

## Original Investigation

# Smoking Cues, Argument Strength, and Perceived Effectiveness of Antismoking PSAs

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## Abstract

**Introduction:** The study examines the effectiveness of anti smoking public service announcements (PSAs) among adult smokers as a function of smoking cues and the argument strength of the PSAs. Consistent with the previous cue-reactivity studies, smoking cues are defined as one of the following visual scenes: (a) objects associated with smoking, (b) holding or handling cigarettes, and (c) actual smoking behaviors. Argument strength indicates smoker's judgments of perceived strength and persuasiveness of the arguments extracted from the PSAs.

**Methods:** Data were collected through a web-based experiment of a random sample of general population of smokers ( $n = 566$  adults aged 19 years or older). Each participant was shown 4 PSAs randomly selected from a set of 60. Data were analyzed using multilevel modeling to assess the effects of smoking cues and argument strength. Effectiveness measures include perceived persuasiveness, transportation, valenced thought, negative emotion, and smoking-related thoughts.

**Results:** Argument strength is a significant predictor of outcome variables. Although there were no significant main effects of smoking cues on any outcome variables, smoking cues were found to interact with argument strength such that the association between argument strength and outcome variables became weaker for PSAs in the smoking cue condition compared with those in the no-cue condition.

**Conclusions:** The interaction between smoking cues and argument strength suggests that smoking cues in antismoking PSAs undermine a significant part of what makes PSAs effective—their arguments against smoking. In designing antismoking messages, the inclusion of smoking cues should be weighed carefully.

## Introduction

Approximately 46 million adults were smokers in the United States in 2008. Cigarette smoking, causing about 30% of U.S.

cancer deaths each year, is considered the leading preventable cause of death. Tobacco control programs have been increased to reduce overall cigarette smoking (National Cancer Institute, 2009/2010). Mass-media campaigns, employing antismoking public service announcements (PSAs), are often a centerpiece of these tobacco control programs to influence awareness, knowledge, and beliefs in service of smoking-related intention and behavior change (Davis, Gilpin, Loken, Viswanath, & Wakefield, 2008).

These campaigns can be, but are not always, effective (Davis et al., 2008; Wakefield et al., 2008). Although increased exposure to antismoking PSAs has been shown to be helpful in reducing smoking prevalence, the quality of the messages can affect subsequent cessation (Durkin, Biener, & Wakefield, 2009). The majority of studies in the area have explored various types of content or format, which can contribute to message effectiveness (Beaudoin, 2002; Biener, Ji, Gilpin, & Albers, 2004; Terry-McElrath et al., 2005). The primary focus of this study is to investigate whether the presence of smoking cues undermines message effectiveness.

## Smoking Cues

A line of research has investigated how smoking cues could elicit smoking urges, which underlie addictive behavior in smokers and are one of the central reasons for relapse in former smokers (Killen & Fortmann, 1997; R. S. Niaura et al., 1988; Shiffman et al., 1997). The findings of previous laboratory studies showed that smoking cues increase smoking urges (Hutchison, Niaura, & Swift, 1999; Kang, Cappella, Strasser, & Lerman, 2009; R. S. Niaura et al., 1988), suggesting that smoking urges elicited by smoking cues are conditioned appetitive responses. Therefore, exposure to smoking cues lead to increased reports of cravings to smoke as well as showing changes in physiological responses, such as heart rate, blood pressure, and startle reflex (Hutchison et al., 1999; R. Niaura et al., 1998).

The current study examines smoking cues shown in anti smoking PSAs. Although antismoking PSAs use smoking cues to illustrate the negative consequences of cigarettes (Kang,

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Cappella, Strasser, et al., 2009), smoking cues are frequently used in such PSAs. Our review of 270 adult-targeted 30- to 60-s antismoking PSAs that covered cessation and treatment seeking showed that 44.4% of the PSAs in the sample contained smoking cues (Cappella, Bindman, Sanders-Jackson, Forquer, & Brechman, 2009).

When smokers were exposed to such PSAs, their responses were altered (Kang, Cappella, Strasser, et al., 2009). Self-reported smoking urges decreased after exposure to both strong and weak antismoking argument PSAs with no smoking cues. When PSAs had smoking cues, urges remained low after exposure to PSAs with strong arguments, but urge increased when PSAs' arguments were weak. Heart rate was also found to decrease during PSAs with smoking cues compared with those with no smoking cues, suggesting increased attention to the PSAs as a function of smoking cues.

Various cognitive reactions can occur when smoking cues elicit urges in smokers (Sayette, 2004; Zwaan, Stanfield, & Madden, 2000). Smokers who focus their attention on smoking cues could reduce their processing of other more pertinent aspects of the message (Field, Munafò, & Franken, 2009; Tiffany, 1990). Sayette, Schooler, and Reichle (2010) investigated the effects of smoking urges on smokers' mental lapses, showing that, during a reading task, smokers in the smoking-urge condition (longer abstinence from smoking) were more likely to report that their mind was wandering and less likely to catch themselves losing concentration compared with those in the low smoking-urge condition. This suggests that smoking urges increase smokers' vulnerability to distraction while simultaneously undermining their ability to notice being distracted.

Smoking cues in antismoking PSAs could undermine the PSA's effectiveness given that they can create smoking urge in committed smokers (Kang, Cappella, Strasser, et al., 2009). Based on the findings of Kang, Cappella, Strasser, et al. (2009), we ask whether smoking cues will undermine the perceived effectiveness of antismoking PSAs when they elicit smoking urges. In line with previous studies (Hutchison et al., 1999; Kang, Cappella, Strasser, et al., 2009; Tiffany, Carter, & Singleton, 2000; Waters et al., 2004), this study defines smoking cues as visual scenes related to smoking but investigates their effect in the context of antismoking PSAs.

## Perceived Message Effectiveness

Consistent with previous research in tobacco control, persuasion, and social psychology, this study employs multiple measures of perceived effectiveness, including persuasiveness, transportation, emotional reaction, valenced thought, and thoughts about smoking.

### Persuasiveness

Persuasiveness, a self-report measure, is certainly not the same as actual effectiveness. However, a robust line of research holds that it is a strong predictor of message's actual persuasive effects (Dillard, Weber, & Vail, 2007).

### Emotion and Transportation

Durkin et al. (2009), focusing on antismoking PSAs and adult smoking cessation, indicated two message factors to explain their effects on cessation—emotional intensity and narrative

form for communication. Our measure of emotion taps into the first of these components, and our measure of transportation, the degree of viewers' engagement with message content (Green & Brock, 2000), taps into the second.

### Valenced Thought

Two self-report items are employed to assess viewers' thoughts about smoking. A "favorable thoughts" item asks if the PSA puts thoughts about quitting smoking in the viewer's mind, while a second item asks if the PSA puts "unfavorable thoughts," that is, thoughts about wanting to continue smoking in their minds. Their combination with reversed unfavorable thoughts produces the typical measure of valenced thought in response to the message. The open-ended form of this measure, called thought listing (Cacioppo & Petty, 1981), is widely used in social psychology and persuasion. The closed-ended version has been validated against the open-ended version; it is more efficient to use and as predictive (Zhao et al., in press).

### Unfavorable Thoughts

The item of unfavorable thoughts is treated here as a surrogate measure of smoking urge. It is not the same as the standard 10-item urge measure (Cox, Tiffany, & Christen, 2001) but a weak substitute. Sayette and Hufford (1997) found that smokers during high-urge than low-urge condition generate significantly increased number of positive characteristics of smoking, but this was not significant for negative characteristics of smoking. This suggests that smoking urges influence smoking-related positive thoughts. Based on these results, we treat unfavorable thoughts as a proxy for smoking urge. While we recognize that our proxy is not as strong an indicator of smoking urge as standard measures, observing effects consistent with past work offers an acceptable test of smoking urge in response to smoking cues in antismoking PSAs.

## Hypotheses and Research Questions

### Smoking Cues

It has been suggested that smoking cues reduce the effectiveness of PSAs. Antimarijuana PSAs were rated less favorably by high-risk adolescents when marijuana cues were present in the PSAs than when they were not (Kang, Cappella, & Fishbein, 2009). Kang (2007) also found that messages' persuasiveness decreased from no-cue to cue PSAs but only for those with weak arguments. Thus, we ask whether the presence of smoking cues has main effects on the indicators of PSA effectiveness.

Despite considerable data indicating increased smoking urge in response to smoking cues, there has been only one study (Kang, Cappella, Strasser, et al., 2009) suggesting that smoking cues in antismoking PSAs increase smoking urges and then only for occurrences in weak antismoking arguments. Thus, we propose a research question to investigate the effect of smoking cues on unfavorable thoughts.

### Argument Strength

A line of research has identified argument strength as the most robust predictor of effective persuasion (Johnson, Maio, & Smith-McLallen, 2005; Park, Levine, Westerman, Orfgen, & Foregger, 2007; Petty & Cacioppo, 1986). Strong arguments elicit predominantly favorable thoughts about a message, whereas weak arguments tend to elicit predominantly unfavorable ones. We use the measure of argument strength developed

and validated by Zhao et al. (in press). Consistent with the literature, we hypothesize that as argument strength increases, favorable thoughts about cessation will increase and unfavorable thoughts will decrease. In addition, we hypothesize that PSAs with stronger arguments will be evaluated as higher on all outcome variables (Kang, Cappella, Strasser, et al., 2009).

### Argument Strength and Smoking Cues

Smoking cues in antismoking PSAs exist in a message context that is created to persuade smokers to avoid smoking. The context is intended to provide arguments and reasons against smoking by citing various threats and increasing confidence in cessation. The arguments and reasons are embedded in a format of visual and auditory features that can support or undermine the arguments. We expect that when PSAs have strong arguments, smoking cues could distract smokers from favorable thoughts and diminish the effectiveness of the PSAs (Kang, Cappella, & Fishbein, 2009). When the viewer's attention is diverted from the central argument of the message, the viewer is more likely to be influenced by peripheral features (Petty & Cacioppo, 1986). Thus, we hypothesize an interaction between smoking cues and argument strength on the effectiveness of the PSAs such that the effect of argument strength will be mitigated by smoking cues in the PSAs.

On the other hand, unfavorable thoughts should operate differently. The association between argument strength and unfavorable thoughts should be negative in the absence of smoking cues, whereas in the presence of smoking cues, it should be less negative. That is, smoking cues should alter the negative association between argument strength and unfavorable thoughts, making it less negative.

## Methods

### Participants and Study Design

Adult smokers ( $N = 566$ ) aged 19–66 years ( $M = 49.57$  years,  $SD = 11.01$ ) completed this study with a response rate of 49.7%. The data were collected online through Knowledge Networks, a survey research company, which has developed a nationally representative panel of adults in the United States. Eligible participants were those currently smoking cigarettes, had smoked more than 100 cigarettes in their lifetime, and a minimum of five daily cigarettes in the past week. Participants' individual characteristics, such as demographics, need for cognition, and sensation seeking, were assessed prior to exposure to the PSAs along with a series of other smoking-related variables, such as nicotine dependence, stage of change, and smoking history.

Each participant was presented with four antismoking PSAs randomly selected from a set of 60. Each PSA was viewed by 38 people on average (range: 24–50). After exposure to each PSA, the participant answered items about effectiveness. Outcome variables measured include (a) unfavorable thoughts, (b) favorable thoughts, (c) persuasiveness, (d) transportation, and (e) negative emotions (i.e., fear, guilt, and anger).

### Stimulus PSAs and Message Selection

Although these data were gathered for a purpose unrelated to the effects of smoking cues, of the 60 PSAs, 30 had smoking cues and 30 did not. The PSAs were selected from an archive of anti-

smoking PSAs targeting adults, focused on negative consequences of smoking, and the desirability of treatment seeking and quitting smoking and were in English.

## Independent Variables

### Smoking Cues

Smoking cues were defined as visual scenes related to smoking and coded into four categories: (a) smoking-related materials (i.e., cigarettes, ashtrays, matches, lighters, etc.); (b) holding and handling of cigarettes (without puffing and inhaling); (c) actual smoking behavior (puffing and inhaling of a cigarette); and (d) no smoking cue. Intercoder reliability for presence of smoking cues was virtually 100%, while for the scenes with smoking cues, it was .82 (Krippendorff's  $\alpha$ ; Cappella et al., 2009).

### Argument Strength

Arguments were evaluated in two steps. In Step 1, the textual arguments of the PSA were extracted by expert evaluators in an iterative process. First, two trained coders viewed the PSAs and transcribed the verbal and visual claims of each PSA. Next, two different coders viewed the PSAs while reviewing the messages generated in Round 1, editing the text to capture all the content of the PSA stated explicitly via voice and text on screen and implicitly through the visuals. This process generates arguments embedded in the messages but separates content from presentation format. In Step 2, the argument extracted from each PSA is assessed for perceived argument strength (Zhao et al., in press) by a nationally representative sample of smokers. Each argument was randomly assigned and evaluated by 38 smokers on average (range: 25–51). Those evaluating the arguments were different from the set of smokers evaluating the full video PSAs in which the arguments appear. Finally, perceived argument strength scores were created by averaging eight items developed by Zhao et al. (in press; Cronbach's  $\alpha = .94$ ).

### Outcome Measures

After viewing each PSA, participants completed the following measures: thoughts of continuing smoking, thoughts of quitting smoking, persuasiveness, transportation, and negative emotions. The measures are on 5-point scales (1 = *strongly disagree* to 5 = *strongly agree*). A single item was used to measure unfavorable thoughts about cessation ("The ad put thoughts in my mind about wanting to continue smoking") and favorable thoughts about cessation ("The ad put thoughts in my mind about quitting smoking"). Consistent with thought listing procedures, a measure of valenced thoughts was created by subtracting the score for unfavorable thoughts from the score for favorable thoughts (Petty & Cacioppo, 1986).

Persuasiveness was measured using two items: (a) "This ad was convincing" and (b) "Watching this ad helped me feel confident about how to best deal with smoking" (Cronbach's  $\alpha = .75$ ). For the transportation measure, three items chosen from *Transportation Scale items* (Green & Brock, 2000) were used: (a) "I could picture myself in the scene of the events shown in the ads," (b) "The ad affected me emotionally," and (c) "The events in the ad are relevant to my everyday life" (Cronbach's  $\alpha = .83$ ). Negative emotion was measured by means of fear, guilt, and anger individually while watching the PSA: "I felt afraid," "I felt guilty," and "I felt angry" scored from 0 (*not at all*) to 4 (*very much*).

## Covariates

### Individual Characteristics

Individual characteristics included age, education, gender, and the number of children in household and smoking history. Nicotine dependence was assessed through the Fagerström Test for Nicotine Dependence (FTND; [Heatherton, Kozlowski, Frecker, & Fagerström, 1991](#)). The FTND is a self-report measure of nicotine dependence (range: 0–10) assessed using six items. It has satisfactory internal consistency and high test-retest reliability ([Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994](#)).

The participants' readiness to quit smoking was measured using the contemplation ladder ([Biener & Abrams, 1991](#)), which has been used in previous studies to predict smoking cessation and stages of the process linked to quitting interventions. The 11-point ladder is anchored at 0 (*I have no thoughts about quitting smoking*) to 10 (*I am taking action to quit smoking*). Need for cognition is the tendency to "engage in and enjoy thinking" ([Cacioppo & Petty, 1982](#), p. 116) and was measured with four-item short form of need for cognition scale ([Cacioppo, Petty, & Kao, 1984](#)) using 5-point scales (1 = *a lot like me* to 5 = *not at all like me*). Responses to all items were reverse coded and summed (Cronbach's  $\alpha = .53$ ). Sensation seeking ([Zuckerman, 1990](#)) was measured with four items accompanied by 5-point scales (1 = *strongly agree* to 5 = *strongly disagree*). Response to all items was summed (Cronbach's  $\alpha = .70$ ).

### PSA Characteristics

Smoking cues could covary with a variety of executional features of PSAs (i.e., how the content is presented visually and verbally). To reduce the likelihood that these executional features could confound any observed associations between smoking cues and effectiveness, we included such characteristics as covariates at the PSA level. PSA characteristics included individual items of message sensation value (MSV) and structural features (information introduced— $I^2$ ). MSV measures the formal and content audiovisual features based on their ability to elicit sensory, affective, and arousal responses ([Palmgreen et al., 1991](#)). It includes 14 features, such as cuts, edits, special visual effects, unexpected formats, sound saturation, music, narrative form, acted out, or talking head, etc. Two trained coders viewed 199 PSAs and rated each for MSV features using explicit rules based on work by [Morgan, Palmgreen, Stephenson, Hoyle, and Lorch \(2003\)](#) but modified slightly (Kendall's  $\tau = .90$ ). Coding  $I^2$  was done based on work by [Lang, Bradley, Park, Shin, and Chung \(2006\)](#) and [Lang, Park, Sanders-Jackson, Wilson, and Wang \(2007\)](#).  $I^2$  measures how much cognitive attention is automatically allocated and required to process a message as a function of the message's structural changes in audio and video channels. Video  $I^2$  coding involves identifying eight characteristics, such as camera change, emotional change, object change, perspective change, relatedness between scenes, etc. (Krippendorff's  $\alpha = .94$ ). Audio  $I^2$  coding includes five characteristics, such as emotion, new object, emotion change, form change, and unrelatedness (Kendall's  $\tau = .76$ ). These executional features serve as covariates only and are not otherwise of interest in this study.

### Analyses

The research questions and hypotheses were tested with multi-level modeling using the xtmixed procedure in STATA 11. In

the study, each PSA is viewed by multiple participants, and individual participants evaluated four PSAs randomly selected. Thus, there are clustered observations within PSAs and within individual participants. Outcome variables are a function of both person-level and PSA-level characteristics. A Hierarchical Cross-classified Model (HCM; [Raudenbush & Bryk, 2002](#)) was employed because HCM can estimate effects of two sets of predictors on each outcome variable, here, individual participants' characteristics and PSAs' structural and content features.

## Results

### Sample Characteristics

The sample consisted of 256 males (45.2%) and 301 females (54.8%), with 19.3% having a bachelor's degree or higher, 36.9% having some college, 38.3% completing high school, and 5.5% having less than a high school education. Approximately 80% of the participants were White, 8.1% Black, 5.1% Hispanic, 5.1% mixed, and 1.7% marked "other."

The overarching research question was if the presence of smoking cues (a) undermines the effectiveness of antismoking PSAs and (b) moderates the association between argument strength and outcome variables. Table 1 shows the results of HCM estimating the effects of smoking cues, argument strength, and their interaction on outcome variables under a variety of individual- and PSA-level controls.

### Smoking Cues

The main effects of smoking cues were not significant for any outcome variables. None of the measures of perceived effectiveness were affected by PSAs having smoking cues nor was the variable of unfavorable thoughts associated with smoking cues.

### Argument Strength

As predicted, argument strength was a significant predictor of favorable thoughts ( $\beta = .147, p < .01$ ), indicating that increased argument strength elicited greater thoughts of quitting smoking. Similarly, argument strength was a significant associate of persuasiveness ( $\beta = .208, p < .001$ ), transportation ( $\beta = .184, p < .01$ ), valenced thought ( $\beta = .089, p < .01$ ), and fear ( $\beta = .138, p < .05$ ). Each outcome increased as argument strength increased. No relationship was observed between argument strength and unfavorable thoughts.

### Smoking Cues and Argument Strength Interaction

The presence of smoking cues reduces the association between argument strength and the outcome variables, persuasiveness ( $\beta = -.151, p < .05$ ), transportation ( $\beta = -.172, p < .05$ ), and valenced thoughts ( $\beta = -.113, p < .01$ ) moderating the effect of argument strength on these outcomes. The results of favorable thoughts ( $\beta = -.136, p = 0.052$ ), although not quite significant, show a similar pattern. When smoking cues are absent, the association between argument strength and the outcome is stronger; when the smoking cue is present, the association is weaker.

The moderating effect of cues on argument strength is especially interesting for unfavorable thoughts about cessation. As

**Table 1. Effectiveness of PSAs as a Function of Presence of Smoking Cues and Argument Strength Controlling Individual Characteristics and PSA Characteristics**

	Favorable thoughts	Unfavorable thoughts	Perceived effectiveness	Transportation	Valenced thought	Afraid	Guilty	Angry
Smoking cue	0.046 (0.080)	0.020 (0.049)	0.083 (0.084)	0.043 (0.101)	0.01 (0.046)	0.044 (0.102)	0.075 (0.11)	0.145 (0.099)
Argument strength	0.147** (0.051)	-0.03 (0.033)	0.208*** (0.054)	0.184** (0.064)	0.089** (0.03)	0.138* (0.066)	0.127 (0.07)	-0.019 (0.063)
Interaction (cue, argument)	-0.136 (0.070)	0.090* (0.045)	-0.151* (0.074)	-0.172* (0.087)	-0.113** (0.041)	-0.019 (0.089)	-0.180 (0.096)	0.076 (0.087)
Education level	-0.029 (0.025)	0.011 (0.021)	-0.059** (0.020)	0.004 (0.020)	-0.021 (0.016)	-0.006 (0.023)	0.024 (0.025)	0.028 (0.023)
Gender	0.065 (0.083)	-0.070 (0.072)	0.135* (0.068)	0.218*** (0.066)	0.065 (0.056)	0.258*** (0.078)	0.246** (0.085)	0.146 (0.077)
Need for cognition	-0.179*** (0.051)	-0.144*** (0.044)	-0.143*** (0.042)	-0.101* (0.041)	-0.0187 (0.034)	-0.169*** (0.048)	-0.191*** (0.053)	-0.028 (0.047)
Sensation seeking	0.086 (0.053)	0.107* (0.045)	0.103** (0.043)	0.098* (0.042)	-0.008 (0.035)	0.091 (0.049)	0.048 (0.054)	0.002 (0.048)
FTND	0.001 (0.016)	-0.012 (0.014)	-0.006 (0.013)	0.028* (0.013)	0.006* (0.011)	0.026 (0.015)	0.040* (0.016)	0.044** (0.015)
Stage of change	0.128*** (0.013)	-0.033** (0.012)	0.061*** (0.011)	0.073*** (0.011)	0.080*** (0.009)	0.062*** (0.012)	0.079*** (0.014)	0.046*** (0.012)
Special visual effect	-0.162 (0.093)	0.055 (0.059)	-0.085 (0.097)	-0.208 (0.115)	-0.107* (0.054)	-0.188 (0.118)	-0.127 (0.126)	0.085 (0.114)
Music_1	-0.306* (0.142)	0.104 (0.091)	-0.067 (0.149)	-0.178 (0.177)	-0.205* (0.083)	-0.088 (0.181)	-0.302 (0.193)	0.068 (0.175)
Music_2	-0.230** (0.082)	0.063 (0.052)	-0.137 (0.086)	-0.220* (0.102)	-0.154** (0.048)	-0.107 (0.104)	-0.189 (0.112)	0.053 (0.101)
Sound effects	-0.086 (0.093)	0.105 (0.059)	-0.066 (0.097)	-0.032 (0.116)	-0.098 (0.054)	-0.130 (0.118)	-0.038 (0.127)	-0.247* (0.115)
Act out vs. talking head	-0.314** (0.091)	-0.063 (0.058)	-0.226* (0.095)	-0.292** (0.113)	-0.126* (0.053)	-0.247* (0.115)	-0.350** (0.123)	0.078 (0.112)
Unexpected format	-0.205 (0.114)	0.094 (0.073)	-0.253* (0.119)	-0.367** (0.142)	-0.148* (0.066)	-0.053 (0.145)	-0.168 (0.155)	0.049 (0.140)
Camera change	0.026 (0.019)	-0.024* (0.012)	0.017 (0.020)	0.028 (0.024)	0.024* (0.011)	-0.022 (0.024)	0.002 (0.026)	-0.021 (0.024)
Object change	-0.066** (0.022)	0.008 (0.014)	-0.046* (0.023)	-0.041 (0.027)	-0.036** (0.013)	-0.024 (0.028)	-0.034 (0.03)	0.009 (0.027)
Visual distance	0.054* (0.025)	0.008 (0.016)	0.006 (0.026)	0.015 (0.031)	0.022 (0.014)	0.044 (0.031)	0.031 (0.034)	0.004 (0.030)
New object	0.031* (0.015)	0.005 (0.010)	0.022 (0.016)	0.022 (0.019)	0.014 (0.009)	0.033 (0.019)	0.026 (0.021)	0.011 (0.019)
Intercept	3.351*** (0.468)	2.532*** (0.397)	3.365*** (0.392)	2.486*** (0.395)	3.434*** (0.310)	2.500*** (0.4514)	2.572*** (0.494)	1.661*** (0.446)
Random components								
Level 2 (PSA)	0.021	0.000	0.029	0.046	0.005	0.046	0.054	0.040
Level 2 (person)	0.599	0.434	0.378	0.347	0.271	0.507	0.627	0.473
Level-1	0.562	0.479	0.444	0.465	0.240	0.561	0.586	0.617
N (total observations)	2,210	2,206	2,202	2,193	2,200	2,208	2,208	2,206
N (PSA)	60	60	60	60	60	60	60	60
N (individual)	554	554	554	553	554	554	554	554

Note. SEs in parentheses and \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . The table excludes the covariates, which do not have significant  $\beta$  for any of outcome variables. The list includes age, number of kids in household, slow motion, unusual color, disturbing explicit, sound saturation, surprise, emotional visual, relatedness between visual scenes, perspective change in visual scene, form change in visual scene, orienting eliciting sound feature, newness in audio, form change in audio, emotion change in audio, and presence of emotional audio feature. PSA = public service announcement

Table 1 shows, the association between argument strength and unfavorable thoughts is a nonsignificant,  $\beta = -.03$ . The reason that argument strength has a null association across 60 PSAs is revealed in the significant positive interaction effect ( $\beta = .09$ ,  $p < .05$ ). Figure 1a shows that the association between argument strength and unfavorable thoughts is crossed. When smoking cues are absent, the stronger the argument is, the less the unfavorable thoughts are elicited. When smoking cues are present, the association between them is positive. That is, smoking cues undermine the strength of antismoking arguments, rendering them likely to enhance thoughts about wanting to continue smoking rather than their more typical function of undermining the thoughts.

## Discussion

Overall, the results of the study were in line with the notion that smoking cues weaken the association between argument strength and effectiveness of the PSAs. Specifically, stronger antismoking arguments should yield PSAs perceived to be more effective and they do in this study, but presence of smoking cues weakened this association.

Smoking-related visual scenes in antismoking PSAs are often deployed to improve message relevance to smokers because messages highly relevant to target audiences draw more attention and are more persuasive (Petty & Cacioppo, 1979; Roser, 1990). As well, due to automatic processing nature of visuals, smoking cues become important message features for such

PSAs to efficiently deliver the main arguments. Also, the smoking cues themselves are sometimes a part of the core argument being made in the PSAs and not merely “window dressing.” In such cases, such cues might function as an important complement to the overall argument. We are testing these ideas in ongoing studies. In the meantime, for persuasive messages to be effective, arguments employed in PSAs need to produce favorable and minimize unfavorable thoughts about cessation. The present investigation reveals that smoking cues can generate—at least in some circumstances—unfavorable effects on anti smoking PSAs by reducing the impact of strong arguments.

Our analyses show that PSAs with stronger antismoking arguments are seen as more effective irrespective of the presence of smoking cues. However, the associations between argument strength and outcome variables—valenced thought, persuasiveness, and transportation—were mitigated by smoking cues. Interestingly smoking cues alter smoker participants’ unfavorable thoughts—wanting to continue smoking. When there is no cue in the PSAs, a negative association appears between argument strength and unfavorable thoughts. The stronger the argument becomes, the less likely the viewers are to say they have thoughts about wanting to continue smoking. However, when cues are present in the PSAs, the association between argument strength and unfavorable thoughts is flat to slightly positive, undermining the general effect of argument strength against smoking.

Our study did not have a standard measure of smoking urge, only a measure of unfavorable thoughts about cessation. As well, smoking cues were shown to alter the pattern rather

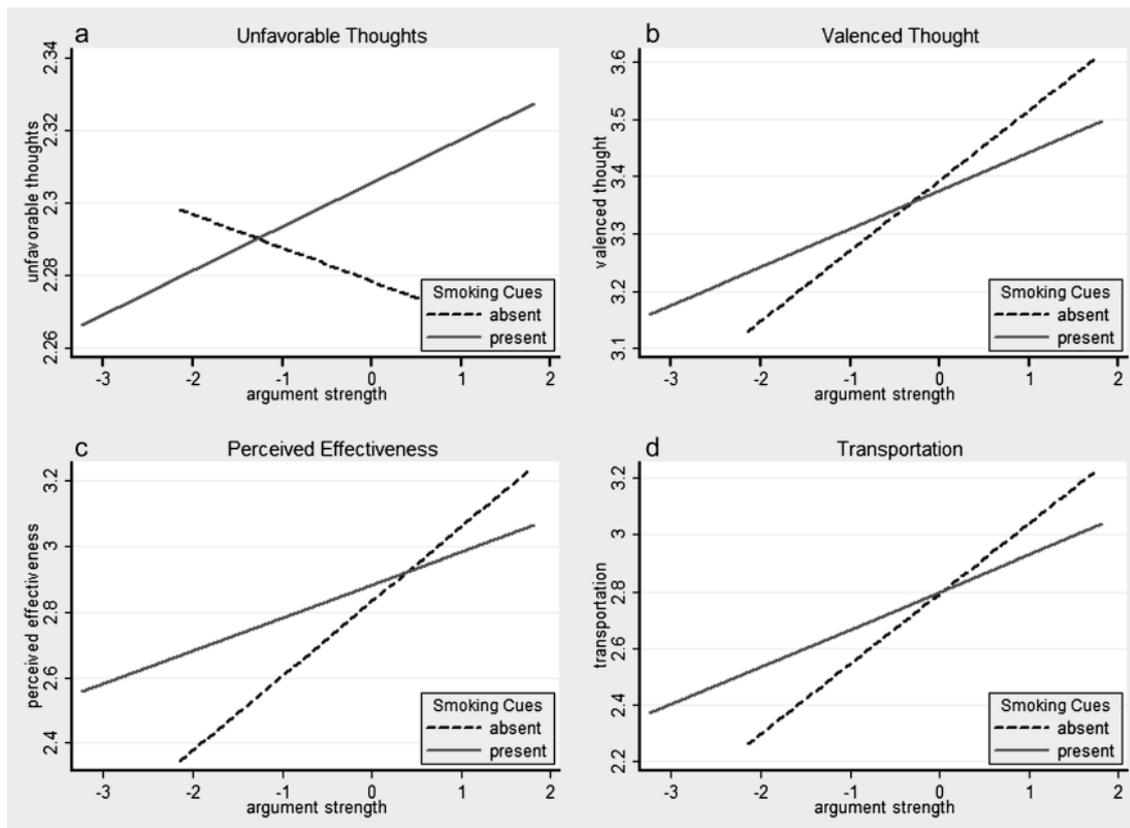


Figure 1. Interactions between smoking cues and argument strength.

than create significant increase in unfavorable thoughts. Nonetheless, our finding is unexpected and alarming because smoking cues activate unfavorable thoughts, functioning as potential distracters and inviting smokers to think about their smoking desires, although they are presented in the context of antismoking content. Using a standard measure of smoking urge, Kang et al. (2009) also showed that smoking urge increased from baseline when smoking cues appeared in such PSAs with weak arguments.

The goal of antismoking PSAs is to reduce cigarette smoking, and smoking cues are commonly used to help PSAs to be more engaging and persuasive to the target audience. From a practical perspective, our data suggest that the addition of smoking cues may not always be effective in advancing the PSA's intent. These results imply that inclusion of smoking cues should be carefully considered in designing antismoking PSAs in concert with PSAs' level of argument strength.

Despite the consistent set of findings observed over a large set of antismoking PSAs, the current study has some limitations. First, our measures of effectiveness are not measures of behavior, intention, or belief change (but see Dillard et al., 2007). Nevertheless, messages that are emotional, transporting, and create thoughts of quitting have been shown to be linked to increased smoking cessation (Durkin et al., 2009). Second, our study is observational, allowing the factors in PSAs to vary freely, although with random assignment to persons. To minimize potential confounds, we control a wide array of individual and message characteristics and employ a large number of messages avoiding the problem of a single (or small set) of PSAs that could be unique.

Evidence about the role of smoking cues in antismoking PSAs is growing. The present study indicates that the effectiveness of PSAs is mitigated by the presence of smoking cues across a large number of PSAs and for a large number of person and message characteristic controls. Future research needs to test these effects in an experimental context and to test behavioral outcomes beyond self-reported urges and perceived effectiveness.

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## Declaration of Interests

None declared.

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