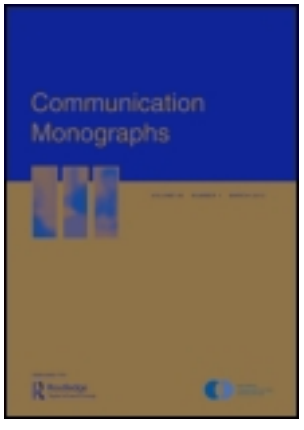

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A Multilevel Analysis of Antimarijuana Public Service Announcement Effectiveness

René Weber, Amber Westcott-Baker & Grace Anderson

In public-health campaign research, 3 prominent theories of persuasion and media effects—elaboration likelihood model (ELM), activation model of information exposure (AMIE), and limited capacity model of motivated mediated message processing (LC4MP)—have been used to predict message effectiveness. Although conceptually overlapping, these theories suggest contradictory predictions about individual-level and message-level factors on persuasion outcomes. In this study, we contrast and test competing predictions of antidrug message effectiveness from 3 recent publications that draw on ELM, AMIE, and LC4MP. We use televised antimarijuana messages, young-adult samples, and a multilevel modeling approach. Significant interactions between individual- and message-level factors were found predicting message effectiveness as theory dictates; these results replicate some, but not all of the findings from the aforementioned publications.

Keywords: Elaboration Likelihood Model; Persuasion; Health Communication; Multilevel Analysis; Antidrug Public Service Announcements

Whereas a decade ago many public-health campaigns were atheoretical (Noar, 2006; Rice & Atkin, 2013), a trend toward using theory and research in message design is emerging. Three prominent theories of persuasion and media effects—the Elaboration Likelihood Model (ELM), the Activation Model of Information Exposure (AMIE), and the Limited Capacity Model of Motivated Mediated Message Processing

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(LC4MP)—have accumulated support for their predictions about the effects of message-level and individual-level variables on changes in attitudes and behaviors. This research can have real impact when used as rationale for public-health campaigns (Palmgreen & Donohew, 2010).

However, several recent studies have found interactions where the theoretically predicted effects of a given message variable are conditional upon other variables (Kang, Cappella, & Fishbein, 2006; Lang & Yegiyan, 2008; Langleben et al., 2009; Stephenson & Palmgreen, 2001). Specifically, two important message features in many persuasion theories are (1) the strength of arguments within the message, and (2) the degree to which a message elicits physiological arousal. The first, *argument strength* (also argument quality, claim strength, etc.) ostensibly refers to an objective feature of the argument that determines its persuasiveness, but is nearly always operationalized using audience/receiver ratings (O'Keefe, 2006). The latter, message arousingness, is often operationalized using message sensation value (MSV), a content-analytical measure of message features thought to elicit physiological arousal in audience members. These constructs are usually used in conjunction with major persuasion theories like the elaboration likelihood model (ELM; Petty & Cacioppo, 1986) and the activation model of information exposure (AMIE; Donohew, Palmgreen, & Duncan, 1980).

Unanticipated results in recent studies have often been interpreted to confirm and/or refute one theory over another (e.g., supporting ELM over AMIE in Kang et al., 2006). However, we take issue with these interpretations for two reasons. First, these theories, in general, make *complementary* rather than *contradictory* hypotheses; it would be difficult to formulate many falsifiable hypotheses that could be used to test any of these theories "against" the others. Second, many campaign studies suffer from measurement issues, especially with regard to putative message features. Very often these "message features" are measured by polling audience members as to what they *perceive*. The problem with this method is that either (1) researchers ask the same sample questions about their message-feature perceptions (using this as an independent variable) as they also ask about outcomes (e.g., Stephenson & Palmgreen, 2001, with PMSV), or (2) researchers ask a different sample to rate the message feature, but then lose individual-level information by aggregating the scores, assigning a single score to represent the feature regardless of variance in the *perception* of that feature (e.g., Kang et al., 2006, with AS). The first approach suffers from problems of nonindependence of measurements; the second involves loss of important individual-level variation. Both methods neglect to provide a measure of an actual *feature*, but instead provide information about (average) feature *perception*.

Such theoretical and methodological issues are far more than academic when persuasion research is used to formulate real public-health campaigns. For example, sensation-seeking tendency (SS), or the tendency to seek out arousing or exciting situations, correlates considerably with negative health behaviors and can help identify risk for onset (Sargent, Tanski, Stoolmiller, & Hanewinkel, 2010), while also correlating with enjoyment of high-MSV media messages. AMIE theorists capitalized on this connection by developing practical guidelines for sensation-seeking targeting (SENTAR) campaigns (Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001).

SENTAR programs target high-SS individuals through high-MSV messages; such campaigns seem to be effective in field tests for reducing marijuana use (Stephenson et al., 2002), tobacco use (Dickson, 1982), and risky sexual behavior (Palmgreen, Noar, & Zimmerman, 2009) in high-SS audiences. However, the connection between SS, MSV, and message effectiveness is far from clear, and AMIE and SENTAR are not without their criticisms. For example, the mechanisms behind the arousing nature of MSV are largely unknown and outcomes are difficult to predict (Donohew, 2006).

In order for designers to use theory and research to create effective messages, the effects of individual-level and message-level variables, as well as their interactions, must be clear. In this study, we examine the persuasive effects of antimarijuana public service announcements (PSAs) drawing on three cognitive-processing theories of persuasion and/or media consumption: ELM, AMIE, and the limited capacity model of motivated, mediated message processing (LC4MP; Lang, 2006). To do this, we examine the hypotheses and conclusions of three recent studies using these theories to predict PSA effectiveness with similar variables of interest. Each study deals with variable interactions, but often with contradictory theory, findings, and/or conclusions. Kang et al. (2006) examined the interaction between message AS, MSV, and participant drug risk on measures of message effectiveness, finding that the typical high-MSV, high-AS ads used to target at-risk adolescents were the *least* effective message type in the high-risk adolescent audience. Stephenson and Palmgreen (2001) tested the effects of SS and marijuana personal involvement (PI), as separate risk-related variables, as well as *perceived* MSV on cognitive-processing amount and valence. Lang and Yegiyan (2008) examined content arousingness (theoretically similar to MSV), AS, and emotional valence of the message on measures of recognition and effectiveness.

Though not exhaustive of the literature, these three studies present typical, complementary health-communication theory and methods, with elements that can be combined into a single study. Therefore, we examine these studies' treatment of message-level variables of MSV and AS, and the individual-level variables of drug risk and its components personal involvement (PI) and sensation seeking (SS). Our outcome variables are measures of message effectiveness, which have been shown to correlate well with actual effectiveness and behavior (Dillard, Weber, & Vail, 2007).

We examine variables at two levels of analysis—the participant level (e.g., risk) and message level (e.g., AS), summarized in Table 1. Though researchers commonly analyze data by aggregating participant variables or repeating message-level variables, these approaches can either lose statistical power or fail to account for nonindependence of observations. Drawing conclusions about individuals based on aggregated or disaggregated data can produce incorrect results (formally known as the ecological fallacy). To avoid these problems, we analyze our data using multilevel modeling (Hayes, 2006).

Cognitive and Emotional Processing: Three Theories, Three Articles

Each of the studies we incorporate draws on two or more of the cognitive-processing theories of persuasion noted in the introduction: ELM, AMIE, and LC4MP.

Table 1 Summary of Variables and Levels of Analysis

Variable	Definition
Individual level	
Sensation-seeking tendency (SS)	The tendency to seek out novel, complex, or exciting situations and stimuli
Personal involvement (PI)	The degree to which an individual is engaged in a given topic (in this case, marijuana use)
Marijuana risk (risk)	The degree to which an individual is likely to begin or continue to use marijuana
Message level	
Message sensation value (MSV)	The amount of stimulating visual, auditory, and narrative features contained in a media message, as quantified by content analysis
Argument strength (AS)	The degree to which an argument tends to result in persuasion under conditions of high scrutiny (often quantified using audience ratings)
Information introduced (I-squared)	The amount of visual information that is introduced by the average "cut" or change in visual perspective in a media message, as quantified by content analysis
Outcomes (Individual × Message)	
Perceived message effectiveness (PME)	The degree to which an individual believes that a message is an effective persuasive message, likely to positively affect one's own attitude and those of close others
Thought valence (TV)	The degree to which *positive* or *negative* thoughts about the message predominate following message receipt
Ad liking (AL)	The degree to which an individual enjoys a message

This section provides background on the three theories; the next section will present our integration of the three representative articles and our related hypotheses.

Figure 1a provides an overview of the relevant portion of each theory (the variables and interactions hypothesized in this study are further illustrated in Figure 1b). The grey bar along the top of the figure summarizes the mechanism of viewing and processing a persuasive message. This simplified process involves three stages: attention, processing, and response. Each of these stages involves subprocesses that can lead to important message effects.

Attention, a central concept in all three of our theories, is a term with many definitions; broadly, it is the mechanism by which the brain selects information for further processing. Many theories of attention involve multiple types (Banich, 2011); one prominent theory involves three types of attention—orienting, alerting, and executive attention (Posner, 1992; Posner & Fan, 2004). Orienting attention is when the spotlight of one's attention moves from one object or scene to another; this process can be voluntary, as when you choose to orient your attention to this page to read it, or involuntary, as when a loud noise startles you and causes you to involuntarily divert your attention to find the source of the noise.

With respect to media messages—especially advertisements—the orienting response is key, and messages are designed to capture attention involuntarily (e.g., billboards along the freeway are designed to grab attention away from the road),

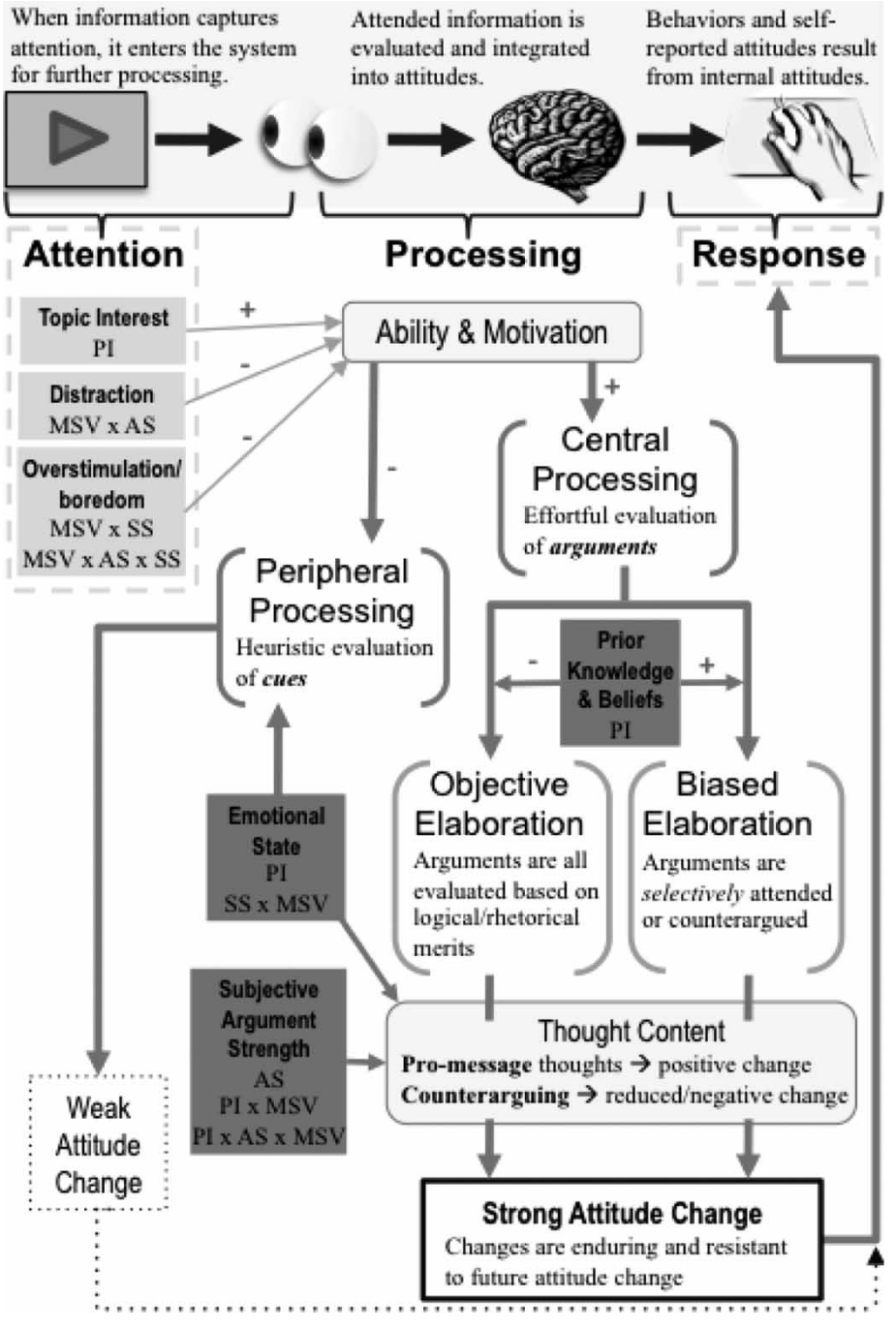

Figure 1a Illustration of theoretical model, including some variables and interactions.

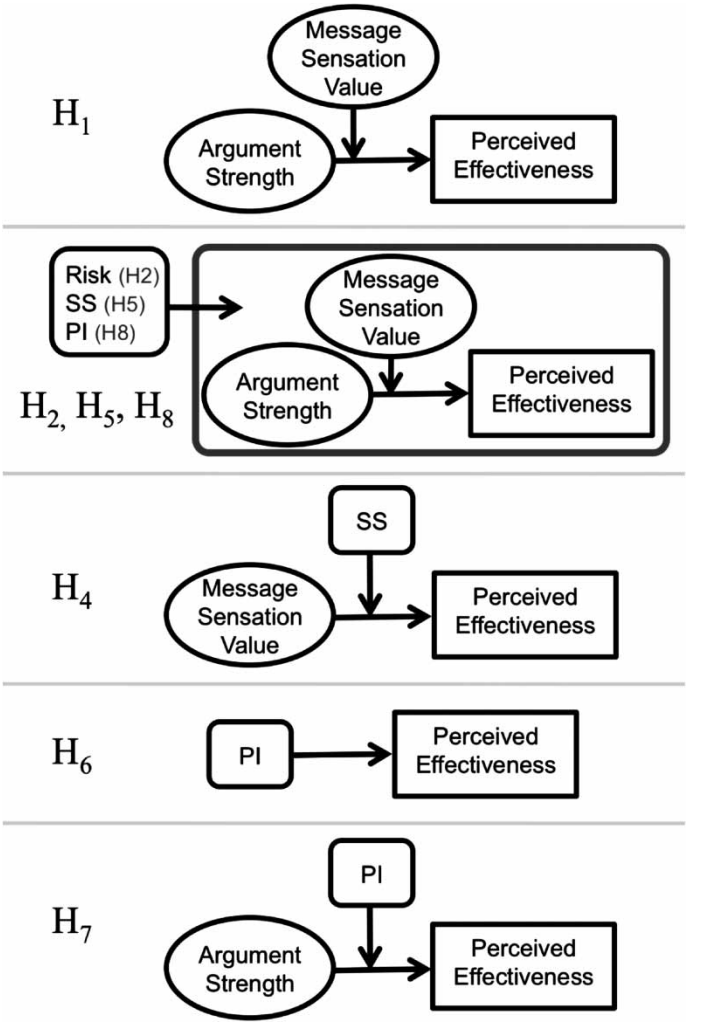

Figure 1b Model diagrams for each hypothesized effect. Ellipses represent message features, rounded rectangles represent individual characteristics, and rectangles are outcome measures. For H3, replace "Message Sensation Value" with "I-squared" in the relevant figures.

and to hold attention once under voluntary control (e.g., commercials are amusing or have catchy music to prevent viewers from changing the channel). Unfortunately for much academic research, this subprocess is difficult to study in controlled settings; a captive audience, without the ability to choose whether or not to watch the messages, is a shortcoming of this and many other studies. However, this type of attention is only one part of the cognitive process and is not the focus of this study.

A second type of attention, alerting (or arousal) attention, is dedicated to monitoring the environment for important information (e.g., checking for unusual noises). This network is responsible for mobilizing physiological resources in

response to cues in the environment, and can be thought of as the source of physiological arousal that high MSV musters. That is, message arousingness is the degree to which it causes alerting attention to increase cognitive and physiological resources devoted to processing and responding to relevant stimuli.

When alerting attention musters resources, it also triggers the executive attention network to further evaluate the stimuli and decide whether and what action is necessary. Executive attention is the more conscious form of attention—what people usually mean when they say they are paying attention to or concentrating on a stimulus. With regard to these communication models, executive attention can be thought of as motivation and ability to process centrally.

Though attention takes up relatively small space in Figure 1a, it is a crucial gateway to processing—information that fails to capture attention and receive resources for further processing will not enter into the cognitive system, and thus cannot result in persuasion in either direction. On the other hand, attended information then enters the processing stage; the diagram in the lower portion of Figure 1a summarizes the relevant mechanism proposed by ELM, AMIE, and LC4MP. The results of processing, finally, feed into responses, including behavioral responses and self-reported attitudes. The next sections provide brief reviews of each of the theories and their predictions about health-message processing.

Elaboration Likelihood Model

The elaboration likelihood model (ELM; Petty & Cacioppo, 1986) posits that people are motivated to hold correct beliefs, but that cognitive processes have a limited capacity. Messages can be evaluated by the central route or the peripheral route, according to a person's ability and motivation to process information in the message (see Figure 1a). The central route involves effortful evaluation of the message's argument(s). The peripheral route involves making quick, relatively effortless judgments about messages based upon heuristic information, or cues. Cues can include aspects of the message like the attractiveness of the source, the presence of an "expert" opinion, or the quantity of information presented.

Personal, message, or contextual factors can affect persuasion by increasing central processing, increasing peripheral processing, or affecting the magnitude and/or direction of attitude change. The processing route predicts differential permanence of resulting attitude change; central-route processing produces attitude change that is more enduring, more likely to predict behavior, and more resistant to counterarguing than peripheral route processing. The predominance of promessage or counter-message thoughts during elaboration determine the direction and magnitude of attitude change.

Thus, a tenet of ELM is that factors affecting an individual's ability or motivation to elaborate will predict changes in effectiveness outcomes. For example, distraction will reduce an individual's ability to effortfully evaluate an argument—that is, an argument that is rated as strong when evaluated under optimal conditions may be weaker under distraction, when the argument is less thoroughly processed and thus

has less opportunity to generate positive thought responses (Petty & Cacioppo, 1986). The resulting change will also be more shallow and transient.

Receivers of a message can also engage in biased central processing, which "often . . . results from a person's initial attitude becoming a more important schema in guiding processing" than the information in a message (Petty & Cacioppo, 1986, p. 163). During biased processing, processing is effortful as in objective central processing, but receivers selectively discount arguments and/or counterargue (leading to reduced or even negative attitude changes, or a "boomerang effect").

Involvement is a central variable in many theories of persuasion, including the ELM. Involvement has at least two theoretical effects on processing: First, because it increases interest in the topic, it increases motivation to process centrally. Second, because involvement correlates with prior knowledge and/or beliefs about a topic, it increases the likelihood that central processing will be *biased*. Specifically, elaboration is biased toward supporting prior beliefs and discounting counterattitudinal arguments. Together these effects suggest that personal involvement with marijuana (PI) should increase central, biased processing such that high-PI individuals should respond with low or negative persuasion to antimarijuana ads, in general.

Activation Model of Information Exposure (AMIE)

AIME (Donohew et al., 1980) holds that individuals have an optimum level of arousal, related to their sensation-seeking tendency (SS; Zuckerman, 1994). The match between the individual's ideal arousal level and the stimulus' sensation value—or, for media, MSV (Morgan, Palmgreen, Stephenson, Hoyle, & Lorch, 2003)—determines in part the resulting attention to the stimulus. Stimuli that do not meet an individual's threshold are boring and ignored, whereas those that exceed the optimum are experienced as over-stimulating and noxious (see Figure 1a). Because messages must capture attention to convey information, messages outside the target's optimal zone will be less effective than those that match the individual's SS.

Thus, AMIE describes a relationship between SS, MSV, and attention. Note that the theory does not make direct predictions about *persuasion* outcomes, but rather predicts *attention*, relying on other models (e.g., ELM) to connect attention to persuasion.

Because AMIE specifies an ideal match between two variables, relevant predictions necessarily involve interactions between those (and potentially other) variables.

Limited Capacity Model of Motivated Mediated Message Processing

Limited Capacity Model of Motivated Mediated Message Processing (LC4MP; Lang, 2006, 2009; Lang & Yegiyan, 2008) predicts outcomes based on both the constraints of human information processing and the effects of motivational/emotional processes. LC4MP proposes that humans have a limited pool of resources for processing perceptual stimuli, including media messages. These resources are allocated according to motivational rules, and can be used to encode (into perceptual/working memory),

store (into long-term memory), and retrieve (or activate from long-term memory) information.

Both physiological arousal and message complexity—variables that are both conceptually linked with MSV—play a potential role in cognitive resource allocation. Physiological arousal, at moderate levels, is theorized to increase encoding and storage of information, allowing for future retrieval. However, at very high levels of arousal, the theory states that people will be motivated to avoid the arousing stimulus due to a phenomenon called the negativity bias (Lang, 2009). Similarly, high message complexity could contribute to cognitive overload, which would overwhelm resources for encoding and storage, decreasing future retrieval.

Note that, like AMIE, this theory does not concern the *persuasiveness* of information; rather, LC4MP concerns whether or not information reaches the attention and memory systems. Thus, the *content* of message-relevant cognition is, again, left to other theories like ELM.

In sum, ELM, AMIE, and LC4MP are conceptually overlapping theories, yet they generate unique predictions about individual-level factors (sensation seeking and personal involvement) and message-level factors (message sensation value and argument strength) on health-message outcomes (perceived message effectiveness, thought valence, and ad liking). The next section synthesizes these predictions into related hypotheses.

Contrasts in Theory and Related Research

The theories and their representative articles offer a number of hypotheses related to the mechanisms of message features, individual characteristics, and their interactions. Sometimes the theory and research align, all pointing to the same hypothesis, while at other times competing hypotheses are evident.

How Sensation Value Changes Argument Strength: AS × MSV

In their 2006 study, Kang et al. performed a secondary analysis using data from three independent datasets. The first two datasets served to assign values to the message features AS and MSV, as follows: (1) a sample of adolescents rated AS for written arguments that had been professionally extracted from antidrug PSAs (i.e., written statements that summarized the main argument in each ad), and (2) trained coders content analyzed the PSAs for message features including MSV. Finally, (3) a separate sample of adolescents rated the persuasiveness of the PSA videos on three measures of effectiveness, which served as outcome measures.

All data were aggregated on the ad level. Independent variables were MSV and AS (message features), as well as drug risk (individual characteristics, assigned as high or low by median split). AS was assigned to each PSA using mean ratings of effectiveness for the extracted arguments (Dataset 1); MSV was assigned from Dataset 2. Outcomes were the measures of PSA message effectiveness (Dataset 3), aggregated across participants (i.e., a mean effectiveness score was created for the overall sample, as well

as for the high- and low-risk groups, for each ad). Analyses were then run on the ad-level scores.

Kang et al.'s (2006) first hypotheses involved argument strength and MSV, and were phrased to test AMIE against ELM. In their first hypothesis, they reason that "AMIE argues for an attention-catching effect for MSV features . . . [leading] to a more in-depth processing of the arguments embedded in the ads" (p. 356). Conversely, for their "ELM" hypothesis, they posit that MSV can get so high that it becomes distracting. Due to ELM's predictions about processing under distraction, Kang et al. suggest that AS should have less impact on the outcome when MSV is high. Therefore, they proposed that ELM would be supported by an interaction between MSV and AS where "strong arguments are more effective than weak arguments for low MSV ads, whereas weak arguments are equally or more effective than strong arguments for high-MSV ads" (p. 357). The results favored the second, "ELM" hypothesis.

Interestingly, the effect crossed over such that for high-MSV ads, increases in argument strength led to *decreases* in message effectiveness. Our first hypothesis seeks to replicate this effect:

> H1a: AS and MSV will interact such that for lower MSV, AS will have a positive effect on measures of effectiveness, whereas for higher MSV, AS will not show a positive effect.

However, it is unclear from Kang et al.'s (2006) rationale—or from ELM and other theory—why AS should be *negative* under distraction. Moreover, this pattern of interaction is at odds with other findings. For example, in their 2008 study, Lang and Yegiyan test LC4MP-derived hypotheses about the effects of message arousingness (theoretically similar to MSV), AS, and valence of emotional message content on drug-PSA processing and effectiveness. Relevant to this study, they note that "LC4MP predicts that as arousing content increases, messages will be processed more thoroughly" (p. 436) because more arousing messages elicit more resources for message processing. Moreover, if messages are processed relatively thoroughly (i.e., centrally), then strong arguments should be more effective than weak arguments as the ELM predicts under these conditions. They predict and find evidence for an interaction between AS and arousingness such that high-AS messages are always more effective than low-AS messages, "but that effect [is] much greater for arousing compared to calm messages" (p. 436). This hypothesis provides an alternative to our H1a:

> H1b: AS will have a positive main effect; this effect will be stronger as MSV increases.

The role of risk: AS × MSV × Risk. In their study, Kang et al. (2006) also examined a third dimension, marijuana risk, which included age, SS, and measures of personal involvement with marijuana. Assuming that high-risk adolescents would be more involved in the issue and thus motivated to attend to and process the ad, Kang and colleagues hypothesized that the interaction between MSV and AS "is more likely to occur among high risk than low risk adolescents" (p. 358).

Kang et al. (2006) found a significant three-way interaction for AS, MSV, and risk, such that the high-risk group drove the two-way interaction results. Once again, for the high-risk group, effectiveness actually *decreased* as AS increased in high-MSV ads. The interaction for high-risk adolescents warrants special attention, as these results run counter to the rationale behind theoretical/SENTAR-based message designs. Thus, a second hypothesis seeks to replicate this interaction:

H2a: The interaction from H1 will be weak or absent for lower risk and will be stronger as risk increases.

However, the original rationale for this hypothesis is somewhat unclear. While the ELM would suggest that higher-involvement individuals would be more motivated to process the ad, they would also be, as elucidated in the ELM review section, more likely to process in a manner biased against the ad's intent. Moreover, increased motivation to process does not explain why high-risk individuals should be *more distracted* by high MSV than low-risk individuals, nor does it explain the conditional *negative* effect of AS in high-risk individuals for high-MSV ads.

One potential explanation for a conditional negative effect for argument strength lies in the tendency for individuals to rate shorter, simpler arguments as weak and longer, more complex arguments as strong (Pierro, Mannetti, Erb, Spiegel, & Kruglanski, 2005). That is, AS correlates with the amount of rhetorical information; meanwhile, MSV is, in part, the amount of visual, auditory, and narrative information present in an ad (we will return to this claim momentarily). So the MSV × AS interaction could be thought to represent a composite measure of information density across two dimensions of information type (rhetorical and audiovisual).

In this case, ELM and AMIE together would suggest a different pattern of results than found in Kang et al. (2006). Specifically, because risk includes SS, low-risk individuals should prefer the condition with the lowest information density (low-AS, low-MSV), whereas they should find the high-information-density condition (high-AS, high-MSV) overstimulating. Similarly, high-risk individuals should prefer high-AS, high-MSV ads and should find low-AS, low-MSV ads boring. Thus, we present an alternative hypothesis to H2a:

H2b: The interaction from H1 will be stronger for lower risk and will be weaker or absent as risk increases.

This hypothesis uses the composite measure of risk; its mechanisms can be further examined by breaking risk into component constructs, SS and PI.

The Information-Density Hypothesis

We suggested previously that the AS × MSV interaction represents a composite measure of information density within the ad. However, this claim assumes that MSV, aside from being a measure of physiological "arousingness," also quantifies visual, auditory, and narrative information that must be processed in order to perceive and understand the message. In some respects, this makes sense: The more information in an ad, the more attentional resources it requires to process, and thus

the more the brain and physiological system must be aroused to allocate resources to executive attention. However, message complexity and physiological/emotional arousingness are not *necessarily* the same, and one criticism of MSV is its conflation of message complexity and capacity to induce emotional arousal. For this reason, Lang and Yegiyan (2008) measured arousingness while controlling for message complexity across two measures, camera changes and information introduced (Lang, Bradley, Park, Shin, & Chung, 2006).

Many of our hypotheses propose mechanisms of avoidance due to cognitive overload in circumstances of high information density—whether by distraction or by overstimulation of low-SS individuals. This would suggest that informational complexity—rather than physiological "arousingness" per se—could explain some unexpected research outcomes related to MSV (including, perhaps, some of the unexpected effects observed in other studies).

Information introduced (I-squared) is an alternate measure of information complexity without such confounds with emotional content; it quantifies the amount of visual information contained in a media message. If effects found for MSV are due to the amount of information and the potential for cognitive overload, rather than the physiological arousingness of the message, then substituting I-squared in place of MSV should yield similar results.

H3: The results from H1 and H2 will replicate when replacing MSV with I-squared.

The Mechanisms of "Risk": Sensation Seeking and Personal Involvement

In our third representative article, Stephenson and Palmgreen (2001) examined the effects of SS and PI separately, as well as the effect of *perceived* message sensation value (as rated by the participant; PMSV), on antimarijuana PSA processing. Their outcome measures indexed both amount and valence for three types of mental processing—cognitive, sensory, and narrative—via self-report.

Because AMIE postulates that individuals should prefer a match between MSV and their SS level, Stephenson and Palmgreen predicted that high-SS individuals, compared to low-SS, would report more processing in response to antidrug PSAs (which were all intentionally produced to be high-MSV). They also hypothesized that for high-SS individuals, *perceived* MSV would positively predict message-processing amount and valence. That is, high-SS individuals would think more, and more positively, about higher-PMSV messages than lower-PMSV messages. Conversely, for low-SS individuals, PMSV would negatively predict amount and valence of processing. Meanwhile, Stephenson and Palmgreen note that PI should lead to biased processing and counterarguing according to ELM (see earlier); therefore, increases in PI should lead to less processing, with more negative valence in ad evaluations.

In general, their PI-related hypotheses were supported, whereas their SS-related hypotheses were not supported or only partially supported. High-SS individuals did *not* engage in more processing in general than low-SS. Moreover, their predicted interaction between SS and PMSV did not manifest; instead, for all processing types,

low sensation seekers showed more processing as well as more positive processing with increasing PMSV. The authors speculated that the antimarijuana ads may not have been stimulating enough to overwhelm low-SS individuals or impress high-SS individuals.

However, an important shortcoming of this study involved using PMSV rather than MSV. Perceived message sensation value (PMSV) and coded message sensation value (MSV) are two different variables. PMSV is a self-reported, individual-level variable. MSV is a content-analytical, message-level variable. Thus, it is possible that the PMSV measure reflects *individual*-level emotional responses to the ads (such as differences in ad enjoyment) rather than variance in message features per se. Nonetheless, their study offers a viable scaffold for further examining the mechanism of the AS × MSV × Risk interaction. Specifically, the separation of risk into SS and PI allows us to make separate hypotheses about these variables' effects on PSA processing, since these constructs have conflicting theoretical effects despite their tendency to covary.

Sensation seeking. AMIE predicts an ideal match between SS and MSV for attention outcomes. Though Stephenson and Palmgreen (2001) failed to find a significant interaction between SS and PMSV on processing amount and valence, the use of PMSV instead of MSV could obscure findings. Thus, with similar rationale, we test the following hypothesis:

H4: SS and MSV interact such that for high SS individuals, high-MSV messages are more effective; but for low SS individuals, low-MSV messages are more effective.

Returning to the relationship between argument strength and MSV, recall that our rationale for H2b involved specifically the relationship between risk and sensation-seeking tendency. That is, we proposed that high-AS, high-MSV ads are high in information density, while low-AS, low-MSV are low information density. We proposed an interaction between information density and risk, assuming that low-risk individuals, who tend to be low in SS, will find higher information density to be overstimulating. Breaking risk down into its component constructs allows us to test this mechanism directly; thus, we offer the following competing hypotheses, analogous to H2a and H2b above, but replacing risk with SS. Our AMIE-based rationale suggests H2b should be correct.

H5a: The interaction from H1 will be stronger for higher risk and will be weaker or absent as risk decreases.

H5b: The interaction from H1 will be stronger for lower risk and will be weaker or absent as risk increases.

Personal involvement. Like SS, personal involvement has its own theoretical effects on persuasive outcomes. The simplest effect is the tendency for PI—via prior knowledge and belief—to bias elaboration (see Figure 1a). In Stephenson and Palmgreen (2001), greater PI was associated with *less* and *more negative* processing for

all processing types (though, for sensory and narrative processing, only for high-SS individuals). These findings support the ELM premise that PI leads to discounting, counterarguing, and relatively automatic rejection of attitude-threatening arguments. Therefore, we predict the following:

H6: PI will have a negative main effect on message effectiveness.

Moreover, if processing is biased such that high-involvement individuals *selectively* accept information that fits with their current attitude and reject counterattitudinal information, "stronger" arguments would not necessarily lead to better outcomes for high-involvement individuals. In fact, differences in strength may not matter at all for high-PI individuals—that is, all ads, regardless of AS, would result in low ratings. Strength could even work opposite to typical expectations—the stronger an argument is on average, the more attitude-*threatening* it is for high-involvement individuals, and thus the more motivated they are to counterargue and defend their original beliefs. Here again is a potential explanation for a negative conditional effect for AS. Regardless of whether AS is "turned negative" or merely dampened, the role of biased processing suggests an interaction between AS and PI:

H7: AS will have a strong, positive effect in low-PI individuals and a weak or negative effect in high-PI individuals.

It also may suggest a role in the three-way interaction from H2 as a component of risk. Again, if high-marijuana-involvement individuals counterargue with all antimarijuana ads regardless of message features, then message features should have an effect for low-PI individuals but not for high-PI individuals. Again, this suggests a different pattern than that found by Kang et al. (2006), who found a stronger interaction for high-risk (and thus, high-PI) individuals. Thus, like H2 and H5, the following hypotheses tests Kang et al.'s results (H8a) against our rationale based on theory and other results (H8b).

H8a: The interaction from H1 will be stronger as PI increases.
H8b: The interaction from H1 will be stronger as PI decreases.

Method

Like Kang et al. (2006), we ran two separate surveys: one measured strength for arguments professionally extracted from the stimulus PSAs, and a second, independent sample evaluated message effectiveness and individual-level variables including marijuana risk for the actual PSAs. We used the same arguments extracted by researchers at the Annenberg School for Communication at the University of Pennsylvania in the first survey; however, some of these arguments were modified slightly for our sample (e.g., changing "Kids who use drugs . . ." to "People who use drugs . . ."). We used aggregate measures obtained from our first sample for measures of AS (aggregated separately for high-risk and low-risk groups). For our content-analytical data set—MSV and I-squared—we also used the original researchers' data as a control, as these constructs are conceptualized as a static message feature.[1]

Survey 1: Argument Strength Evaluation

Participants. We recruited 185 (76.8% female, 23.2% male) students from social science programs (Communication and Psychology) at a Western United States university. Students received course credit for their participation. Sixty-one percent reported their race as White/Caucasian, 21.6% Hispanic, 2.2% Black/African American, 21.1% Asian, 1.1% Native American/Alaskan, 1.6% Hawaiian/Pacific Islander, and 5.4% chose "Other" (participants could choose more than one race category). The average reported age was 19.5 ($SD = 1.97$); 60 respondents neglected to report an age. Most (45.4%) were college freshmen; 32.4% had completed one year of college, 17.3% had completed two years, 4.3% had completed three years, and one respondent (.5%) had completed four or more years.

Materials. Demographics. Participants were asked to provide their age in years, race, mother's education level, vtheir own last completed education level.

Sensation seeking. A four-item sensation-seeking scale—derived from Zuckerman (1994)—was included. The items were "I like to explore strange places," "I like to do frightening things," "I like new and exciting experiences even if this breaks rules," and "I prefer exciting and unpredictable friends" (Cronbach's alpha = .76).

Personal involvement. Personal involvement was similar to that used by Stephenson and Palmgreen (2001) and identical to a subscale of Kang et al. (2006). Participants were asked about the likelihood of using marijuana once or twice, using marijuana nearly every month, and of refusing marijuana if offered in the next 12 months, as well as the degree to which their feelings are mixed regarding the thought of using marijuana nearly every month for 12 months. Other questions asked the degree to which the participant felt s/he could say no if s/he really wanted to, how many friends used marijuana in the last year, and how many times the participant had been offered marijuana in the last 30 days. The scale's reliability (Cronbach's alpha) was .89.

Marijuana risk. Risk included the items from sensation seeking and personal involvement. As expected, the internal consistency of this scale was high (Cronbach's alpha = .87).

Argument strength. The instrument consisted of 73 written persuasive arguments for avoiding marijuana or drug use. (Example: "Everyone wishes they could be a little cooler, taller or stronger sometimes. Some people think smoking pot will help them fit in with the crowd. You are not as different as you think. Most people do not smoke pot.") Participants answered nine Likert-scale questions on how believable, unconvincing, important, and confidence building they found the arguments, as well as the degree to which the arguments would help friends stay away from marijuana, generated thoughts about staying away from marijuana, and generated thoughts about wanting to try marijuana. They were rated the degree to which they agreed/disagreed with the argument and the degree to which the argument gave a strong/weak reason for staying away from drugs (Cronbach's alpha = .81).

Procedure. The survey was administered online via SurveyMonkey.com. The stated purpose of the study was to examine how people cognitively evaluate antidrug arguments. The survey took approximately 45 minutes to complete.

Survey 2: Ad Effectiveness Evaluation

Participants. We recruited 599 (73.8% female, 26.2% male) students from social science programs (Communication and Psychology) at a Western United States university. Students received course credit for their participation. The average age was 19.65 ($SD = 2.12$). Because of the high prevalence of female participants, we controlled for gender in all analyses.

Materials. The PSA survey included questions on demographics, marijuana risk including SS (Cronbach's alpha = .75), and PI (Cronbach's alpha = .87). Participants were then asked to rate at least 10 of the 63 stimulus antimarijuana PSA videos, which were linked in a separate Internet browser window with nondescriptive links (e.g., Video 63), in random order. Participants could rate up to 15 PSAs; we had 97% compliance in completing at least 10 ratings (all participants completed at least five). Thought valence, perceived message effectiveness, and ad liking were assessed.

Thought valence (TV) is a difference score between two 7-point Likert items regarding the ad generating thoughts about wanting to try marijuana and generating thoughts about staying away from marijuana.

Perceived message effectiveness (PME) asks participants to rate on a 5-point scale the degree to which the ad is unconvincing, says something important, helps him/her feel confident, and would help friends stay away from drugs (Cronbach's alpha = .72).

Ad liking (AL) is a single seven-point Likert item asking the degree to which the participant liked the ad. The survey took approximately one hour if participants completed all 10 requested PSA evaluations.

Procedure. The survey was administered on line via WebSurveyor Version 4.1. Participants were told that the purpose of the study was to examine how people evaluate antidrug PSAs.

Results

For each of the three dependent variables (TV, PME, and AL), we estimated a multilevel model with two levels (PSA evaluations nested within subjects) and no predictors. Based on this "empty" model, we used the residual estimate and the intercept variance on the subject level to calculate the intraclass correlation ρ (Hayes, 2006). For PME, ρ was .396, indicating that 39.6% of the variance was attributable to subject-level variance and 60.4% of the variance was attributable to PSA-level variation. For TV, ρ was .443; and for AL, ρ was .161. Thus, for all three dependent variables we added subject-level predictors (marijuana risk, SS, or PI, along with

gender as a control variable) and PSA-level predictors (MSV and AS) to the model. We estimated a mixed, random-effects model with repeated measurements, taking into account that PSA-evaluation residuals within subjects were not independent (each subject evaluated between five and 15 randomly selected PSAs). All PSA-level predictors have been centered on the subject-level mean in order to simplify the coefficients' interpretation.

The fixed effects of the models explained 8.7% of the total variance for PME, 13.4% for TV, and 4.8% for AL. Interestingly, the covariance parameter for the PSA-level predictors (MSV and AS) in our random-effects model were not significant, indicating that the estimated effects of MSV, AS, and their interaction did not significantly vary across participants. The residual covariance structure in all models followed a nonsignificant, first-order autoregression (AR1) and thus had no impact on the validity of the statistical tests.

The models for H1 and H2 including the estimated effects for all three outcome variables (PME, TV, and AL) are listed in Table 2.[2]

For PME, significant simple effects emerged for risk and AS, but not for MSV. Both the two-way interaction MSV × AS and the cross-level, three-way interaction MSV × AS × Risk were significant; that is, the conditional AS effect should be interpreted in the context of MSV and risk (see Hayes, Glynn, & Huge, 2011, for the correct interpretation of linear models with conditional effects). Likewise, risk and AS were significant predictors of TV. MSV, was significant as well, but had only a minor effect on TV. Both the two-way (MSV × AS) and cross-level three-way (MSV × AS × Risk)

Table 2 Multilevel Model: Effect of Message Sensation Value (MSV), Argument Strength (AS), and Marijuana Risk on Perceived Message Effectiveness, Thought Valence, and Ad Liking

Parameter	Estimate	*SE*	*df*	*t*	Lower 95% CI	Upper 95% CI
Perceived message effectiveness ($R^2 = 8.7\%$)						
Risk	−1.31	0.13	524	−9.68***	−1.57	−1.04
MSV	−0.01	0.01	4262	−0.78	−0.03	0.01
AS	1.06	0.16	4236	6.60***	0.75	1.38
MSV × AS	−0.32	0.11	4408	−2.99***	−0.54	−0.11
MSV × AS × Risk	0.13	0.04	4407	2.94***	0.04	0.21
Thought valence ($R^2 = 13.4\%$)						
Risk	−0.60	0.06	523	−11.63***	−0.77	−0.55
MSV	−0.02	0.01	4304	−3.76***	−0.03	−0.01
AS	0.32	0.06	4280	5.13***	0.20	0.44
MSV × AS	−0.13	0.04	4436	−3.11***	−0.21	−0.05
MSV × AS × Risk	0.05	0.02	4434	3.15***	0.02	0.09
Ad liking ($R^2 = 4.8\%$)						
Risk	−0.39	0.05	529	−7.96***	−0.48	−0.29
MSV	0.03	0.01	4400	5.27***	0.02	0.04
AS	0.50	0.08	4345	5.92***	0.33	0.66
MSV × AS	−0.14	0.06	4681	−2.53**	−0.25	−0.03
MSV × AS × Risk	0.06	0.02	4677	2.70***	0.02	0.11

**$p < .01$, ***$p < .001$; all models controlled for gender; predictor variables have been mean centered.

interactions were significant as well which, again, suggests that all simple effects have to be interpreted as conditional effects. The same pattern holds for AL; significant simple effects were found for risk, AS, and, though small, for MSV; and both interactions were significant. The two-way interactions AS × Risk and MSV × Risk are unrelated to our hypotheses and proved to be nonsignificant in our models—for the sake of brevity we decided not to report these effects in our tables.

Sensation Value and Argument Strength: AS × MSV

The first two hypotheses predict two-way (AS × MSV) and 3-way (AS × MSV × Risk) interactions. Figures A1 through A3 in the Appendix provide interaction charts (AS × MSV) with the model's estimated means for all participants (H1a/b) as well as for high- and low-risk participants (H2a/b).

Hypotheses 1a and 1b predicted specific patterns for the AS × MSV interaction; H1a predicted that a positive slope for AS will be conditional upon high MSV, whereas H1b predicted that AS will always be positive, but merely stronger for high-MSV than low-MSV. Neither hypothesis was fully supported, but H1b receives more support than H1a. Figure A1 in the Appendix demonstrates that, in the entire sample, AS has a positive main effect for all values of MSV (partially supporting H1b). However, this effect is stronger for *low*-MSV ads than *high*-MSV ads, contrary to both hypotheses. Thus, these results partially support H1b, in that the two-way interaction is present and the effects of AS remained positive for both high and low MSV, but the slope of MSV's effect is opposite to that predicted.

H2a/b predicted that the AS × MSV interaction would further interact with marijuana risk—H2a specifies that the AS × MSV interaction would be stronger for high-risk individuals, whereas H2b specifies that it would be higher for low-risk individuals. Figures A2 and A3 in the Appendix illustrate the two-way interaction charts for high- and low-risk participants, respectively. The AS × MSV interaction fully manifested for the low-risk group, supporting H2b.

The Information-Density Hypothesis

To test H3, we replaced MSV with I-squared. Results are almost identical to those using MSV (see Table 3).[3] The effect of I-squared is slightly stronger than the effect of MSV. The effects of the interactions are stronger with I-squared compared to MSV. Overall, the results suggest that I-squared and MSV index message complexity in a similar fashion.

The Mechanisms of "Risk": Sensation Seeking and Personal Involvement

To test the risk-mechanism hypotheses, we ran the previous models twice more, replacing risk with SS and with PI.

Table 3 Multilevel Model: Effect of Message Sensation Value (MSV), Argument Strength (AS), and Sensation Seeking (SS) on Perceived Message Effectiveness, Thought Valence, and Ad Liking

Parameter	Estimate	*SE*	*df*	*t*	Lower 95% CI	Upper 95% CI
Perceived message effectiveness ($R^2 = 2.4\%$)						
SS	−0.41	0.16	523	−2.50*	−0.74	−0.09
MSV	−0.01	0.01	4256	−0.74	−0.03	0.01
AS	1.05	0.16	4234	6.38***	0.73	1.37
MSV × AS	−0.05	0.05	4374	−1.08	−1.38	0.04
MSV × AS × SS	0.05	0.05	4359	1.04	−0.04	0.14
Thought valence ($R^2 = 4.5\%$)						
SS	−0.26	0.07	522	−3.71***	−0.40	−0.12
MSV	−0.02	0.01	4298	−3.81***	−0.03	−0.01
AS	0.31	0.06	4279	4.93***	0.19	0.44
MSV × AS	−0.03	0.02	4399	−1.93*	−0.07	0.00
MSV × AS × SS	0.06	0.02	4385	3.03**	0.02	0.09
Ad liking ($R^2 = 1.5\%$)						
SS	−0.09	0.06	525	−1.49	−0.20	0.03
MSV	0.03	0.01	4390	5.30***	0.02	0.04
AS	0.50	0.09	4342	5.79***	0.38	0.66
MSV × AS	−0.01	0.02	4632	−0.53	−0.06	0.03
MSV × AS × SS	0.03	0.02	4603	1.13	−0.02	0.08

*$p < .05$, **$p < .01$, ***$p < .001$; all models controlled for gender; predictor variables have been mean centered.

Sensation seeking. For H4 we tested whether SS and MSV interact such that for high-SS individuals, MSV has a positive effect, but for low-SS individuals, MSV has a negative effect. For PME, we found a significant effect for SS, $\beta = -.41$, $df = 523$, $p < .05$, but no significant results for MSV and the interaction between MSV and SS. Similar patterns emerged for TV and AL. Thus, H3 was not supported; however, an MSV × AS × SS interaction was significant (see the results for H5/7 later and in Table 3).

H5a and H5b provided competing hypotheses for how SS would affect the AS × MSV interaction; for these hypotheses, we found significant effects for TV (see Table 3) with an explained variance of 4.5%.

The results for PME and AL approached significance with *p*-values smaller than .10, and coefficients similar to TV. The models' explained variance was low ($R^2 = 2.4\%$ for PME; $R^2 = 1.5\%$ for AL). The pattern of group means suggest support for H5b rather than for H5a (see Figure 2).

For low MSV, the higher the AS, the more the ad is perceived as effective; whereas for high-MSV, increases in AS lead to no increases or decreases in measures of message effectiveness. This pattern occurs for low-SS participants and not for high-SS, supporting H5b. Interestingly, high-SS participants showed the reverse pattern.

Personal involvement. H6, predicting a main effect for PI, was supported with strong effect sizes (see Table 4).

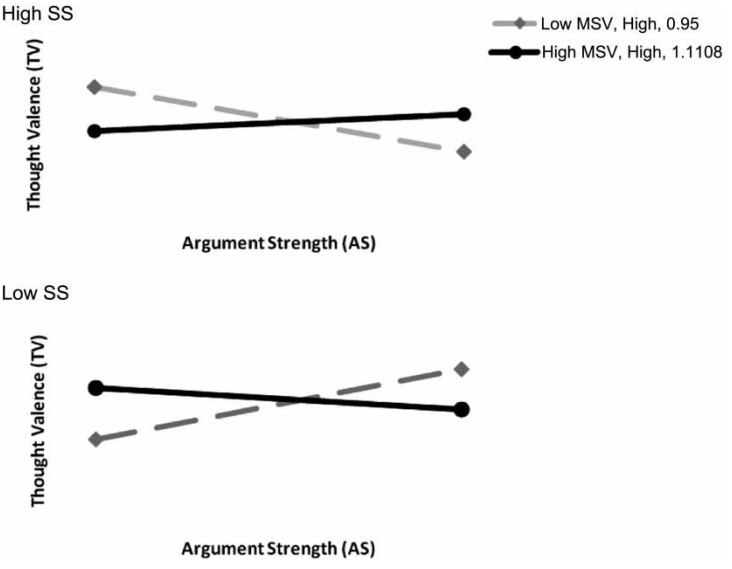

Figure 2 Means of thought valence (TV) by message sensation value (MSV) and argument strength (AS) for low and high sensation-seeking (SS) participants.

Unfortunately, H7's predicted interaction between AS and PI was only supported for AL (PME: $\beta = -.17$, $df = 4234$, $p < .21$; TV: $\beta = -.09$, $df = 4278$, $p < .11$; AL:

Table 4 Multilevel Model: Effect of Message Sensation Value (MSV), Argument Strength (AS), and Personal Involvement (PI) on Perceived Message Effectiveness, Thought Valence, and Ad Liking

Parameter	Estimate	*SE*	*df*	*t*	Lower 95% CI	Upper 95% CI
Perceived message effectiveness ($R^2 = 10.9\%$)						
PI	−1.1	0.09	523	−11.56***	−1.23	−0.91
MSV	0.01	0.01	4265	−0.82	−0.03	0.01
AS	1.01	0.17	4237	6.02***	0.68	1.34
MSV × AS	−0.20	0.08	4390	−2.36**	−0.36	−0.03
MSV × AS × PI	0.07	0.03	4378	2.20**	0.01	0.13
Thought valence ($R^2 = 17.6\%$)						
PI	−0.57	0.04	522	−14.78***	−0.65	−0.50
MSV	−0.02	0.01	4308	−3.74***	−0.03	−0.01
AS	0.32	0.07	4281	4.91***	0.19	0.45
MSV × AS	−0.13	0.04	4436	−3.11***	−0.21	−0.05
MSV × AS × PI	0.05	0.02	4434	3.15***	0.02	0.09
Ad liking ($R^2 = 14.4\%$)						
PI	−0.36	0.03	526	−10.14***	−0.42	−0.29
MSV	0.03	0.01	4406	5.24***	0.02	0.04
AS	0.47	0.09	4346	5.40***	0.30	0.64
MSV × AS	−0.01	0.04	4649	−2.26**	−0.18	−0.01
MSV × AS × PI	0.04	0.02	4630	2.48**	0.01	0.07

*$p < .01$, ***$p < .001$; all models controlled for gender; predictor variables have been mean centered.

$\beta = -.17$, $df = 4343$, $p < .02$), although the mean pattern are in the correct direction for all three measures of ad effectiveness.

With regard to H8a and H8b, presenting competing three-way interaction patterns between PI, AS, and MSV, H8b was fully supported—the AS × MSV interaction grew stronger as PI increased. Notably, using PI increased the model's explained variance substantially; the explained variance of the fixed effects was 10.9% for PME, 17.6% for TV, and 14.4% for AL.

Discussion

In this study, we find support for ELM, AMIE, and LC4MP as models of health-message outcomes for the variables included in this study (see Figure 1a). However, we wish to highlight the conditional nature of our findings—with our multilevel analysis we found numerous (often cross-level) interactions that paint a complicated picture of the effects of personal characteristics and message features on persuasive outcomes. These findings suggest that scholars and practitioners wishing to use one or more of these theories must be careful in their predictions, measurement, and interpretation; even effects that seem straightforward, such as the idea that strong arguments produce persuasive outcomes, are likely to be conditional upon a number of other factors, both at the audience level and at the message level.

Theoretical Support

ELM. Our results provide support for multiple major predictions of ELM. First, regarding the tenet that factors affecting an individual's ability or motivation to elaborate will predict changes to effectiveness outcomes: Our results showed that factors theoretically affecting an individual's ability (such as information overload) or motivation (such as topic interest) to evaluate message arguments led to lower ratings of message effectiveness in "high-AS" conditions. We will discuss each of these factors further later in the discussion.

Second, ELM predicts biased processing when individuals hold strong initial opinions; in our results, high-risk individuals rated all PSAs with low effectiveness, with variations in message features leading to very little variance in outcomes for high-risk individuals compared to low-risk individuals. This suggests that high-risk individuals selectively discounted and counterargued information that conflicted with their initial attitudes. Moreover, when examining the role of involvement directly, we found that PI had a negative simple effect overall—as involvement increased, message effectiveness decreased. Interestingly, PI interacted with AS, but not with MSV—that is, involvement seemed to function to bias *central* processing (as predicted in ELM), but did not change the effects of arousingness/complexity of the message.

The results of this analysis and complementary observations from open-ended feedback questions at the end of the survey suggest that our high-risk participants engaged in counterarguing: The ads were *all* rated with relatively low efficacy by

high-risk individuals. Unfortunately, these findings do not bode well for SENTAR message designers hoping to reach high-risk individuals using high-MSV messages. High-MSV may function to capture attention for high-SS individuals, but if the audience members are predisposed to disagree with the message, increased attention will not translate to increased persuasion (indeed, may translate to *decreased* persuasion).

AMIE/SENTAR. AMIE predicts that a match between SS and MSV leads to optimum attention. Like Stephenson and Palmgreen's (2001) results, a match between SS and MSV did not lead to increased message *effectiveness* in our sample. However, this unsupported hypothesis itself does not refute AMIE, which predicts *attention* rather than effectiveness. In fact, the three-way interactions show evidence of the predicted effects of withdrawal during mismatch.

Unfortunately, high-risk participants showed consistently low persuasion. For low-risk participants, on the other hand, the interaction between AS and MSV was evident, supporting the AMIE notion that low-SS individuals dislike overstimulation. High-MSV, high-AS ads contain the most information, and thus would be the most mentally and physiologically stimulating ads. The negative emotional state associated with overstimulation would lead to a decreased perception of effectiveness. In fact, when we broke risk into PI and SS, low-SS individuals showed a *negative* effect for AS in high-MSV ads.

These results not only support AMIE's predictions about attention, but also add to the body of research that suggests that SENTAR may not be the best approach in cases where the at-risk population already holds strong beliefs, as attention must overcome the tendency to counterargue in order to translate to persuasion.

LC4MP. One of our LC4MP hypotheses did not bear support—though AS and MSV interacted and the effects of AS remained positive for both high and low MSV, AS showed a steeper slope for low, rather than high-MSV. That is, increases in the strength of an argument had more effect for low-MSV ads than for high-MSV ads. This result is not entirely contrary to LC4MP, however; according to the theory, when arousal becomes too high, the negativity bias kicks in and causes individuals to withdraw from the stimulus—similar to AMIE's prediction about low-SS individuals withdrawing from overstimulation. This idea provides a tempting explanation, especially since the effect was stronger in low-risk/low-SS individuals, but was nonetheless unanticipated.

On the other hand, when we substituted I-squared for MSV, we obtained similar, and even stronger, effects compared to MSV. Because I-squared is designed to be purely an index of information density, this result suggests that the effects of MSV found here may be more due to message complexity than to emotional and physiological arousingness. In their study, Lang and Yegiyan (2008) controlled for message complexity because LC4MP makes different predictions about the effects of complexity and arousingness. Specifically, as complexity increases, overload of resources allocated

to message processing becomes more likely. During overload (much like ELM and distraction) individuals cannot fully process the information in the message. Thus, though the arousal component was not supported as predicted, this may be due to confounds in the MSV variable. The I-squared result also supports the conclusion that conditional reduced or negative effects of AS could be due to information overload.

Conclusions and Limitations

Diminished or even negative effects of AS on message effectiveness create potential problems for researchers and message designers alike, and undermine the validity of argument strength as a construct. Unfortunately, AS is (problematically) *defined* by its outcomes. If variation in the PSAs' assigned AS fails to produce commensurate variation in perceived effectiveness measures, this calls into question whether the AS measure is valid (e.g., whether "extracted" arguments rated by the first sample matches the other participants' perceptions of the actual PSAs' arguments). Fortunately, our simple effects for AS on ad effectiveness align with expectations—increases in AS lead to increases in perceived message efficacy *on average*.

Nonetheless, interpreting the conditional effects for practical, communication-oriented conclusions is difficult without a theorized mechanism for AS. O'Keefe (2006) distinguishes between three classes of research claims that persuasion researchers make about message features; these claims relate persuasive outcomes to (1) a psychological state, (2) specific message features/variations, or (3) both message features and psychological states (the latter often as mediators). Though we (and other researchers) use the phrase "message feature" to describe argument strength, our study and the studies we draw on fall into the first category of claims with regard to AS (though not MSV). That is, argument strength is not defined by some objective, quantifiable feature of the message, but instead by the psychological state it induces in the participant (i.e., the amount of persuasion it induces when participants effortfully evaluate the argument).

As O'Keefe (2006) points out, using variables defined by their psychological outcome tells us little about properties of a message that lead to greater or reduced persuasion, shedding "rather less light than one might like on communication" (p. 256). In our study, the effect of a PSA's assigned "argument strength" differs based on audience characteristics (risk) and other message features (MSV)—but why? What does this mean for message designers? The traditional, circular definition of AS offers no insight because it includes no theory as to *how* argument variations produce variations in perceived argument strength. Thus, this study highlights a long-recognized need to further examine the mechanism of argument strength, such as uncovering specific argument characteristics that produce variation in perceived AS. Scholars have begun work on this important front (Cappella, 2011; Krippendorff, 1995), but more research and theory are needed in order to interpret results for practical purposes.

Our study also calls into question the utility of SENTAR and other targeting methods for risky behaviors in populations where prior beliefs are already strong,

underlining the need for intervention with at-risk populations *before* beliefs have cemented. Indeed, most antidrug ad campaigns are targeted to young adolescents who are less likely to have already tried drugs. For high-involvement individuals in our study, ads are of low effectiveness regardless of message features. Moreover, low-SS individuals find the typical high-MSV, high-AS ads unpleasant. It might be argued that low-SS individuals can be ignored because they are not the target audience (Palmgreen & Donohew, 2010); however, this approach can be dangerous, especially when ineffective messages actually may "boomerang" and result in *negative* persuasion. Ignoring low-SS individuals for antimarijuana campaigns is especially misguided because marijuana is a depressant, and thus may actually be *sought out* by those who find overstimuluation to be unpleasant. Though the type of sensation seeking that draws some people to stimulating media *covaries* with drug experimentation, their overlap is far from absolute.

In fact, while we did not collect data on actual marijuana use in this sample, in a series of follow-up studies using the same brief SS scale, nearly as many low-SS (62%) as high-SS (78%)[4] college-freshman participants had tried marijuana, a difference that does not achieve statistical significance, $\chi^2(1) = 2.77$, $p = .10$. Thus, though the high-SS individuals are (nonsignificantly) more likely to have tried marijuana, more than half of low-SS participants had also tried it. If highly stimulating, informationally dense ads lead to negative feelings in low-SS individuals, this collateral damage cannot be written off as unimportant because they are not the target audience with such a meager correlation between sensation seeking and use, especially for marijuana.

However, this point brings up a limitation of this study: study participants were young college students. On one hand, the narrow age range of our sample allowed for some control on cognitive ability, which can range widely in adolescent samples (e.g., Kang et al.'s adolescent sample was aged 11–19, which represents a very wide developmental window). On the other hand, our sample is at the very upper margin of the target audience for antidrug ads, with PSAs and interventions today aiming for middle-school students and younger in order to catch adolescents prior to onset of marijuana exposure.

Additionally, a limitation of both our study and those that we cite is that participants are instructed to attend to ads, and therefore there is likely to be very little variance in the amount of attention paid to an ad compared to a natural setting. That is, unlike when aired on TV, during these studies the ads are not "competing" with other stimuli for attention, and thus MSV is unlikely to function in the same way that it might for high-SS individuals in natural-viewing circumstances. Specifically, as noted earlier, when instructing individuals to attend to an ad, we are losing both involuntary and voluntary orienting responses; thus, our study only represents part of the attention-processing-response process, beginning with the point where the "spotlight" of attention is already focused upon the ad. However, if anything, this fact simply means that our results indicate that practitioners should be all the more cautious about predicting positive persuasive effects—that is, our results and other "captive audience" studies and formative evaluations represent a "best

case" for persuasion, because positive effects—however conditional—can only diminish with the freedom to disregard the message.

Overall, our results contribute to the body of empirical findings supporting ELM, AMIE, and LC4MP at a theoretical level. However, this support is not straightforward or unconditional, and we did not find support for all hypotheses from the exemplar studies. The abundance of interactions in these results—interactions that determine whether message features have a desired or undesired effect—illustrates the notion that humans and their responses to messages define a complex system (Lang, 2009). On a practical level, these interactions highlight the need to continue refining theoretical message planning and evaluation; it is not enough to design high-MSV or high-AS messages and expect them to have positive outcomes for all audience members, or even the target segment. Instead, as our study demonstrates, multiple individual- and message-level factors, as well as their interactions, should be considered during planning and evaluation.

Notes

[1] We thank Joseph N. Cappella for generously providing the original PSAs, extracted arguments, and content analytical data for this study.

[2] Due to space limitations, we have omitted nonsignificant results for lower-order interactions that were not addressed in this study's hypotheses.

[3] Due to the limited space we do not provide another table with only slightly different numbers. The result table for I-squared instead of MSV is available upon request from the paper's first author.

[4] This calculation compares the top third of SS scores with the bottom third; comparing the upper half to the lower half would lead to less of a difference.

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Appendix

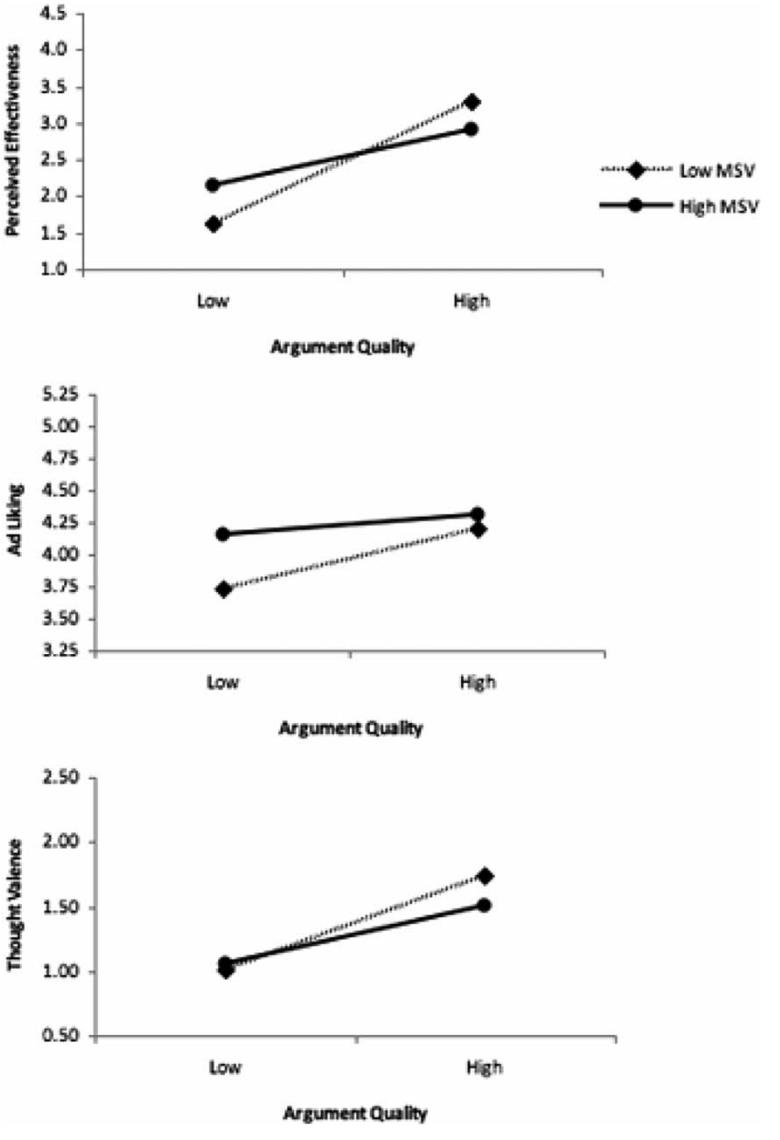

Figure A1 Means of ad effectiveness by message sensation value (MSV) and argument quality/strength (AS).

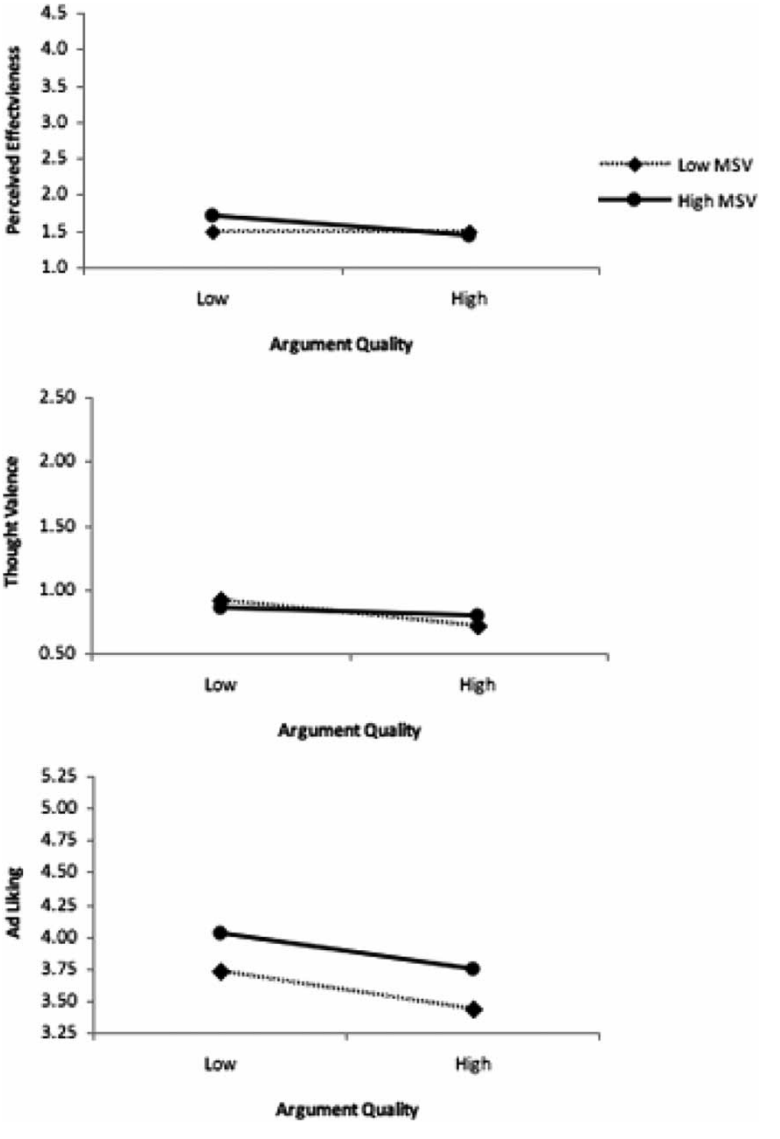

Figure A2 Means of ad effectiveness by message sensation value (MSV) and argument quality/strength (AS) for high-risk participants.

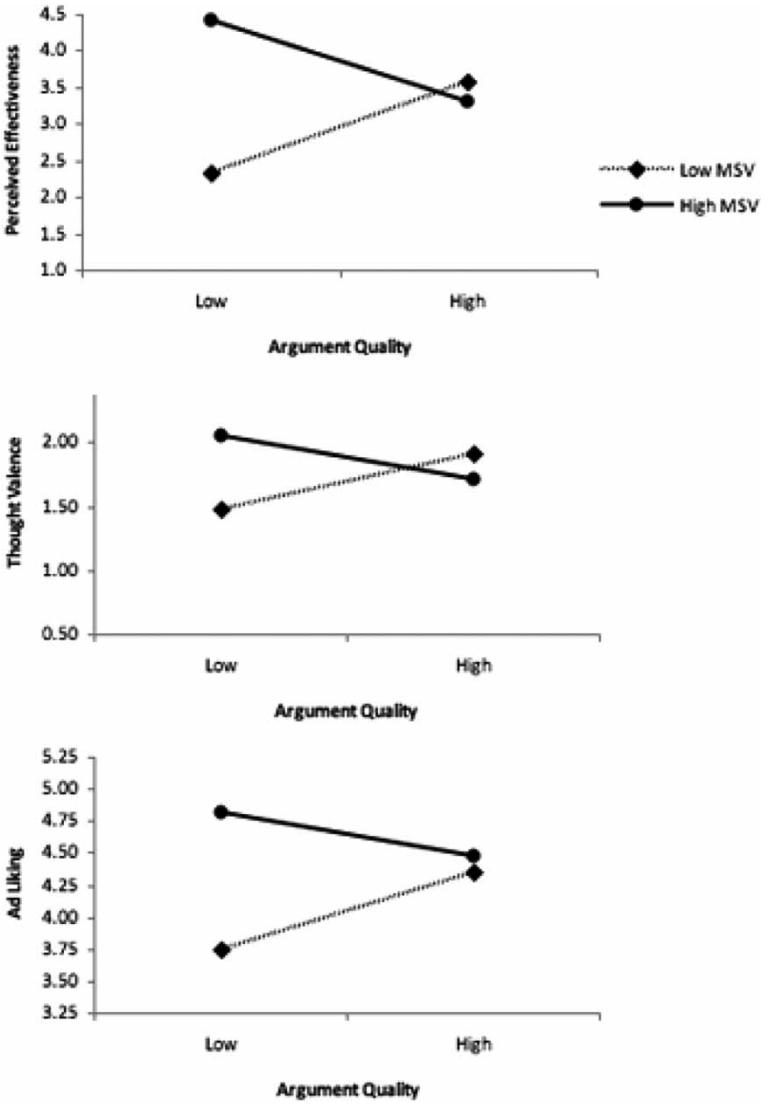

Figure A3 Means of ad effectiveness by message sensation value (MSV) and argument quality/strength (AS) for low-risk participants.