously and continuously performed as long as an individual is engaged in processing information in the environment.

According to the LC4MP, cognitive resources can be allocated to encoding information through controlled or automatic processes. Research suggests that emotional, motivationally relevant stimuli automatically capture attention (P. J. Lang, Bradley, & Cuthbert, 1997), indicating that emotionally charged content requires more resources to be processed than nonemotional content (e.g., A. Lang, Bolls, Potter, & Kawahara, 1999; P. J. Lang et al., 1997). Message processing is facilitated when allocated resources are greater than the resources required by the message.

Incorporated into the most recent version of the LC4MP is the view that emotional content in media messages automatically activates two fundamental motivational subsystems that underlie human emotion, the appetitive and aversive. Psychologists have proposed that these systems are the foundation of human emotional response (Berntson & Cacioppo, 2000). Appetitive and aversive systems act as independent dimensions of emotional response, and activation of these systems can be reciprocal or coactive. Reciprocal processing occurs when activation in one system is high while activation in the other is low. Coactive processing occurs when activation in both systems is equal.

Appetitive and aversive activation have been found to significantly affect processing of media messages (e.g., A. Lang, Shin, & Lee, 2005). Under conditions of low to moderate arousal, the appetitive system is more active than the aversive system. This is known as positivity offset and serves the purpose of encouraging an individual to explore the environment (Cacioppo, Gardner, & Berntson, 1999). As stimuli become more negative and arousing, aversive activation increases. Aversive responses are stronger and occur faster than appetitive activation. This pattern of emotional responding has been termed negativity bias (Cacioppo et al., 1999). The nature of negativity bias is such that when negative stimuli are initially encountered, automatic activation of the aversive system leads an individual to allocate cognitive resources to encoding information. Resources allocated to encoding increase with higher levels of aversive activation up to a point where a stimulus becomes so aversive that the individual shifts resources to storage and retrieval in order to engage in an appropriate defensive response (A. Lang, 2006).
There is no research that explicitly tests how message framing may impact attention and memory in the context of the LC4MP. However, the advantage in taking this perspective is that motivation activation will permit us to make hypotheses regarding the impact of message frame and outcome extremity on the allocation of attentional resources.

SECONDARY-TASK REACTION TIME, RECOGNITION MEMORY, AND HYPOTHESES

Ample research shows that emotional content requires more resources to be processed than does nonemotional content (A. Lang et al., 1999; A. Lang et al., 1995; Newhagen & Reeves, 1992). One way of assessing processing resources is by measuring secondary-task reaction times (STRTs). In an STRT study, participants are told to pay attention to a primary task (e.g., television viewing) and respond to a probe (e.g., audio tone) as fast as they can (e.g., by pressing a key on computer). The time it takes to respond to the probe is the secondary task reaction time. This measure represents the difference between the processing resources the viewer allocates to the message and the resources that the message requires to be processed (A. Lang, Bradley, Park, Shin, & Chung, 2006). Messages that are more difficult to process require more resources than messages that are easier to process. In this case, the required resources use up more of the processing resources that were allocated, resulting in fewer available resources as evidenced by slower STRTs. Conversely, messages that are easier to process require fewer resources and, therefore, result in more resources available as evidenced by faster STRTs.

Further, if our reasoning that messages with more extreme outcomes are more arousing, then it follows that messages with more extreme outcomes would result in slower STRTs (e.g., A. Lang et al, 1999; A. Lang et al., 1995). Also, if loss-framed messages activate the aversive system, then loss-framed messages should also require more resources and, thus, result in slower STRTs. This leads us to our first hypothesis, in which we predict the following interaction:

H1: Loss-framed messages with more extreme outcomes will produce slower STRTs than either loss-framed messages with less extreme outcomes, or any of the gain-framed messages.

Recognition memory is an indication of how well stimuli are encoded (A. Lang, 2000). Generally, when resources allocated to processing a message are adequate (i.e., there are more resources allocated than required, resulting in available resources) messages that engage more cognitive resources should result in better message recognition. Task performance on recognition should not be hindered in this study because none of the messages we used would be expected to create cognitive overload. In their study in which they measured the amount of information introduced within a message, A. Lang et al. (2006) found that the condition that produced the slowest STRTs also produced the best recognition memory, up to the point of cognitive overload. Therefore, we predict the following interaction:

H2: Loss-framed messages with more extreme outcomes will produce better recognition memory than either loss-framed messages with less extreme outcomes, or any of the gain-framed messages.

The line of health communication research that addresses the effectiveness of health or social appeals has focused primarily on negative physical health outcomes (i.e., loss-framed health outcomes or physical fear appeals), whereas relatively little attention has been devoted to social appeals. Fear appeal theories suggest that negative health consequences, such as the onset of a disease, can arouse feelings of fear and motivate people to adopt the recommended behavior (Stephenson & Witte, 2000; Witte, 1992). It is likely that chronological development impacts the salience of health- or social-related issues. For college students, the contemporary research is unclear which of these two approaches would be more personally relevant and, thus, which would most strongly engage one or both of the motivational systems. Further, we found no studies that addressed message frame, type of appeal, and outcome extremity simultaneously. We believe that a further exploration of the interaction of these factors will help to increase our understanding of how antismoking messages are processed. Thus we aim to address the following question:

RQ1: What is the relationship among message frames, appeal types, and outcome extremity, and STRTs?

RQ2: What is the relationship among message frames, appeal types, and outcome extremity, and recognition memory?

METHOD

Design and Independent Variables

This experiment was a $2 \times 2 \times 2$ full-factorial mixed design with message frame (gain/loss) and message appeal (health/social) as within-participants factor and outcome extremity (high/low) as a between-participants factor with random assignment. Message frame was manipulated as messages that focused on the gains or losses (i.e., benefits or risks) associated with smoking. Message appeal was manipulated as messages that focused on either a health or a social appeal. A gain-framed health message focused on the positive health outcomes (e.g., increased energy, increased lung capacity, increased performance) a person can expect by not smoking. A gain-framed social message focused on the positive social outcomes (e.g., appearance, attractiveness, sexual appeal) a person can expect by not smoking. A loss-
framed health message focused on the negative health outcomes (e.g., frequent coughs, risk of lung cancer, emphysema, heart disease) a person can expect by smoking. A loss-framed social message focused on the negative social outcomes (e.g., bad breath, yellow teeth, social isolation) a person can expect by smoking. Outcome extremity was manipulated as the severity of the risk or the level of the benefit in each ad (e.g., coughs vs. death; bad breath vs. social isolation).

Stimulus Materials

One-hundred and four 30-sec antitobacco ads that we thought might meet the combination of frame, appeal type, and outcome extremity were first selected from our collection of antitobacco messages (from various state and national campaigns) as candidates for the experiment. These messages were pretested by 27 undergraduate students. Participants were asked to answer two 7-point Likert-type questions asking about the frame of messages (gain/loss): (a) “This ad mainly tells me that . . . .”, anchored by “I may gain something if I don’t smoke” versus “I may lose something if I smoke,” and (b) “This ad is mainly about . . . .”, anchored by “the positive sides of not smoking or quitting” versus “the negative sides of smoking” ($r = .96, p < .01$). Participants were also asked to answer two 7-point Likert-type questions asking about the appeal of consequence theme (social/health): (a) “This ad is mainly about . . . .” anchored by “whether a person smokes will influence how others look at him/her” versus “whether a person smokes will influence how he/she physically feels,” and (b) “This ad is mainly about . . . .,” anchored by “how social life can be affected by smoking” versus “how health can be affected by smoking” ($r = .47, p < .05$). Last, participants rated their arousal level on three 7-point scales: calm/jittery, dull/excited, and unaroused/aroused (Bradley & Lang, 1994; $\alpha = .94$). Ads with the highest and lowest ratings on these dimensions were used for the corresponding outcome extremity condition. We wanted to confirm that the messages with the more extreme outcomes also showed the most self-reported arousal.

Twenty-one ads were chosen as the stimuli for this study, based on responses to the frame, appeal type, and arousal questions. The more outcome-extreme ads, $M = 4.24, SD = .22$, were rated significantly more arousing than the less outcome-extreme ads, $M = 3.73, SD = .53$; $F(1, 21) = 8.02, p < .01, \eta^2_{\text{part}} = .61$. The loss-framed ads, $M = 5.80, SD = .84$, were significantly different from the gain-framed ads, $M = 2.82, SD = .98$; $F(1, 21) = 61.60, p < .01, \eta^2_{\text{part}} = .98$. The health appeal ads, $M = 5.78$, were significantly different from the social appeal ads, $M = 3.05, SD = 1.09$; $F(1, 21) = 57.88, p < .01, \eta^2_{\text{part}} = .76$. The ads are listed in the Appendix.

Three messages served as exemplars for the gain/social more extreme, gain/health more extreme, loss/social less extreme, loss/health more extreme, and loss/health less extreme conditions. Only two messages served as exemplars for the gain/social less extreme, loss/social more extreme, and the gain/health less extreme conditions. None of the other 83 ads pretested had means that clearly placed them in one of the eight conditions. Four tapes in each outcome-extremity condition represented randomized order of ads. Each tape contained eight ads: two gain/social, two loss/social, two gain/health, and two loss/health. Two of the three exemplar ads for the five conditions in which there were three ads were chosen per message order and were counterbalanced across conditions.

Dependent Variables

Resources available were indexed by STRT (Bower & Clapper, 1991; A. Lang & Basil, 1998). Participants were instructed to watch the antismoking video messages (primary task) and to press a button when they heard an audio tone (secondary task, latency measured in milliseconds, ms). Four audio tones were randomly generated during each public service announcement (PSA), with the requirements that (a) no tone occurred during the first or last 5 sec, and (b) two tones occurred during the first half of the PSA and two tones occurred during the second half.

Recognition memory was indexed using a four-alternative multiple-choice test. Three factual questions were developed for each ad, and each question had four choices, one of which was the correct answer. This task is similar to recognition tests used in other media research (e.g., A. Lang et al., 1999; A. Lang et al., 2006). The questions for the recognition task came from both the audio and visual tracks. Responses were coded as either correct or incorrect. Results are reported as the percentage of correct responses across messages at each level of frame, appeal type, and outcome extremity. Eight orders of recognition items were created that corresponded to the stimulus videotapes.

Procedures

Participants individually came to a viewing room in a laboratory setting. They were instructed to watch and pay attention to several ads while monitoring the audio for a tone. They were told that when they heard a tone, they should press a button as quickly as they could. STRTs were measured to ±1 ms, calculated from the onset of the audio tone to the pressing of the button. Participants were given a practice trial with a 30-sec ad that was not part of the main experiment. For the main portion of the study, each participant viewed eight ads. After viewing all ads, participants were asked to complete the pencil-and-paper recognition task. Last, participants were debriefed, thanked, and given a small financial incentive.
Equipment

Audio tones were generated and the STRTs were compiled by PsyScope (Cohen, MacWhinney, Flatt, & Provost, 1993), a psychological software program that ran on a Macintosh G3 computer. PsyScope generated the tones and collected the STRTs. The button box on which participants registered their responses was connected to the computer. When the audio tone was sounded, the internal clock in the computer began. When the button on the button box was pressed, the internal clock stopped. The STRTs were stored in a data file in Psyscope, then were converted to an SPSS data file for analysis.

Participants

Data from the 2003 National Health Interview Survey show that smoking rates have steadily declined between 1983 and 2003; a sustained decline in cigarette smoking occurred in all age groups except persons ages 18 to 24 years. This age group had the second-highest smoking rate compared to other age groups, and it had the highest smoking rate until 2003 (CDC, 2005). Except for cessation programs that target pregnant women, there are few programs that explicitly target young adults (Ling & Glantz, 2004). There are few programs that target young adults to participate in our study.

Seventy-two students were recruited in communication classes and via campus mass e-mail at a large Midwestern university to participate in the experiment. Sixty-nine were undergraduate students and three were graduate students. There were 51 women and 21 men (M = 19.10, SD = 1.57). Sixty-six participants identified themselves as White or Caucasian, three as Asian, two as Black or African American, and one as “other.” Sixty-five participants identified themselves as current nonsmokers, which was defined as (a) has never smoked regularly (i.e., never smoked one or more than one cigarette per day for 30 days) and has not smoked more than one cigarette in the past 30 days, or (b) has smoked regularly before, but has not smoked at all the past 30 days and reported that it was extremely improbable that he or she would smoke in next 6 months (Center for Disease Control and Prevention, 2002; Johnston, O’Malley, & Bachman, 2002; National Cancer Institute, 2002).

RESULTS

Prior to statistical analysis, data collected for STRTs were screened for outliers. Outliers were truncated to plus or minus 3 SDs from the participants’ overall STRT means (2.7%). After truncation, STRTs distributions did not deviate substantially from normal (skewness and kurtosis statistics were not statistically significant), so no transformations were necessary. There were no missing STRTs.

Processing-Resources Hypotheses

H1 predicted that outcome-extreme loss-framed messages would produce slower STRTs than either less outcome-extreme loss-framed messages or any of the gain-framed messages. A 2 (Frame) × 2 (Appeal) × 2 (Outcome Extremity) mixed repeated-measures analysis of variance was conducted on the STRT data to analyze the processing resources hypothesis and the research question. There was one significant interaction. As Figure 1 shows, Frame interacted with Outcome Extremity, F(1,70) = 5.36, p < .024, h2part = .07, such that the more extreme loss-framed messages, M = 311.30, SD = 71.18, had the slowest STRTs. H1 was supported.

RQ1 asked about the relationships among message frame, message appeal type, and outcome extremity on STRTs. This was tested by examining the Appeal × Frame × Outcome Extremity three-way interaction. The interaction was not significant, F(1,70) = 0.41, p = n.s., h2part = .006. Neither the Appeal × Frame interaction, F(1,70) = 0.92, p = n.s., h2part = .034, nor the Appeal × Outcome Extremity interaction, F(1,70) = 0.33, p = n.s., h2part = .005, was significant. The main effect for Appeal was not significant either, F(1,70) = 1.12, p = n.s., h2part = .02. Therefore, RQ1 for STRTs was answered in the negative.

Memory Hypotheses

H2 predicted that more outcome-extreme loss-framed messages would produce better recognition memory than either less extreme loss-framed messages or any of the gain-framed messages. A 2 (Frame) × 2 (Appeal) × 2 (Outcome Extremity) mixed repeated-measures analysis of variance was conducted on the recognition data to analyze the memory hypothesis and the research question. As with the STRT data, there was one significant interaction. As Figure 2 shows, Frame interacted with Outcome Extremity, F(1,70) = 8.74, p = .004, h2part = .11, such that the most extreme loss-framed messages had the best recognition
memory ($M = 85.42\%, SD = 0.09$). For the less outcome-extreme group, Frame did not make a difference in recognition memory ($p = .27$). However, those in the more outcome-extreme group recognized content from the loss-framed messages significantly better than that from the gain-framed messages, $M = 75.46\%, SD = 0.17, p = .003$. H2 was supported.

Further, there was a significant main effect for Outcome Extremity on recognition memory, $F(1, 70) = 26.44, p < .001, \eta^2_{part} = .27$, such that the more extreme outcome messages were better recognized, $M = 80.44\%, SD = 0.09$, than less extreme outcome messages, ($M = 67.25\%, SD = 0.12$, see Table 1.

RQ2 asked if the relationship between message frame, message appeal type, and outcome extremity interacted on recognition memory. This was tested by examining the Appeal $\times$ Frame $\times$ Outcome Extremity three-way interaction. The three-way interaction was not significant, $F(1,70) = 0.72, p = n.s., \eta^2_{part} = .010$. Neither the Appeal $\times$ Frame interaction, $F(1,70) = 2.11, p = n.s., \eta^2_{part} = .029$, nor the Appeal $\times$ Outcome Extremity interaction, $F(1,70) = 0.90, p = n.s., \eta^2_{part} = .013$, were significant. The main effect for Appeal was not significant, $F(1,70) = 0.01, p = n.s., \eta^2_{part} < .001$, either. Therefore, RQ2 was also answered in the negative.

### TABLE 1

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Secondary task reaction time (ms)</th>
<th>Recognition score (% correct)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Gain-framed</td>
<td>286.71</td>
<td>68.85</td>
</tr>
<tr>
<td>Loss-framed</td>
<td>302.05</td>
<td>70.68</td>
</tr>
<tr>
<td>Social appeal</td>
<td>292.29</td>
<td>68.91</td>
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<tr>
<td>Health appeal</td>
<td>296.47</td>
<td>68.83</td>
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<tr>
<td>Low outcome extremity</td>
<td>290.45</td>
<td>71.71</td>
</tr>
<tr>
<td>High outcome extremity</td>
<td>298.31</td>
<td>62.31</td>
</tr>
</tbody>
</table>

The second interaction showed that outcome extremity moderated the effect of message frame on recognition memory. Material in loss-framed messages was more accurately recognized than material in gain-framed messages, but only for the messages that had more extreme outcomes. We believe this is because outcome extremity increased arousal. When the messages were less arousing, as we suppose in the less extreme outcome messages, message frame had no impact on recognition memory. This result suggests that loss-framed messages with more extreme outcomes required more resources to encode than did the other message types, and that those resources better enabled message processing.

However, the question of evaluating processing outcomes with persuasion research needs to be carefully examined to get a more complete understanding of message-framing effects. The cognitive advantage for loss-framed messages, although consistent with limited-capacity models of information processing such as the LC4MP, should be discussed in light of other message-framing findings. Ample research (e.g., Rothman et al., 2006) found that gain-framed messages were more persuasive than loss-framed messages when the messages recommended prevention behaviors (which also describes the messages used in this study). They reasoned that prevention behavior such as avoiding tobacco reduces risk and that adoption of the advised behaviors results in more certain outcomes. Contrast that with detection behaviors, in which risk is increased...
because of the possibility of finding out that one has a health problem. In this situation, Schneider, Salovey, Rothman, and colleagues (e.g., Rothman, et al., 1993; Schneider, et al., 2001) found that loss-framed messages were more persuasive. The persuasive advantages of gain-framed antismoking messages did not correspond to the cognitive advantages found in this study. Several dual-process persuasion models, such as the elaboration likelihood model (Petty & Cacioppo, 1986), predict that messages that are processed more thoroughly (central route) will result in stronger, more lasting attitude change. It is possible that gain-framed messages elicit both positive affect and less attention (found in this study). When this occurs, the elaboration likelihood model would predict that peripheral processing is likely to occur, resulting in weaker attitude change because participants may be relying more on peripheral cues than on central ones. Conversely, loss-framed messages, especially those that are arousing, appear to engage more mental resources. Thus, any attitude change that might occur from arousing loss-framed messages is likely to be stronger and less likely to dissipate over time than attitude change that occurs from gain-framed messages. Future research should examine these speculations by varying level of processing to examine the cognitive and persuasive patterns of message frames.

The null findings for type of appeal are interesting. It is unlikely that the appeal manipulation did not work in this study, given that the messages we used showed large differences on appeal in the pretest. More likely is the possibility that social and health appeals are equally salient for the college-age participants we tested.

One limitation of this study is that the within-group variation for outcome extremity may have been so large that it obscured any between-group variation we might have observed. We intentionally ran the outcome extremity manipulation between participants, reasoning that arousal created by outcome-extreme messages might carry over from one message to the next. Future research could run outcome extremity as a within-subjects factor and include brief calming stimuli between each pair of ads in order to get arousal levels back to baseline before the onset of the subsequent message.

This study focused on the effects of message frames, message appeal, and outcome extremity on young adult viewers’ cognitive resources and memory. Future research should test attitudinal and behavioral outcomes, and measure other memory processes such as storage and retrieval. In addition, future studies should test the effect of message frames, appeal types, and outcome extremity among other target audience groups of antismoking campaigns, such as adolescents.

Our data showed that there were significant interactions between message frame and outcome extremity on attentional resources and memory. Such findings suggest that these two factors influence how viewers process antismoking PSAs, and that looking at only one of these factors in isolation from the other may mask phenomena that could prove useful to understanding and explaining such processing. In conclusion, message frames and outcome extremity induced in antismoking PSAs are important factors that need to be considered together when designing antitobacco messages.

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REFERENCES


**APPENDIX**

### Selected Antitobacco Public Service Announcements

<table>
<thead>
<tr>
<th>Appeal type</th>
<th>Gain frame</th>
<th>Loss frame</th>
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<tbody>
<tr>
<td>Social</td>
<td>Low outcome extremity</td>
<td>High outcome extremity</td>
</tr>
<tr>
<td>Social</td>
<td>2. Derek Parra 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4. I Decide</td>
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<sup>a</sup>Ad edited for content. <sup>b</sup>Tag added.