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VISUALIZING, THINKING, AND FEELING THROUGH INTERACTIVITY: EFFECTS OF INTERACTIVITY ON USER ENGAGEMENT, ATTITUDES, AND BELIEFS TOWARD ANTI-SMOKING MESSAGES

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Abstract

This study attempts to reveal theoretical mechanisms by which interactivity features on an anti-smoking website influence individuals' attitudes and beliefs toward anti-smoking messages on the site. Interactivity is operationalized as modality interactivity (i.e., the degree to which users control the medium) and message interactivity (i.e., the degree to which the messages from the medium are contingent upon users' input). Three types of user engagement - imagery engagement (the ease with which participants can picture the effects of smoking in their mind), cognitive engagement (the degree to which participants engage in message elaboration), and emotional engagement (the degree of fear and arousal that participants feel while browsing the site) - are suggested as key mechanisms by which interactivity influences persuasion.

A 3 (Message interactivity: High vs. Medium vs. Low) X 2 (Modality Interactivity: Slider vs. Control) fully factorial lab experiment was performed to test the persuasive effects of interactivity on the stimulus website (N = 167). Results showed that modality interactivity led to more positive interface assessment and greater cognitive absorption. These two outcomes, in turn, contributed to more favorable attitudes toward the website and even toward the anti-smoking messages. Modality interactivity also enhanced the feeling of presence and imagery engagement, which in turn, resulted in more favorable attitudes toward the anti-smoking messages and a perception of smoking as a less attractive behavior. As for emotional engagement, modality interactivity caused greater fear appeal, especially when there was no message interactivity on the website. The presence of modality interactivity tended to reduce the amount of message-related thoughts after browsing. In contrast, message interactivity enhanced message elaboration for participants, especially those with low involvement in the message topic. Theoretical and practical implications of these findings are discussed.

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INTRODUCTION

Interactivity is perhaps the most distinguishable feature of modern media technology. Interactive features allow users to take a number of actions instead of passively receiving information from a medium. Users can swipe, zoom, and mouse over content on an interactive website, and click through several layers of hyperlinks to open hidden content. As the term itself implies, interactivity rests on the notion of active users who can control media content and interface. To media effects researchers, interactivity requires a completely new angle to study the interaction between users and media – the perspective that accounts for users' input and capability to change both the content and the form of mediated messages.

Persuasion and health communication literature has been focusing on message features such as argument quality (e.g. Petty & Cacioppo, 1984) and message sensation value (e.g. Palmgreen, Donohew, Lorch, Rogus, Helm, & Grant, 1991) that can change users' attitudes and behaviors. On the other side, structural features such as scene changes on TV (Lang, 2000) and usability and aesthetics of webpage (Fogg, Marshall, Laraki, Osipovich, Varma, Fang et al., 2001; Sutcliffe, 2002), and even the type of medium (i.e. Web, television, radio, print, etc.) (Lang, 2006) also have been discussed as an important factor to change attitudes toward message. With the arrival of digital media, however, there is a growing realization that the interactivity afforded by the medium can also have a persuasive appeal (Sundar, 2008). Going beyond the given, fixed format of messages delivered by media, digital media users are actively involved in accessing information in a variety of ways--by swiping and zooming images, and making decisions about which parts of the message to read by clicking different hyperlinks and buttons. If the user is navigating their way through various paths of a website, the way they interact with the content

could change the way they are influenced by the messages delivered by the website. In the context of health communication, the same message may be more or less effective in changing health-related outcomes depending on the interactivity of the medium via which the message is delivered.

Given that interactivity calls for heightened user activity, it is generally assumed that interactivity can create higher involvement in interacting with media (Sundar & Kim, 2005). However, it is debatable whether this heightened degree of user activity can hold true for engagement with content, and further, whether it can influence individuals' attitudes and beliefs toward the content. Several theoretical approaches have been suggested for examining the ways in which interactivity engages users and creates psychological effects for individuals, including a curvilinear model of interactivity (Bucy, 2004), the mediated moderation model of interactivity (Bucy & Tao, 2007), a dual-process model of interactivity effects (Liu & Shrum, 2009), and the model of interactivity effects on user engagement (Sundar, 2007). As Rafaeli (1998) suggested in his seminal work on interactivity, it is important to clearly define the concept of interactivity and theorize the effects of interactivity independently from the ever-changing examples of interactivity, given that newer interfaces are continuously developed and introduced.

One of the most basic definitions of interactivity refers to almost any function that can enable two-way communication between the user and system (e,g., Bucy, 2004; Liu & Shrum, 2009). The next question is whether all the different interactive features uniformly influence psychology of users, or differentially affect the outcome depending on their own characteristics. Given the vast variety of operationalizations and conceptualizations of interactivity, it is difficult to draw any firm conclusions that can summarize previous results. When technology changes rapidly according to the demand of users, it is harder to find a firm theoretical ground where the

term interactivity can be defined consistently throughout the diverse applications. Given this, the concept of interactivity needs to be rigorously defined before discussing its persuasive effects.

The outcomes of interactivity include various aspects of user engagement. Users can emotionally engage with the message as a result of interacting with the interface, or they can also cognitively engage with processing and learning from the messages that are delivered by the interface. Another unique type of user engagement that can be created by interactivity is a vivid visualization of objects or phenomena in users' mind. For instance, panning a virtual camera on a shopping site provides a realistic experience of observing the actual object. Thus, a comprehensive model for theorizing persuasive effects of interactivity needs to incorporate these various dimensions of user engagement.

Persuasive message designers have suggested various message features that can induce persuasive outcomes, such as fear appeal, argument quality, and message vividness. However, such message features have often been conceptualized in terms of the effect of message variations, rather than in terms of intrinsic message properties (O'Keefe, 2003). In other words, it is still unclear what kind of features we have to employ in order to induce fear appeal or vivid imagery in users' mind. For designing persuasive messages, it is critical to find a medium or message feature that can be defined independently from its expected effects (Sundar, Oh, Kang, & Sreenivasan, 2013). If interactivity as a technological attribute is shown to have persuasive appeal by inducing further user engagement, it will provide a useful set of rules of thumb for health campaigns and interface designers.

This dissertation examines the persuasive appeal of interactivity on an anti-smoking website. It proposes a theoretical model including two types of website interactivity and three types of engagement. Two forms of interactivity (modality interactivity and message

interactivity), both theoretically and practically meaningful in a persuasion context, will be examined. Imagery engagement, cognitive engagement, and emotional engagement will be proposed and examined in order to explain the persuasive effects of interactivity on individuals' attitudes and beliefs toward anti-smoking messages.

LITERATURE REVIEW

Interactivity as Medium and Message Features

Interactivity has been defined as a construct having several elements within it – two-way communication (Liu & Shrum, 2002), multi-media (Ahren, Stromer-Galley, and Neuman, 2000), personalization (Wu, 2006), user control (Coyle & Thorson, 2001; McMillan & Hwang, 2002; Steuer, 1992), responsiveness (Rafaeli, 1988), reciprocal communication (Ha & James, 1998) and synchronicity (Liu &Shrum, 2002). Previous definitions often do not distinguish the concept of interactivity itself from its possible effects such as reciprocal communication, multi-media output, and user control. However, when designing persuasive interfaces or persuasive messages, this outcome-based definition cannot answer the question about how to design interactive websites in order to create persuasive outcomes. Thus, this dissertation first defines interactivity as a technological feature of media, not the outcome produced by using the feature.

Another approach to defining interactivity is to consider interactivity as any type of action possibilities provided by the system (Jensen, 1998; Liu & Shrum, 2009; Lombard & Snyder-Dutch, 2001). However, simply equating interactivity with action possibilities stops short of defining the *object* of user actions. The object of user actions could include source of information, a medium involved in the interaction, or a message that is delivered by the medium. For instance, users can become the source of information by generating contents through social

media. Users can control a medium or an interface by swiping, zooming, and dragging product pictures on a shopping website. They can also control the message involved in the human-website interaction by clicking through layers of hyperlinks. Thus, what precisely the user can control during the communication process is an important defining feature.

Three forms of interactivity explicated by Sundar (2007) suggest three forms of interactivity that can be central to delivering persuasion messages. Based on three basic factors in a communication process (i.e. medium, source, and message), interactivity can exist as a medium feature, source feature, and message feature. *Modality interactivity* (or *Medium-based interactivity*) refers to the variety of tools or modalities available on the interface for accessing and interacting with information. Traditionally, different modalities have referred to text, graphics, audio, and video. Modern multimedia interfaces offer users greater capacity for interaction. For instance, with more developed interfaces, modalities include examples such as sliders, drags, mouse-overs and zoom features available on websites. Thus, the more modalities offered by the website, the greater its interactivity. Using the mouse to spin a virtual camera and to zoom in the details of it would be considered as having more capacity for interacting with the medium or the interface, thus as being higher in interactivity, compared to merely scrolling a webpage with corresponding static pictures, as if in a magazine.

Different from modality interactivity, some forms of interactivity can go beyond being bells and whistles on the interface. *Message interactivity* refers to the degree to which the system affords users to construct an idiosyncratic message thread by reciprocally communicating with the system. In order to do this, the system has to be capable of accounting for previous messages from users as well as those preceding them and thus contingently responding users' input. For

instance, hyperlinks embedded on a website consist of interlinked messages that reflect the user's previous inputs as well as those preceding them.

Indeed, different modality interactivity features and message interactivity features have been widely used for designing health campaign websites. For instance, anti-smoking websites provide layers of hyperlinks where users can click through to see the list of common triggers of smoking. They also embed different modes of interaction such as a video clip about how to quit smoking, a smoking cost calculator, or a slideshow with images and texts about smoking outcomes. While previous persuasion literature has mostly focused on message features to design a successful intervention (e.g. Everett & Palmgreen, 1995; Kang, Cappella, & Fishbein, 2006), interactive tools for persuading people have been only recently highlighted by researchers. Thus, formally testing the persuasive appeal of modality and message interactivity features would reveal both theoretical implications for the role of technology in persuasion and practical implications for designing more effective online interventions for health campaigns.

Interactivity and User Engagement

The traditional approach to investigating interactivity effects on the level of engagement is based on dual-processing theories such as ELM (Petty & Cacioppo, 1986). For high-involvement individuals, interactivity has been found to enhance user engagement with content by demanding user action, resulting in systematic processing of content (Liu and Shrum, 2009). On the other hand, for low-involvement individuals, interactivity is said to induce heuristic processing. For instance, the mere presence of interactivity can serve as a positive peripheral cue such that users with low involvement positively evaluate the credibility of website without further elaboration (Sundar, 2008).

However, individuals' psychological states influenced by interactivity can be varied beyond taking one of the two processing routes (i.e. central and heuristic). In fact, the concept of user engagement has tried to incorporate various dimensions of user experience with media beyond the dual routes of cognitive processing. User engagement, as a broader concept, refers to a psychological state where users are either cognitively or emotionally involved in a task at hand (e.g. Busselle & Bilandzic, 2008; Chapman, Selvarajah & Webster, 1999; Jacques, Preece & Carey, 1995; Strange & Leung, 1999). As Green and Brock (2002) pointed out, the state where users feel engaged with media content does not necessarily mean that they take the central route of cognitive processing about the content.

Also, the theoretical connection between interactivity and user engagement is still unanswered. Some scholars argue that interactivity leads to shallow processing and superficial interactions with media content (e.g. Carr, 2010), whereas others claim that interactivity richly operationalizes the ideal of "active audience" that was not quite realized with traditional mass media (e.g. Sundar, 2007). The interactivity effects model proposed by Sundar (2007) points out that three forms of interactivity (i.e. modality interactivity, source interactivity, and message interactivity) affect individual's cognition, attitudes, and behavior by first influencing user engagement via different mechanisms. When interactivity affords a variety of ways accessing content (i.e. modality interactivity), it can enhance our ability to mentally map the content by expanding our "perceptual bandwidth" and thereby lead to greater user engagement with content, with consequences for users' attitudes toward the interface and content in general. Message interactivity can imbue the sense of back and forth and interconnected interaction, i.e., perceived contingency. This user perception can heighten user engagement with the content, which then leads to other cognitive, attitudinal and behavioral outcomes.

To further elaborate the theoretical connection between interactivity and user engagement, this paper notices two limitations in previous research: first, interactive features have been operationalized as a peripheral feature, rather than playing a central role in delivering messages. Examples of interactive features used in advertising studies are often limited to communication or navigational tools, such as online-contact form, site search tool, online bulletin board, or an interface feature for adjusting information flow (e.g. Lynch & Ariely, 2000; Liu & Shrum, 2009), which are not central to delivering the central persuasion messages related to the product. In order to be a central feature to deliver a persuasive message, interactive features should significantly change the way users access the core message that the website aims to deliver, rather than merely add optional features to the site that can potentially increase the navigational burden.

Second, the concept of user engagement has been narrowly defined which inhibits scholars from constructing more comprehensive model of interactivity effects. Adopting the frame of dual-process models, most studies have focused on elaboration – the degree to which interactivity enables users to systematically process the message (e.g. Sundar & Kim, 2005; Liu & Shrum, 2009; Sicilia, Ruiz, and Munuera, 2005). However, other aspects of user engagement could also be influenced by interactivity. For instance, panning and zooming tools in online shopping websites, with their ability to let users intuitively interact with the product, may lead to more cognitive absorption in the browsing task. This heightened engagement is conceptually different from message elaboration. If elaboration is a process making connections between the product information and what the user has heard about elsewhere, the absorbing experience of interacting with a virtual product is a process where all of the users' cognitive ability is focused on processing the incoming information from the website. With this in mind, this dissertation

proposes two different types of cognitive engagement as mediators for the persuasive effects of message interactivity, as discussed in the following sections.

Explication of User Engagement

User engagement in traditional media has often been defined as a state where users are cognitively and affectively focused on the unfolding of the storyline or narrative. With TV content, viewers are said to be "hooked" on the program emotionally and watch the whole program with focused attention (e.g. Cunningham, Hall, & Young, 2006). Engagement with narrative in general has been defined as a story's success in "directing a reader's thought toward the story and its themes" (Strange & Leung, 1999, p. 437). Narrative engagement is often called as "transportation", which means a construction of mental models where all mental systems and capacities become focused on events occurring in the narrative (e.g. Busselle & Bilandzic, 2008; Green & Brock, 2000). Studies in narrative persuasion have indicated that engagement, absorption, and transportation are describing the same phenomenon in that each concept is the degree to which a message recipient is cognitively and affectively engaged with the vicarious experience of narratives (Slater & Rouner, 2002).

In the context of human-computer interaction, engagement has been defined as user's intrinsically motivated attraction to a multimedia system (Chapman, Selvarajah & Webster, 1999; Jacques, Preece & Carey, 1995, Webster & Ho, 1997). Jacque et al. (1995) mention that users are "engaged" with educational multimedia when it holds their attention and they are attracted to it from their own desire. These authors argue that multimedia design should be attractive enough to engage users, but should not be distracting for final learning outcomes to occur (Jacques, Preece & Carey, 1995). User engagement has also been defined as "a state of playfulness which includes attention focus, curiosity, and intrinsic interest" with the presentation

of multimedia features (Webster & Ho, 1997, p. 65). O' Brien and Toms (2008) suggested similar attributes of user engagement, including aesthetic and sensory appeal, attention, interest, awareness and positive affect. In sum, user engagement indicates a psychological state of being attended or attracted, usually from intrinsic curiosity toward media content or system.

User engagement can be also defined as cognitive efforts or application of rational strategy. In education research literature, cognitive engagement refers to be the level of self-regulatory activity and use of meaningful study strategies to process class material (e.g. Greene & Miller, 1996; Meece, Blumenfeld, & Hoyle, 1988), or to incorporation of new knowledge with pre-existing knowledge while completing learning tasks (Stoney & Oliver, 1999). In this conceptualization, engaged users are proactively setting a strategy to access the content and to thoughtfully process it. Likewise, Douglas and Hargadon (2000) define engagement with hypertext fiction as readers' attempts to discover congruencies between the hypertext and their pre-existing schemas based on the ability to make sense of the work as a whole. Thus, user engagement does not only refer to the state where users are emotionally engrossed by media, but also the rational state of investing mental effort to process incoming information, which can be similar with the concept of elaboration or systematic processing of media messages.

Other conceptually similar terms, such as *user involvement* (i.e. emotionally and cognitively engaged way of enjoying media content) (Vorderer, 1992, as cited in Klimmt & Vorderer, 2003), *transportation* (i.e., the degree to which a message recipient is cognitively and affectively engaged with the vicarious experience of narratives) (Slater & Rouner, 2002), *absorption* (i.e., the degree to which people experience temporal dissociation, focused immersion, heightened enjoyment, curiosity, and control over the computer interaction) (Agarwal & Karahanna, 2000), and *immersion* (i.e., the degree to which people experience lack

of awareness of time, loss of awareness of the real world, involvement and a sense of being in the task environment) (Jennett, Cox, Cairns, Dhoparee, Tijs & Walton, 2006), have been used to refer to the same phenomenon. Across these different usage of terms, the common factors in those definitions is the degree to which users become cognitively and affectively focused on the interaction with media. In summary, *cognitive engagement* and *emotional engagement* have been used as key features to describe the intensity of user experience with media.

Another important facet of user engagement is *imagery engagement*. In cognitive psychology, visually imagined things are said to be powerful enough to govern people's actual behaviors compared to the things from purely logical reasoning (Shepard, 1978). When it comes to media effects, visual imagery constructed in users' mind as a result of reading a narrative has been an indicator to show the degree to which users are engaged in the story (Green & Brock, 2000). However, visual imagery does not function only in the context of textual media. New media interfaces, with their broadened informational bandwidth, are capable of delivering more vivid, realistic images of objects to users. In this sense, imagery engagement induced by interactive media needs to be considered as an important facet of user engagement.

Oh, Bellur, and Sundar (2010) explicated the concept of user engagement as a construct that has four dimensions: physical interaction with interface, cognitive experiences, absorption, and outreach through social network. Physical interaction with interface and outreach through social network represent behavioral dimensions of user engagement whereas cognitive experience and absorption refer to psychological dimensions of user engagement. In this framework, definitions from previous research related to cognitive involvement in a mediated experience can be equated with the stage called *absorption*, where the individual is consciously involved in an interaction, and more specifically with the content of the interaction, with almost

complete attentional focus in the activity. Imagery engagement can be included as one aspect of *cognitive experience*, which is operationalized as "the extent to which the user processes preliminary information from the interface as well as the media content which is marked by an activation of the users' sensory mechanisms." This stage has been said to include perception of visual features, sounds, motion, touch and novelty of information—all stimulus features of "perceptual interfaces" (Reeves and Nass, 2000) which serve to expand the amount of sensory channels.

In summary, three different species of engagement, imagery engagement, cognitive engagement, and emotional engagement of users, can be identified as critical concepts that can reflect the intensity of user experience with media. The next few sections will propose the theoretical and operational definition of each.

Imagery engagement. Imagery engagement is defined as the degree to which users construct vivid mental imagery of objects in their mind in a mediated environment. One precursor of imagery engagement can be the concept of *presence*. Presence has been defined as a sense of "being there" in a mediated environment (Biocca, 1992; IJsselsteign, de Ridder, Freeman, & Avons, 2000). Biocca (1992) attributes this phenomenon of presence to the characteristic of our perceptions - the same perception used to stimulate the automatic perceptual processes in order to respond to the physical world creates the sense of being there when technology can afford it. In human-website interaction contexts, the feeling of presence is said to be heightened when the website gives a sense of interacting with real-life stimuli. For instance, panning and zooming in a virtual product in a commercial website would provide users a sense of manipulating a physical object in real world.

When the websites provide vivid enough stimuli that can involve users' perceptual resource to the extent that the real world requires it when they process the real world counterparts, the websites can create vivid imagery of objects in users' mind. According to Steuer (1992), vividness as formal or technological attribute is comprised of sensory depth and breadth. Sensory breadth refers to the number of sensory dimensions simultaneously presented, and sensory depth refers to the resolution of each perceptual channel. For instance, the 3D carousel feature by which users can flip through pictures on a website can appeal to both our motion and visual systems, whereas static pictures appeal to our visual system only. Likewise, a 3D-animation feature embedded on a website provides higher resolution to describe the same object compared to static 2D pictures. As a result of it, more vivid representations from media stimuli enhance users' ability to picture objects in their mind. Therefore, imagery engagement can be measured by the degree to which media stimuli can evoke vivid pictures or visualizations of the mediated objects in users' mind.

Cognitive engagement. Cognitive engagement is defined as the degree to which users have a focused attention on the message or object described by media. An indicator of cognitive engagement can be the state of *absorption*, which has been defined as the state of temporal dissociation and focused immersion in the interaction (Agarwal & Karahanna, 2000), or the state where individuals are consciously involved in an interaction or with the content of the interaction, with almost complete attentional focus in the activity (Oh, Bellur, and Sundar, 2010).

One might question the distinction between absorption and cognitive involvement when it comes to systematic processing or elaboration in the context of dual process models. Transportation theory suggests one way to make the distinction: Whereas cognitive elaboration includes a divergent process by which individuals are involved in diverse issue-related thoughts

and previous experience to evaluate an argument, transportation (or absorption) is said to be more convergent in that individuals would have a single, strong focus on the narrative (or in general, the content) itself. It is the phenomenon where "all of the person's mental systems and capacities become focused on the events occurring in the narrative" (Green & Brock, 2002, p. 324).

Whether it is more convergent process such as absorption, or more divergent process like elaboration, both of them ultimately refer to the same phenomenon where all of users' cognitive resources are focused on processing media stimuli at hand. Given that both of the concepts refer to an intensive psychological state where users are deeply involved with mediated content, a comprehensive measurement strategy for cognitive engagement would be to incorporate both aspects of absorption and elaboration. Thus, this study operationalizes cognitive engagement as the degree to which users feel absorbed in the process of interaction they are involved in as well as the degree to which they systematically process the messages.

Emotional engagement. Emotional engagement is defined as the degree to which users are aroused and/or experience a certain emotion (e.g. fear, anger, or joy) by mediated content. Emotional engagement has been defined broadly as the degree to which users are affected emotionally by media stimuli. For instance, individuals are said to be emotionally engaged with narrative when they feel empathy or sympathy toward characters (Busselle & Bilandzic, 2009) or when they perceive the narrative content affected them emotionally such that the emotions keep lingering after the exposure (Green & Brock, 2000).

Apart from this general perception of being emotionally affected by media content, one indicator of emotional engagement with media content can be the degree to which individuals feel aroused. According to dimensional views of emotion (Russell, 1980; Tellegen, 1985),

emotional experience varies along two primary dimensions of affective valence and arousal, which can explain most of the variability in affective judgment created by individuals (Osgood, Suci, & Tannenbaum, 1957). Along with specific emotional states, the dimension of arousal needs to be addressed when it comes to measure emotional engagement of users. Thus, this study employs both the degree of arousal and specific emotional states of users affected by media as measurement of emotional engagement.

Based on these definitions of user engagement, the next few sections will decompose the theoretical mechanisms by which different forms of interactivity alter the degree of user engagement, en route to explicating their effects on persuasive outcomes.

Modality Interactivity and Its Persuasive Effects

Modality interactivity and imagery engagement. One of the primary roles of interactivity is to help individuals access information in a variety of ways. For instance, using the mouse to spin a virtual camera and to zoom in the details of it would be considered as more interactive way of accessing the product information, as supposed to merely reading a webpage with corresponding static pictures. This type of interactivity has been defined as "modality interactivity" or "interactivity as a modality feature" (Sundar, 2007, p. 90). Interactivity as a modality feature strives to create a variety of ways to present information for users, which often leads to greater number of bells and whistles on the website. Thanks to the increasing amount of Internet bandwidth, lots of bells and whistles in contemporary websites employ graphical elements, such as video clips, and animated graphics.

When website interactivity involves modality interactivity, it is often accompanied with an ability to manipulate virtual objects. When users spin a virtual camera, the object responds as if the event is occurring in the physical world. 3D carousel, the rotating set of images where you

control the flow by hovering over each image, also provides us an illusion that we control the rotating objects. If the virtual object seamlessly responds to users' input, it can create a feeling of presence – where users feel like they are manipulating an actual object. The combination of the users' movement to manipulate the object and the visual changes accompanied by that is a fundamental factor to explain the effects of modality interactivity.

Previous studies have found that subtle manipulation of modality interactivity can successfully lead to the feeling of presence. For instance, Li et al (2002) found that interactive features enabling users to move, rotate, and zoom-in a virtual video camera evoked greater feeling of presence compared to the 2D version of the same website. Further, persuasion literature points out that modality interactivity can change individuals' attitudes when it induces greater sense of presence. Klein (2003)'s work found that a product website with video and audio features evoked greater feeling of presence than the site with text and static pictures, which led to stronger belief and attitudes about claims made in the advertisement. Li et al (2002)'s findings also revealed that the feeling of presence evoked by move, rotate, and zoom-in interactions with the virtual camera led to greater product knowledge, more positive brand attitudes, and greater purchase intention.

A mechanism by which modality interactivity evokes the feeling of presence and imagery engagement is based on a basic feature of human perception - we have not evolved enough to distinguish the mediated content from real world objects (Reeves & Nass, 1996). When modality interactivity allows users to interact with a virtual object in a manner that is similar to the way they perform the behavior in the real world, it can easily create real-life imagery in our mind. Given that human mind does not distinguish the virtual stimulus from real world phenomena, the heightened presence and real-life imagery in human mind created by modality interactivity can

be comparable to direct experience. Direct experience, such as product trial in an advertising content, has been said to form more confident, enduring, and resistant attitudes than does indirect experience (Fazio & Zanna, 1981). Direct experience is also known to be more trustworthy since individuals themselves control the focus and pace of the interaction (Smith & Swinyard, 1982). Thus, it is likely that mediated experience through modality interactivity can generate a similar persuasive appeal when it successfully replicates the vivid and concrete aspects of direct experience.

Indeed, researchers suggest evidence that a website employing modality interactivity such as zooming an image or animation to simulate movement of an object yielded no significant difference from direct experience of the same physical object, in terms of brand attitudes and purchase intention (Daugherty, Li, & Biocca, 2008). Empirical evidence suggests that modality interactivity increases the degree to which users generate vivid mental images, which can change users' attitudes toward content. Schlosser (2003) found that modality interactivity as clicking on or rolling the mouse over a camera image created more mental imagery than the control condition with static pictures of each corresponding step. The degree of imagery engagement fully mediated the relationship between modality interactivity and participants' purchase intention. Coyle and Thorson (2001)'s findings also suggest more vivid website with audio and animation is able to maintain positive attitudes toward the website even after two weeks.

In sum, when users can interact with objects and products through modality interactivity that simulates real-world phenomenon, the interaction can create feeling of presence in users' mind. Subsequently, the feeling of presence would shape more vivid mental imagery in users' mind, which can lead to more persuasiveness. In the context of website browsing, it can

positively affect individuals' attitudes toward the messages delivered by the website as well as attitudes toward the website. Thus, the following hypotheses are proposed:

H1: Modality interactivity will lead to greater feeling of presence compared to the control condition.

H2: Modality interactivity will lead to greater imagery engagement compared to the control condition.

H3: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more positive attitudes toward the website.

H4: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more positive attitudes toward anti-smoking messages that are delivered by the website.

H5: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more negative attitudes toward smoking, after controlling pre-existing attitudes toward smoking.

The mechanism via which individuals shape their attitudes toward the website can be different from the mechanism by which they form their attitudes toward the messages delivered by the site. For instance, positive website attitudes can be shaped by the fact that modality interactivity enables users to smoothly manipulate the virtual object and thus experience greater feeling of presence. In contrast, positive attitudes toward the persuasive message should involve some processing of the message itself, going beyond playing with the interactive features on the website. Thus, feeling of presence by modality interactivity may create positive website attitudes without necessarily going through imagery engagement. However, invoking more positive attitudes toward message should involve increased level of imagery engagement, the degree to

which participants shape vivid visualization of the negative outcomes of smoking in their mind as a result of further processing the message. Thus, this paper also tests the following hypothesis:

H6: Greater feeling of presence created by modality interactivity will directly lead to more positive attitudes toward the website.

Modality interactivity and cognitive engagement. Greater cognitive absorption in the mediated content can be another outcome of modality interactivity. When the site enables users to interact with the content, one consequence of the interaction might be that they can be led to pay more attention to the website browsing, have more fun while exploring various aspects of the website. A recent study (Sundar, Xu, Bellur, Jia, Oh, & Khoo, 2010) found that a website with the highest degree of modality interactivity including slide, animation, and 3D carousel induced higher degree of cognitive absorption than did the medium level of modality interactivity that was comprised of simple clicking. Users felt more absorbed while browsing the site and perceived that the website held their attention to a greater degree when they used the highest level of modality interactivity. Subsequently, this heightened degree of cognitive engagement led to more positive attitudes toward the website and the message delivered by the site. Thus, when users are more absorbed in the browsing task by well-designed interactive features, their attitudes toward the website and even the content can be positively affected.

Then what aspect of modality interactivity makes individuals feel more immersed while browsing? One theoretical mechanism is based on the notion of perceptual bandwidth (Reeves & Nass, 2000). Sundar (2007) argues that the effect of modality interactivity is to increase the degree to which we can mentally represent the mediated information. For instance, when individuals operate a slider feature on an anti-smoking website, it can show the changes in brain activities from non-smoker's brain to heavy smoker's brain when they move the mouse from left

to right along the slider. This process requires several different perceptions and cognitions. Users are adjusting their motor response to drag their mouse from left to right, perceptually coding the visual changes according to their mouse movement, and finally, cognitively processing the graphical information that shows more inactive areas in the heavy smokers' brain. They can, and often do, move the slider back and forth in order to see and encode dynamic changes. During this process, individuals' perceptual bandwidth will be expanded compared to the situation where they passively receive stimuli from media. Xu and Sundar (2012) found that the richer sensory experience afforded by modality interactivity could enhance users' engagement while browsing the website, which subsequently carry over to persuasive outcomes. In their study, the high-interactivity condition allowed users to spin, zoom, and mouseover the product image, whereas the low-interactivity condition only allowed them to scroll down different product images. As a result of interacting with the product image with a variety of tools, users reported having more fun and feeling in control, which led to more positive attitudes and greater behavioral intention than the low-interactivity condition.

For individuals to successfully process all of this information provided by interactive media, the operation of the media interface needs to be natural and intuitive (Norman, 1991; Naumann & Hurtienne, 2010; Steuer, 1992). Modality interactivity, with its ability to access information by flipping, zooming, sliding, etc., often affords more natural and intuitive interactions than simple clicking or scrolling. As long as modality interactivity creates more natural, intuitive, and easy-to-use interface, the increased perceptual bandwidth by interactivity will be fully used to mobilize their perceptual, motor, and cognitive abilities, which in turn, creates further engagement with browsing. However, if the interaction with system is error-prone or not intuitive enough to interact with, it would be harder for users to be completely

immersed in the browsing experience. Sundar, Bellur, Oh, Xu, and Jia (2013) found empirical evidence supporting that individuals' interface assessment of its naturalness, intuitiveness, and ease of use led to greater feelings of being absorbed while browsing. Subsequently, the increased absorption led to more favorable attitudes toward the website and the content that is delivered by the website.

Given this, this study proposes that participants' evaluation of the interface – including naturalness, intuitiveness, and easiness of the interface mediate the effect of modality interactivity upon users' feeling of absorption while browsing, which in turn, is expected to enhance their attitudes toward the anti-smoking website and its persuasive messages. Furthermore, given that the site is dedicated to delivering anti-smoking messages, this engagement process can eventually adjust their general attitudes toward smoking in a positive direction.

H7: Modality interactivity will lead to more positive interface assessment compared to the control condition.

H8: Modality interactivity will lead to higher cognitive absorption compared to the control condition.

H9: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more positive attitudes toward the website.

H10: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more positive attitudes toward anti-smoking messages that are delivered by the website.

H11: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more negative attitudes toward smoking, after controlling pre-existing attitudes toward smoking.

The mechanism of inducing better attitudes toward the website can differ from the mechanism of producing better attitudes toward the messages delivered by the site. Previous literature about website design suggests that structural features of the website, including the design, usability, organization, and interactivity of the site, can play an important role in determining the credibility of website (Sundar, 2008; Wathen & Burkell, 2002). Thus, positive evaluation about the quality of interface can directly adjust participants' attitudes toward the website. In contrast, attitudes toward the message would depend on the extent to which the positive quality of interface could actually engage users in cognitively processing the messages, rather than the evaluation of the interface itself. Therefore, it is likely that the attitudes toward the website can be solely determined by interface assessment, without going through further cognitive absorption.

H12: More positive interface assessment created by modality interactivity will directly lead to more positive attitudes toward website.

Another indicator of how individuals are cognitively engaged in website browsing is the degree of systematic processing of the message that is delivered by the website. In fact, the limited capacity model of mediated message processing (Lang, 2000) would claim that more and more bells and whistles on the interface would compete for the same pool of cognitive resources that are necessary for processing the message, which might negatively affect users' information processing capability of the message itself. Following this model, a website with many interactivity features would evoke more orienting responses (i.e. users' immediate responses to

changes in the environment) because of the calls for interaction from the modality interactivity. The frequent calls for interaction issued by modality interactivity could result in cognitive overload, which would result in less available resource for systematically processing information displayed on the website with many interactivity features.

There is empirical evidence from Sundar et al (2010) which indicates that a highly interactive website with 3D carousel feature inhibited participants' recall memory on the content compared to the site with only simple clicking. Given that recall memory has been used as a measure of systematic processing (e.g. Chaiken & Maheswaran, 1994), one prediction would be that modality interactivity can inhibit participants' systematic processing of information.

However, the way modality interactivity influences individuals' cognitive processing is not simply negative. Given that modality interactivity includes a variety of bells and whistles existing on the website, different types of modality interactivity can affect their cognitive processing differently. In Sundar et al (2010)'s study, for instance, the study examined the recall memory of different types of addiction from a webpage with a 3D carousel feature. A 3D carousel involves automatically rotating pictures, and the rotating movement functions as pure bells and whistles – hovering over images and changing the direction of the flow do not have any function that can help users understand the information about addiction. Thus, it is natural that 3D carousel can inhibit participants' coding of the relevant content rather than enhance it. In contrast, if the interactive feature is accommodated to understanding the information, it can effectively enhance cognitive processing of the message.

One study that examined six different types of modality interactivity supports this hypothesis. Sundar, Xu, Bellur, Oh, and Jia (2011) found that slider condition where participants moved a slider over hotspots along a timeline of Redwoods produced the most amount of recall

memory of content compared to other types of modality interactivity. The slider is designed to open hotspots in a linear order (from left to right), which is congruent with the chronological information about Redwoods that the study employed. Thus, when modality interactivity is operationalized in a way that it can match the rhythm and flow of the persuasive content, it can aid individuals to more actively process the content, rather than distracting them from the content.

Given this, this paper operationalizes modality interactivity as presence of a slider feature, whereby users can have more opportunities for interaction with the negative outcomes of smoking than merely looking at static pictures. If indeed this slider feature effectively delivers the persuasive content, higher modality interactivity will produce more elaboration about the message. However, if the slider feature merely functions as bells and whistles and consumes more cognitive resources that could have been used for processing the persuasive messages, including slider feature on the website will inhibit individuals' elaboration about the message. Thus, this paper asks the following research question:

RQ1: Does higher modality interactivity, operationalized as presence of the slider, lead to greater message elaboration compared to the control condition?

Modality interactivity and emotional engagement. Modality interactivity have been found to affect participants' emotion, both in intensity and valence, which results in either more or less persuasive outcomes. Reeves and Nass (2000) points out that an increase in the breadth and depth of media representations "turns up the volume knob" (p. 70) on perceptual responses, which may or may not lead to desirable outcomes depending on the quality of stimuli. In other words, perceptually rich experience can induce more intense response from users, which can sometimes create negative influences on attitudinal outcomes when the mediated content is not

properly designed. For instance, Yoo & Kim (2005) compared highly animated banner ads and moderately animated banner ads to static ones. They found that the degree of animation on banner ads linearly increased subjects' intensity of emotional responses measured by self-reported arousal. However, since participants with highly animated banner ads showed the most unpleasant feeling among the three conditions, it ultimately negatively affected attitudes toward the ads.

Given that modality interactivity is accompanied by a changing image of an object like animation and thus capable of inducing immediate orienting responses, it is also likely to induce greater level of arousal among participants. For instance, enlarging an image by a zoom-in/out feature can induce an orienting response given that it requires users to take action and observe the visual changes caused by the action. Both motor activity such as clicking a mouse and visual changes such as animation have been found to generate physiological arousal (Wise & Reeves, 2007, Detenber, Simons, & Bennett, 1998; Sundar & Kalyanaraman, 2004). Another indicator of emotional engagement is fear. The psychological effect of fear is distinguishable from other negatively valenced emotions, such as anger or sadness. From the perspective of discrete emotions (Dillard & Peck, 2000), fear signals danger, and motivates individuals to protect themselves. Fear appeal studies have employed vivid language or gruesome pictures and films as fear-inducing content (Witte, 1992). Indeed, anti-smoking websites employ interactive features in order to deliver the negative outcomes of smoking more vividly and fearfully. For instance, when individuals operate a slider feature on an anti-smoking website, it can show the changes in brain activities from non-smoker's brain to heavy smoker's brain when they drag the slider from left to right. This kind of feature is designed to more effectively deliver the threatening fact about smoking. This leads to the following hypothesis:

H13: Higher modality interactivity will create greater emotional engagement with the content compared to the control condition as indicated by greater level of arousal (H13a) and greater level of fear (H13b) among participants.

In general, strong fear appeals are said to be more persuasive than weak fear appeals (Beck & Davis, 1978; see Witte & Allen, 2000 for a meta-analysis). Fear can lead to greater message acceptance such that participants perceive the persuasion messages as more persuasive and convincing (Dillard, Plotnick, Godbold, Freimuth, & Edgar, 1996). Studies based on dual processing models pointed out that fear had a direct effect on participants' attitudes toward the message (Dillard, Plotnick, Godbold, Freimuth, & Edgar, 1996; Hale, Lemieux, & Mongeau, 1995). In their meta-analysis based on ninety-eight studies, Witte and Allen found that the correlations between the fear manipulation and attitudes, intention, and behavior are all positive and reliable across different settings and manipulations of studies. Especially, individuals' information seeking behaviors tend to keenly respond to perceived risk or fear (Dunwoody, Griffin, & Neuwirth, 2000). Based on the previous findings, this study proposes

H14: Greater fear induced by modality interactivity will lead to greater behavioral intention to seek information.

Message Interactivity and Its Persuasive Effects

Different from modality interactivity, some forms of interactivity can go beyond being bells and whistles on the interface and are explicitly designed to increase systematic processing. *Message interactivity* refers to the degree to which the system affords users the ability to construct an idiosyncratic message thread by reciprocally communicating with the system. In order to do this, the system has to be capable of accounting for previous messages from users as well as those preceding them so that it can contingently respond to users' input. Theoretical

mechanisms underlying the effect of message interactivity rests on the *contingency* involved in message exchange (Rafaeli, 1988). Hyperlinks and buttons embedded in websites show the communication possibilities to users, where they can click to see another layer of content. As opposed to reading the whole content by just scrolling down non-interactively, these interactive features account for users' previous input. When there is a series of exchanges between the user and system through a layered structure of hyperlinks, the message constructed by this interaction relates both to previous messages and to the way previous messages referred to those preceding them. This conceptualization follows the "conversational ideal" (Rafaeli, 1988, p. 117), in that a successful form of message interactivity mimics the way in which humans conduct face-to-face conversations. When the interaction with the system approaches this ideal, two psychological outcomes can occur: absorption and message elaboration.

First, message interactivity can increase the degree of self-reported absorption into website browsing by heightening the level of perceived contingency. A recent study with a movie recommendation site (Sundar, Bellur, Oh, Jia, & Kim, 2012) operationalizes message interactivity as the degree to which the site accounts for users' previous choices of movies by providing more hyperlinks related to the previous actions. They found that higher message interactivity led to higher degree of absorption with the site, which was mediated by the degree to which participants perceived the website as contingently responding to the interaction between them and the system. This heightened degree of absorption with the site led to more positive attitudes towards the site and higher intention to recommend it to others. These findings lead to the following hypotheses:

H15: Higher message interactivity will lead to greater perceived contingency.

H16: Higher message interactivity will lead to greater cognitive absorption while browsing.

H17: Greater perceived contingency resulted from message interactivity will lead to greater cognitive absorption while browsing.

Secondly, the back-and-forth interaction between the user and the system can elicit greater elaboration of persuasive messages that are delivered by the system. This capability of message interactivity would attribute to the fundamental nature of cognitive elaboration such that the elaboration occurs when individuals make a meaningful response to a message received based on their prior knowledge (Tremayne & Dunwoody, 2001). In other words, when message interactivity affords users to be engaged in this reciprocal way of communication with system, the linear process of exchanging messages can trigger further elaboration on the message since the users are forced to create meaningful, contingent response to the previous one.

Several studies have shown that message interactivity indeed has potential to create greater degree of elaboration, which leads to more positive attitudes toward content. In a political candidate's website, medium level of message interactivity induced more positive impressions on the candidate regardless of participants' previous interest in politics (Sundar, Kalyanaraman, & Brown, 2003). This absence of the effect of topic involvement suggests that the optimal level of message interactivity does not function as a mere heuristic cue such that it heavily influences only apathetic users. Instead, it can result in the same outcome in terms of attitude changes for both highly involved users and apathetic users.

Sicillia et al (2005) also showed that higher degree of message interactivity as manipulated by embedded hyperlinks in a product website induced a greater number of website-related thoughts. By using think-aloud protocol, Tremayne and Dunwoody (2001) measured

cognitive elaboration as the number of comments increased, demonstrating a connection between currently encountered information and prior knowledge. An interactive version of website with hyperlinks was found to increase both participants' message elaboration and the amount of content-specific recall.

In this paper, message interactivity will be operationalized as the number of layers of hyperlinks: low (only one layer, i.e. scrolling only) vs. medium (two layers of hyperlinks) vs. high (three layers of hyperlinks plus breadcrumbs). High message interactivity condition would enable users to be involved in the most active message exchanges between the user and the system. Users can further click and open the content they want to read as opposed to being merely exposed to the content. This operationalization of interactivity has been shown in previous research (e.g., Sundar, Kalyanaraman & Brown, 2003; Sundar & Kim, 2006; Sundar, Bellur, Oh, Jia & Kim, 2012) as successfully enhancing the perceived level of interactivity, given successful manipulation checks. Breadcrumbs would allow users to visualize the navigation path they went through, which can also help users more freely determine the content they want to read next. Medium and low conditions would allow lesser chances of constructing their own way of reading the content compared to the high condition. Given this operationalization and previous findings about message interactivity, this study proposes the following hypotheses:

H18: Greater perceived contingency resulting from message interactivity will lead to greater elaboration of anti-smoking messages.

H19: Greater message elaboration will mediate the relationship between message interactivity and attitudes toward messages.

H20: Greater message elaboration will mediate the relationship between message interactivity and belief about the effects of smoking.

The role of cognitive engagement in the persuasion process relies on the degree of involvement that participants had beforehand. Dual-process models (Chaiken, 1987; Petty & Cacioppo, 1986) suggest that highly involved participants will cognitively engage with the content by systematically processing the messages, which in turn, will create more persuasive outcomes. In contrast, for participants who have low involvement with the topic, heuristic processing is said to predominate – their attitudes toward message are simply determined by the presence or absence of relevant heuristic cues. Liu and Shrum (2000) found that website interactivity can work as a heuristic cue for those who are not involved in the topic of the website and elicit uniformly positive attitudes. On the other hand, the same feature can elicit either positive or negative attitudes for those who are highly involved in the topic, depending on whether they are capable of actually using that interactive feature.

In this study, message interactivity is not just bells and whistles, but a feature that is designed to cognitively involve users - as users click through hyperlinks, each hyperlink delivers information related to the anti-smoking topic. In addition, opening and clicking hyperlinks do not involve particular skills or much amount of cognitive resources. Assuming the message interactivity feature proposed by this study can be operated almost unconsciously by users, users' previous experience or skills would not matter.

Based on dual-process models, however, the effect of message interactivity will differ across the level of issue involvement. Those who are highly involved in the issue of smoking would systematically process the anti-smoking messages, therefore be minimally influenced by the message interactivity feature. That is, they will engage with the message no matter how it is structured on the site. Highly involved users of the site will centrally process the message even when it is offered in a relatively non-interactive form, e.g., simply scrolling down a text-heavy

site. Therefore, message interactivity will positively affect the degree of elaboration for those who are not highly involved in the issue of smoking. Given that message interactivity operationalized in this study functions as a tool for involving participants rather than appearing as bells-and-whistles, it is likely that message interactivity further engages low-involvement participants in systematic processing as they open the multiple layers of hyperlinks in stages. This systematic processing induced by message interactivity will likely mediate the effect on the degree of message elaboration, with consequences for subsequent attitudes toward and beliefs about the persuasive messages. In other words, the potential of message interactivity for cognitively engaging users would be more pronounced for those who do not have personal involvement in the issue of smoking. Thus, the following hypotheses are proposed:

H21: Higher message interactivity will result in greater message elaboration of anti-smoking messages, only for low-involvement participants.

H22: Message elaboration will mediate the relationship between message interactivity and attitudes toward messages, only for low-involvement participants.

H23: Message elaboration will mediate the relationship between message interactivity and beliefs about messages, only for low-involvement participants.

Combinatory Effect of Modality Interactivity, Message Interactivity, and Issue Involvement

Simply put, the combinatory effect of modality interactivity and message interactivity means that users will have more interaction possibilities with the website. The MAIN model (Sundar, 2007) suggests a variety of ways by which the mere existence of interaction possibilities on an interface can serve as heuristic cues. The suggestion of activity, by way of different kinds of interaction techniques (zooming, dragging, etc.) available on the interface, is

said to trigger the *activity heuristic*. The presence of dialog boxes and other features that invite user input may cue the *interaction heuristic*. A menu bar with a series of tabs could cue the *choice heuristic*, and so on. These heuristics promote perceptions of dynamism, specificity, accessibility of information and other such credibility markers in the minds of users and persuade users by promoting short-cut judgments of the quality of the content delivered by the interactive interface.

However, with the addition of more interaction techniques, there might be a curvilinear relationship between levels of interactivity and its persuasive outcomes such that there is a threshold beyond which the positive potential of interactivity decreases. Bucy (2004, p. 378) named this non-linear effect of interactivity as "interactivity paradox". Sundar, Kalyanaraman and Brown (2003)'s findings also showed a clear curvilinear effect of interactivity on attitudes toward website and political candidates such that medium-interactivity condition elicited the highest score for almost every attitudinal outcome. Whereas previous studies focus on the amount of interactivity and its effects, this study operationalizes interactivity in two different ways – modality and message interactivity – and investigate how these different types of interactivity affect each other when they work together in the same interface. Modality interactivity can be considered as bells and whistles, in that it often contains some visual, playful features that allow users to access information in a variety of ways. With these features, modality interactivity can easily enhance the perceived level of interactivity, and function as a prominent heuristic cue. In contrast, message interactivity more likely lead individuals' attention to the message delivered by the website, rather than any other interface aspects of the website. For low-involvement individuals, modality interactivity can overwhelm the effect of message interactivity, thereby negate any effect from the message interactivity feature. As dual process

models (Chaiken, 1987; Petty & Cacioppo, 1986) suggest, low-involvement individuals can be easily persuaded up by peripheral interface features such as modality interactivity. Thus, when modality interactivity is placed on the same interface with message interactivity, it can offset the effect of message interactivity on message elaboration by inducing heuristic processing. For high-involvement individuals, the interaction potential offered by modality interactivity may or may not be appreciated, depending on whether they are compatible with the judgment based on systematic processing (Chaiken, & Maheswaran, 1994). According to the *additivity hypothesis*, when the information yielded by systematic processing does not overwhelm the effect of heuristic cue and the heuristic cue provides compatible information, the presence of heuristic cue can bolster the persuasive outcome. However, when the heuristic cue provides information that contradicts the judgment based on systematic processing, the effect of heuristic cue can be negligible.

Given that there is not enough empirical evidence about how the information provided by modality interactivity (in the form of a form of a slider) is perceived by users, this dissertation proposes the following research question:

RQ2: How does the interaction effect of modality interactivity, message interactivity, and issue involvement influence user engagement, attitudes and beliefs toward anti-smoking messages?

Figure 1 summarizes the hypothesized relationships between variables. Figures with hypothesis and research question numbers will be provided in the results section.

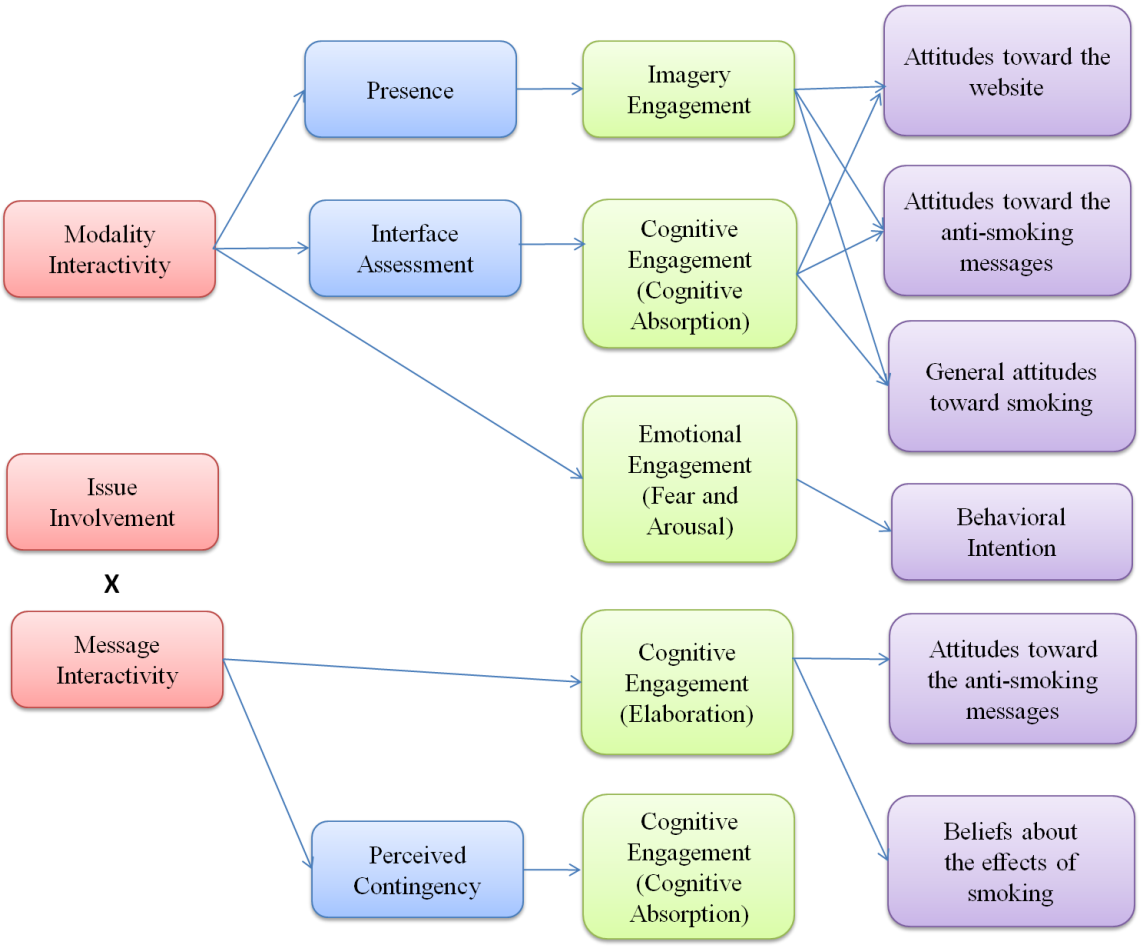

Figure 1. Hypothesized effects of modality interactivity and message interactivity

METHOD

Two independent variables—modality interactivity and message interactivity —were manipulated to vary the level of interactivity on the stimulus websites. A 2 (Modality interactivity: Control vs. Slider) X 3 (Message interactivity: Low vs. Medium vs. High) fully factorial, between-subjects lab experiment was conducted to collect data. Pre- and Post-tests method was employed to account for pre-existing attitudes toward smoking. Thus, the study consisted of two parts – the first part was the pre-test, online survey that measured their smoking attitudes and demographic information, and the second part was a lab session where they browsed the stimulus website and filled out another questionnaire (post-test).

Participants

Participants were recruited from undergraduate classes at Penn State in exchange for extra credit. One hundred seventy three participants successfully completed both parts of the study. Two of them were removed from the data set because they said that they had participated in the pilot test of the same study. After checking the time spent for browsing the stimulus website, four participants who spent less than thirty seconds were eliminated from the data set. The final sample consisted of 167 participants. The final sample included 97 females (58.1%) and 70 males (41.9%), with the average age 19.6 (SD = 1.43). Most of the participants were Caucasian (N = 115). Other races in the sample were Asian (N = 17), African American (N = 14), Hispanic (N = 12), Arab (N = 3), and Other (N = 6). The sample included 56 freshmen, 43 sophomores, 35 juniors, and 33 seniors. The majority of the sample were native English speakers (N = 150).

Procedure

First, a 5-minute, self-administered online questionnaire was sent to recruited participants in order to measure their smoking status, issue involvement with smoking, and preexisting attitudes toward smoking. At the end of the survey, participants were directed to a sign-up link where they could reserve a lab session. Participants were able to sign up for a session that was scheduled at least 24-hours after upon the completion of the online survey.

The second part of the study was administered in a media effects research laboratory at Penn State University. Upon arrival, participants were administered informed consent forms. They started an online questionnaire by typing the last four digits of their cell-phone number and the month they were born, which served as an anonymous id for each participant in the data analysis stage. They were then given a browsing task on an anti-smoking website. The questionnaire software randomly assigned each participant to one of the six conditions. The instruction for the browsing task included a brief introduction about the website (i.e. "Tobacco Free State College"), and was framed as a learning task. The instruction asked participants to fully browse the website and spend as much time as they needed. They were specifically told that the site contained three different topics and asked to explore all three topics and learn as much as they could (see Appendix for the complete instruction). On average, participants spent 317.08 seconds browsing the entire website (SD = 149.07, Min = 30.37 seconds, Max = 682.98 seconds). After they finished browsing the site, they were asked to fill out a questionnaire. The post-test questionnaire included media use and demographic information of participants, and all the outcome measures that will be described in Measurement section of this paper. The entire study session lasted approximately 40 minutes.

Stimulus Material

Six prototype websites [2 (Modality interactivity: Control vs. Slider) X 3 (Message interactivity: Low vs. Medium vs. High)] were constructed for this study. The six prototypes differed only in the interactivity features they offered to the users. Except for the interactivity features employed, all six versions of the prototype shared the same content, and the same page layout. The prototype website was titled as "Tobacco Free State College".

All of the prototype websites had three topics describing the negative health outcomes induced by smoking: "how smoking affects your looks", "how smoking affects your brain", and "how smoking affects your respiratory system". Each of the three issues was further categorized into three sections: "how smoking affects your looks" was divided into "premature aging and wrinkles", "icky teeth", and "thinner hair"; "how smoking affects your brain" was divided into "smoking reduces your IQ", "smoking induces lack of concentration", and "smoking is linked to brain shrinkage"; and "how smoking affects your respiratory system" was divided into "oxygen intake", "mucus congestion", and "emphysema".

For all prototype websites, the name of the website, "Tobacco Free State College", was located at the left top corner of the web page. Right next to the logo of "Tobacco Free State College", the site provided a simple mission statement, saying "To protect the people in State College from the dangers of tobacco". The website was comprised of one main graphic area followed by three smaller boxes underneath. The main graphic area showed an undergraduate student who seemed to taking a note in a library, and provided a cover story of the website: "Facts Matter**:** Everyone thinks they've heard it all before, but take some time to explore for yourself how deadly and dangerous tobacco can be to you and your loved ones." Each of the three smaller boxes underneath contained a block of text stating one of the three topics (i.e. "how

smoking affects your looks", "how smoking affects your brain", and "how smoking affects your respiratory system") (Figure 2).

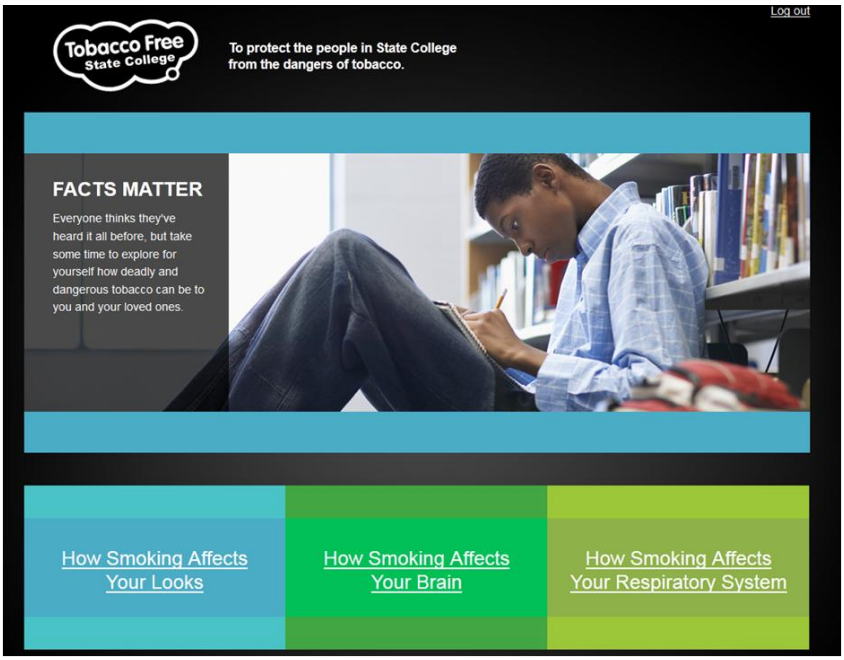

Figure 2. Homepage of stimulus website

Manipulation of modality interactivity. Modality interactivity is operationalized as the presence (Slider condition) vs. absence (Control condition) of slider feature. In Control condition, each of the three topics contained at least two static images related to the topic (i.e. looks, brain, and respiratory system). The images were designed to show three different health outcomes regarding each topic area. For the "how smoking affects your looks" topic, a computer-simulation of aging process was presented by three static pictures corresponding to a female's looks 1) in a current state, 2) in the case of an aged non-smoker, or 3) in the case of an aged smoker (Figure 3, left). For "how smoking affects your brain", three pictures described different outcomes in glucose metabolism of a human brain in the case of 1) a non-smoker, 2) a smoker 10

days after having stopped smoking, or 3) a smoker 100 days after having stopped smoking (Figure 3, middle). For "how smoking affects your respiratory system", two pictures showed 1) healthy lungs, or 2) a smoker's lungs (Figure 3, right).

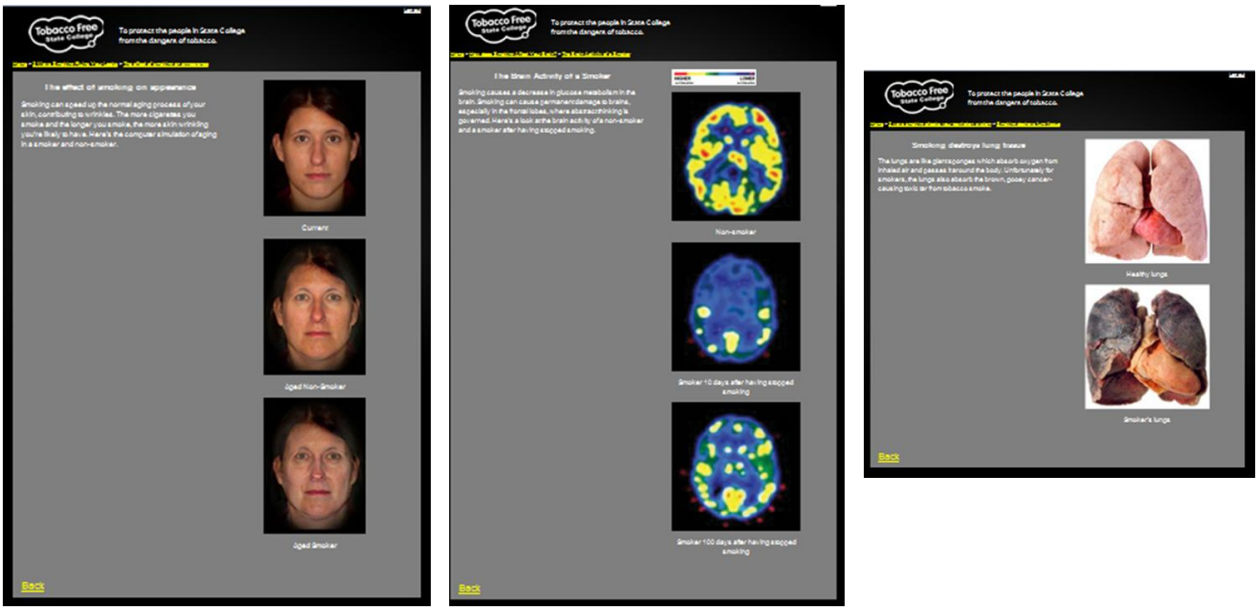

Figure 3. The absence of modality interactivity (control condition)

In Slider condition, a drag-and-slide bar was located under the same-sized images. The images of a female's look (Figure 4, left), brain activity (Figure 4, middle), and lungs (Figure 4, right) changed as participants moved the slider across the image. Instead of showing images discretely like those in the Control condition, the images were morphed into one so that the same image showed gradual changes over time upon slider movement across the horizontal axis. See also Appendix for the links to the actual stimulus websites.

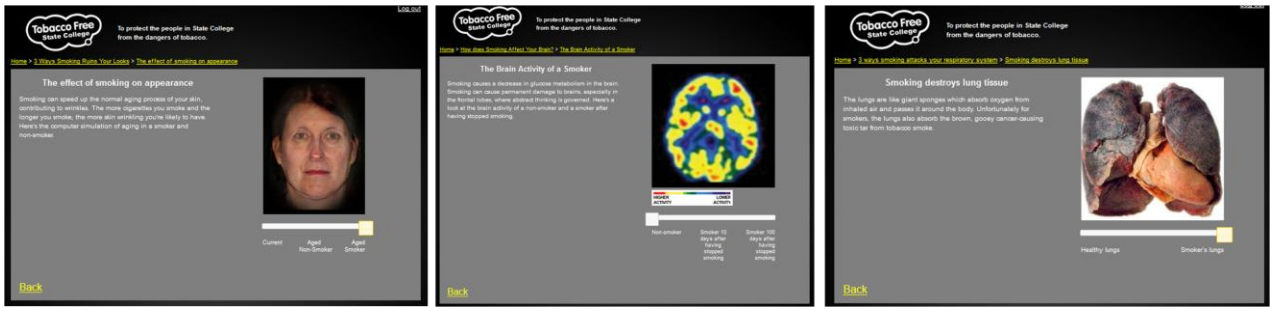

Figure 4. Slider (modality interactivity condition)

Manipulation of message interactivity. Message interactivity was operationalized as the number of layers of hierarchical hyperlinks and the presence/absence of breadcrumbs. The low condition did not have any hyperlinks. Participants were able to read the three topics (i.e. the effects of smoking on looks, brain activity, and respiratory system) by simply scrolling down the screen (Figure 5).

Figure 5. Low message interactivity condition

The medium condition had two layers of hyperlinks. On the homepage, participants were able to click one of the three boxes under the main frame, which directed them to one of the same three topics with the low condition. If a participant clicks the link saying “how smoking affects your looks”, this click would direct the participant to the next page with the heading of “how smoking affects your looks”. In this page, the site listed all of the three subtopics (i.e. “premature aging and wrinkles”, “icky teeth”, and “thinner hair”) and related textual descriptions. At the bottom of the page, “back” and “next” buttons were provided to take users either back to the homepage where they can click the other two topics, or to proceed to the final layer where there were pictures (or slider, depending on the modality interactivity condition) describing the negative outcomes of smoking (Figure 6).

Figure 6. Medium message interactivity condition

The high condition had three layers of hyperlinks and breadcrumbs. Like the medium condition, participants could click one of the three boxes under the main frame, which moved them to one of the three topics. On the next page, participants were able to click further. There were three hyperlinks listing the three sub-issues of the selected topic, allowing them to click

them one by one. Upon selection of each hyperlink, the site showed one or two paragraphs of textual information about each sub-topic, while automatically closing the other sub-topic if it had been opened. The page contained both “Back” and “Next” button as the medium condition had. They could proceed to the final layer that was maintained exactly the same with the medium condition. Additionally, participants could see yellow-colored breadcrumbs that track their locations on the website right above the main frame (Figure 7).

Figure 7. High message interactivity condition

Measurement

Moderator. *Issue involvement* with smoking was defined as the degree to which information about smoking is of personal importance. Issue involvement was measured by ten items from Zaichkowsky (1985). On a 9-point semantic-differential scale, participants indicated if information about smoking is "unimportant-important", "irrelevant-relevant", "means nothing to me-means a lot to me", "worthless-valuable", "not needed-needed", "boring-interesting", "unexciting-exciting", "uninvolving-involving", "unappealing-appealing", and "mundane-fascinating"(M = 4.92, SD = 1.88, Cronbach's α = .93).

Control variables. Due to the nature of the anti-smoking topic, participants' smoking status and their pre-existing attitudes toward smoking were included in the analysis. *Smoking status* was classified into three categories, based on Siegel (2000): (1) nonsmokers, (2) experimenters, and (3) established smokers. Nonsmokers were defined as participants who never tried smoking. Experimenters were defined as those who tried smoking at least once, but smoked fewer than 100 cigarettes. Established smokers were those who answered that they smoked at least 100 cigarettes in their lifetime. 50.3% (N = 84) of participants were classified as nonsmokers, whereas 37.7 % of participants (N = 63) were experimenters, and 12% of them (N = 20) were established smokers.

Pre-existing attitudes toward smoking were measured by 10 items on a 9-point semantic-differential scale before they came to the lab. They included 8 items from Swanson, Rudman, and Greenwald (2001), "bad-good", "unhealthy-healthy", "unsexy-sexy", "unpleasant-pleasant", "harmful-harmless", "unsociable-sociable", "ugly-glamorous", and "stressful-calming", and two additional items such as "negative-positive", and "unfavorable-favorable". An exploratory factor analysis using principal axis factoring extraction and Oblimin rotation was employed to examine

the structure of participants' attitudes toward smoking. The analysis revealed two factors with eigenvalues greater than 1. These two factors explained 77.74% of the variance. The first factor included three semantic-differential items, "bad-good", "unhealthy-healthy", and "harmful-harmless". This factor was labeled as attitudes toward health effects of smoking. The second factor was comprised of remaining seven items, "unsexy-sexy", "unpleasant-pleasant", "unsociable-sociable", "ugly-glamorous", "stressful-calming", "negative-positive", and "unfavorable-favorable". This factor was labeled as attitudes toward attractiveness of smoking. In sum, two indexes were created based on the factor analysis. *Attitudes toward health effects of smoking* were calculated by averaging three items, "bad-good", "unhealthy-healthy", and "harmful-harmless" (M = 1.48, SD = .86, Cronbach's α = .85). *Attitudes toward attractiveness of smoking* were calculated by averaging the remaining seven items, "unsexy-sexy", "unpleasant-pleasant", "unsociable-sociable", "ugly-glamorous", "stressful-calming", "negative-positive", and "unfavorable-favorable" (M = 2.58, SD = 1.69, Cronbach's α = .92).

Persuasion literature points out that defensive processing can bias message processing (Block & Williams, 2002; Freeman, Hennessy, & Marzullo, 2001; Liberman & Chaiken, 1992). When the persuasive message is threatening, or personally relevant, individuals tend to put more effort to process the message, but in a defensive and critical way. For instance, individuals tend to perceive that the message is trying to manipulate their feelings, evaluate the message as distorted and overblown, and actively generate counter-arguments. Given that biased processing is an important determinant of persuasion outcomes, this study controls the degree of biased processing about anti-smoking messages delivered by the stimulus website.

Biased message processing was measured using six semantic differential items on a 9-point scale. The items were adapted from Shen, Monahan, Rhodes, and Roskos-Ewoldsen

(2009). Participants indicated their attitudes toward the message on the website with six pairs of adjectives: “not distorted-distorted”, “not overblown-overblown”, “not exaggerated-exaggerated”, “not boring-boring”, “not manipulative-manipulative”, and “not exploitative-exploitative” (*M* = 3.04, *SD* = 1.69, Cronbach’s α = .90).

Manipulation check. Perceived interactivity was measured by three items adapted from Kalyanaraman and Sundar (2006). The first item asked participants to indicate their attitudes toward website ranging from 1(= not at all interactive) to 9 (= highly interactive). The next two items asked participants to indicate their attitudes toward two statements about the website on a 9-point Likert scale, ranging from 1 (= strongly disagree) to 9 (= strongly agree): “This website allows me to perform a lot of actions”, and “This website allows me to access information in a variety of ways” (*M* = 5.21, *SD* = 2.16, Cronbach’s α = .91).

Mediating variables. Perceived contingency was measured by three items from Sundar, Bellur, Oh, Jia, and Kim (2012). Participants indicated how well they thought each statement described the website on a 9-point Likert scale, scale ranging from 1 (= describes very poorly) to 9 (= describes very well). The statements include “I was involved in several back and forth interactions with the site”, “I felt as if the information on the website was well connected to my actions”, and “The website was aware of the actions I performed”. (*M* = 4.89, *SD* = 2.28, Cronbach’s α = .85).

Presence was measured using three items obtained from Witmer and Singer (1998) on a 9-point Likert-type scale. The items included: “How well could you move or manipulate objects while browsing? (ranging from 1 = not very well to 9 = very well)”, “How much did the visual aspects of the website involve you? (ranging from 1 = not at all to 9 = a lot)”, and “How

completely were all of your senses engaged while browsing? (ranging from 1 = not completely to 9 = completely)" (*M* = 6.52, *SD* = 1.76, Cronbach's α = .76).

The Interface assessment measure consisted of three items on a 9-point Likert scale. Participants responded to three statements indicating their feeling toward their interaction with the website: "My interaction with the website was intuitive", "The ways that I used to control the changes on the website seemed natural", and "The website was easy to use" (*M* = 7.06, *SD* = 1.30, Cronbach's α = .63).

Imagery engagement was measured by three items adapted from Schlosser (2003). Three questions asked participants how much they could construct vivid mental imagery of negative outcomes of smoking in their mind while browsing the website ranging from 1 (= not at all) to 9 (= a lot), such as "How much did the website have features to help you imagine the effects of smoking?", "How much could you easily picture the effects of smoking in your mind?", and "How much did the website let you easily visualize the effects of smoking?" (*M* = 7.44, *SD* = 1.26, Cronbach's α = .88).

Cognitive engagement was measured by (1) self-reported cognitive absorption, (2) self-reported elaboration, and (3) message elaboration reflected in a thought-listing measure. First, *absorption* was measured by 15 items obtained from Agarwal and Karahanna (2000). The original instrument in Agarwal and Karahanna (2000) included five dimensions, "temporal dissociation" (the degree to which users lose track of time while engaged in interaction), "focused immersion" (the degree to which users experience total immersion while interacting with system), "heightened enjoyment" (the degree to which users experience fun while interacting with system), "control" (the degree to which users feel in charge of the interaction), and "curiosity" (the degree to which the interaction arouses users' imagination and curiosity) (p.

673). The factor structure was examined by an exploratory factor analysis with principal axis factoring extraction and Oblimin rotation. The result showed that only three factors emerged from the data set, with eigenvalues greater than 1. These three factors explained 60.00% of the variance. The first factor, explaining 37.58 % of the total variance, included six items that had been used to measure "heightened enjoyment" and "curiosity" in Agarwal and Karahanna (2000): "I had fun interacting with the site", "The site's features provided me a lot of enjoyment", "I was bored (reverse-coded)", "I felt as if my curiosity was excited", "I felt as if my imagination was aroused", and "I felt that my interest was evoked" (M = 5.43, SD = 1.53, Cronbach's α = .88). The second factor included both "focused immersion" and "control" dimensions in Agarwal and Karahanna (2000), six items explaining 13.20 % of the total variance: "I was able to block out most other distractions", "I was absorbed in what I was doing", "I was immersed in the task that I was performing", "My attention did not get diverted", "I felt in control", and "I felt that I had no control over my interactions (reverse-coded)" (M = 6.68, SD = 1.21, Cronbach's α = .77). The third factor was the same with "temporal dissociation" dimension in Agarwal and Karahanna (2000), comprised of three items explaining 9.18% of the total variance: "Time appeared to go by very quickly", "I lost track of time", and "I spent more time than I had intended" (M = 5.18, SD = 1.53, Cronbach's α = .66). Only the first factor, representing the degree of heightened enjoyment and curiosity, yielded a significant result. Thus, the first factor was named as cognitive absorption and discussed further in this study.

Message elaboration has been measured in several different ways in prior research, including thought-listing technique and self-reported inventory. Fichten, Amsel, and Robillard (1988) found out that the list of thoughts and feelings from participants using the thought-listing

technique showed only few differences from the list obtained by the self-reported inventory measure. However, literature also suggests that cognitive responses measured via the thought-listing technique can yield different results than those measured by self-reported levels of attention and cognitive effort (Wheeler, Petty, and Bizer, 2005). Thus, this study employs both measures and report findings from both thought-listing question and self-reported items.

Self-reported elaboration was measured by asking participants to indicate the degree to which they were involved in message elaboration while browsing the website. Five items were obtained from Kahlor, Dunwoody, Griffin, Neuwirth, and Giese (2003): "I thought about what actions I myself might take based on what I browsed", "I found myself making connections between the website content and what I've read or heard about elsewhere", "I thought about how and what I had browsed related to other things I know", "I tried to think of the practical applications of what I browsed", and "I tried to relate the ideas in the website to my own life" (M = 7.52, SD = 1.19, Cronbach's α = .79).

A thought-listing measure was also employed to measure cognitive engagement. Right after participants finished browsing, they were asked to list all the thoughts they had while browsing the website. They had 2 minutes to answer. After 2 minutes, the online questionnaire automatically moved them to the next page where they answered to other questions. Three coders coded the open-ended responses following the steps described in Shen and Dillard (2009). First, the coders fragmented the data into thought units. 10% of the data was checked if they agree on the thought units. Guetzkow's U (Guetzkow, 1950) averaged .015 for all pairs of coders. In other words, there was 1.5% of disagreement in coders' unitization of thought.

Secondly, they coded each thought unit as favorable, neutral, and unfavorable thought toward the message and the website, respectively. Favorable thoughts about the message

expressed a positive or agreeing response to the anti-smoking messages (e.g. “While browsing the website, I realized just how bad smoking is for your body”). Neutral thoughts toward the message were those that did not express any evaluation about the anti-smoking messages on the site, but still were relevant to the topic (e.g. “I thought of my boyfriend's parents who are smokers”). Unfavorable thoughts were those that expressed a negative or disagreeing response to the messages (e.g. “I wish that the information on this page was more elaborate”). The Cohen’s kappas for three pairs of coders were .50, .56, and .73.

Favorable thoughts about the website expressed a positive response to the website structure, layout, colors, etc. (e.g. “The appearance of the website was nice”), apart from the message delivered by the site. Neutral thoughts about the website were supposed to be those that did not express any evaluation, but still mentioned some aspects of the website. However, no thought was found in this category. Unfavorable thoughts reflected a negative response to the website (e.g. “I felt that it was hard to follow with all of the bright colors directing my eyes to different places”). The Cohen’s kappa for the three pairs of coders were .73, .82, and .91.

Three indexes were obtained based on the coding results. One outlier was identified and removed from the analyses that involved any of the three indexes. First, *total amount of thoughts* an individual generated was the number of thought units (M = 4.81, SD = 2.07, Min = 0, Max = 15, N = 166). Secondly, *the valence of message-related thoughts* was calculated by subtracting the number of unfavorable thoughts toward the message from the number of favorable thoughts toward the message (M = .76, SD = 1.29, Min = -1, Max = 5, N = 166). The same formula was applied to calculate *the valence of website-related thoughts* (M = 2.45, SD = 2.54, Min = -4, Max = 14, N = 166).

Emotional engagement was measured by arousal and fear. *Arousal* was measured using three items selected from Mehrabian and Russell (1974), on a 9-point sematic differential scale. Participants were asked to indicate their feeling while they were browsing the website, on the items including "relaxed – stimulated", "sleepy – wide-awake", and "unaroused – aroused" (M = 4.41, SD = 1.58, Cronbach's α = .64). *Fear* measure consisted of three items on a 9-point Liker-type scale from Dillard and Peck (2000). The items asked participants their feeling while they were browsing the website, including fearful, afraid, and scared (M = 3.31, SD = 2.10, Cronbach's α = .92). The scale ranged from "none of this feeling = 1" to "a great deal of this feeling = 9".

Dependent variables. General attitudes toward smoking were measured by the same 10 items on a 9-point semantic-differential scale that measured the pre-existing attitudes toward smoking. *Attitudes toward health effects of smoking* were calculated by averaging the same three items with the pre-existing attitudes measure, "bad-good", "unhealthy-healthy", and "harmful-harmless" (M = 1.34, SD = .65, Cronbach's α = .76). *Attitudes toward attractiveness of smoking* were calculated by averaging the same seven items with the pre-existing attitudes measure, "unsexy-sexy", "unpleasant-pleasant", "unsociable-sociable", "ugly-glamorous", "stressful-calming", "negative-positive", and "unfavorable-favorable" (M = 2.29, SD = 1.52, Cronbach's α = .92).

Attitudes toward anti-smoking messages were measured using six items selected from Sundar (2000). Participants indicated how well the adjectives (believable, informative, insightful, objective, interesting, and clear) describe the messages that were delivered by the website on a 9-point Likert-type scale (M = 7.22, SD = 1.22, Cronbach's α = .82). The scale ranged from "describes very poorly = 1" to "describes very well = 9".

Attitudes toward the website consisted of six items selected from Sundar (2000) and Sundar, Xu, Bellur, Oh, and Jia (2011). Participants were asked to indicate how well the adjectives (exciting, high quality, fun, cool, imaginative, and entertaining) describe the website that they interacted with on a 9-point Likert-type scale (M = 5.27, SD = 2.01, Cronbach's α = .95). The scale ranged from "describes very poorly = 1" to "describes very well = 9".

Beliefs about the effects of smoking were measured using 7 items. Participants were asked to indicate how likely they believe that a smoker will develop certain symptoms if s/he continues to smoke, compared to a non-smoker on a 9-point Likert-type scale, anchored with "much less likely = -4", "same as = 0", and "much more likely = =4". The symptoms included the negative health outcomes of smoking that the stimulus website conveyed: reduced IQ, brain shrinkage, premature aging and wrinkles, lung cancer, mucus congestion, emphysema, and stained teeth (M = 7.88, SD = 1.02, Cronbach's α = .88).

Participants' behavioral intention related to smoking was measured by *behavioral intention to seek further information*. *Behavioral intention to seek further information* was measured by three items adapted from Hu and Sundar (2010). Participants responded to three statements on a 9-point Likert scale ranging from "strongly disagree = 1" to "strongly agree = 9", such as "I would like to know more about the topic of smoking" and "I would like to browse more content about smoking", and "I would discuss the topic of smoking with my friends".

Demographics. Participants' media use was measured by asking them to enter how many minutes they spend on the Internet on a given day (M = 167.13, SD = 135.17, Min = 0, Max = 1000). Participants' age (M = 19.62, SD = 1.43), gender (70 males, 97 females), ethnic group (17 Asians, 14 African Americans, 115 Caucasians, 12 Hispanics, 3 Arabs, and 6 in Other category),

academic standing (56 freshmen, 43 sophomores, 35 juniors, and 33 seniors), and first language (150 having English as first language) were also measured at the end of the questionnaire.

Table 1. Descriptive statistics for moderating, mediating, dependent, and control variables

Variables	M	SD	MIN	MAX	Skew.	Kurt.	α
Moderator							
Issue involvement	4.92	1.88	1.00	8.40	-0.50	-0.44	.93
Control variables							
Smoking status*	0.62	0.69	0.00	2.00	0.68	-0.69	
Biased message processing	3.04	1.69	1.00	8.00	0.69	-0.17	.90
Attitudes toward health effects of smoking	1.48	0.86	1.00	7.00	2.83	11.44	.85
Attitudes toward attractiveness of smoking	2.58	1.69	1.00	8.14	1.06	0.37	.92
Mediating variables							
Perceived contingency	4.89	2.28	1.00	9.00	-0.15	-0.92	.85
Presence	6.52	1.76	1.00	9.00	-1.08	1.16	.76
Interface assessment	7.06	1.31	3.00	9.00	-0.69	0.42	.63
Imagery engagement	7.44	1.26	2.00	9.00	-1.37	3.09	.88
Cognitive absorption	5.43	1.53	1.33	8.67	-0.39	-0.17	.88
Self-reported elaboration	7.52	1.19	2.60	9.00	-0.87	0.95	.79
Total amount of thoughts	4.81	2.07	0.00	15.00	1.58	5.10	
Valence of message-related thoughts	2.45	2.54	-4.00	14.00	0.55	3.59	
Valence of website-related thoughts	0.77	1.29	-1.00	5.00	1.50	1.74	
Arousal	4.40	1.59	1.00	8.33	0.07	-0.43	.64
Fear	3.31	2.10	1.00	9.00	0.83	-0.09	.92

Dependent variables							
Perceived interactivity	5.21	2.15	1.00	9.00	-.24	-.87	.91
Attitudes toward health effects of smoking	1.34	0.65	1.00	4.33	2.16	4.34	.76
Attitudes toward attractiveness of smoking	2.29	1.52	1.00	8.14	1.33	1.18	.92
Attitudes toward anti-smoking messages	7.22	1.22	1.33	9.00	-1.32	3.57	.82
Attitudes toward the website	5.27	2.01	1.00	9.00	-0.28	-0.45	.95
Beliefs about the effects of smoking	7.88	1.02	1.00	9.00	-2.51	12.87	.88
Behavioral intention to seek further information	4.86	2.13	1.00	9.00	-0.04	-0.71	.92

* Smoking status was coded as a nominal variable: 0 = nonsmokers (N = 84), 1 = experimenters (N = 63), 2 = established smokers (N = 20).

Table 2. Zero-order correlations of all variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Modality interactivity	1.00																					
2. Dummy variable (Low message interactivity)	-.01	1.00																				
3. Dummy variable (High message interactivity)	.00	-.50**	1.00																			
4. Issue involvement	.01	-.06	.13	1.00																		
5. Biased message processing	.04	.01	.00	-.15	1.00																	
6. Pre-existing attitudes toward smoking	.08	.05	-.05	-.07	.28**	1.00																
7. Perceived contingency	.31**	-.11	.14	.02	-.25**	-.13	1.00															
8. Perceived interactivity	.29**	-.13	.14	.05	-.26**	-.23**	.53**	1.00														
9. Presence	.38**	-.05	.11	.06	-.20**	-.08	.42**	.59**	1.00													
10. Interface assessment	.25**	-.10	.10	-.03	-.22**	-.06	.35**	.51**	.47**	1.00												
11. .Imagery engagement	.16*	.14	-.01	-.01	-.28**	-.10	.23**	.30**	.34**	.32**	1.00											
12. Cognitive absorption	.13	.08	-.02	.05	-.35**	-.22**	.33**	.51**	.35**	.27**	.39**	1.00										
13. Self-reported elaboration	-.01	.02	.18*	.21**	-.26**	-.01	.22**	.19*	.24**	.23**	.42**	.33**	1.00									
14. Number of thoughts	-.16*	-.03	-.03	-.10	-.03	.01	-.04	.01	-.01	-.01	.01	.00	.08	1.00								
15. Valence of message-related thought	-.10	-.11	.16*	-.03	-.24**	-.16*	.24**	.25**	.20**	0.14	.16*	.32**	.21**	.36**	1.00							
16. Arousal	.13	.03	.01	.19*	-.29**	-.08	.23**	.28**	.24**	.18*	.28**	.47**	.24**	-.03	.12	1.00						
17. Fear	.05	.11	-.05	.06	-.12	.01	.15	.10	.09	.03	.16*	.18*	.21**	.03	.04	.32**	1.00					
18. Attitudes toward smoking	-.01	.01	-.04	-.09	.42**	.82**	-.16*	-.28**	-.13	-.15*	-.19*	-.21**	-0.08	-.01	-.20**	-.10	.02	1.00				
19. Attitudes toward the message	.13	.13	.08	.12	-.41**	-.10	.29**	.41**	.26**	.28**	.53**	.46**	.36**	.01	.23**	.30**	.17*	-.17*	1.00			
20. Attitudes toward the website	.14	-.04	.08	.10	-.31**	-.18*	.33**	.59**	.43**	.29**	.30**	.54**	.24**	.13	.29**	.28**	.07	-.17*	.45**	1.00		
21. Beliefs about the effects of smoking	-.07	.10	-.04	.04	-.32**	-.23**	.14	.16*	.13	.27**	.25**	.16*	.25**	.02	.13	.15	.03	-.31**	.27**	.17*	1.00	
22. Behavioral intention	.11	.01	.14	.30**	-.19*	-.05	.28**	.38**	.26**	.16*	.19*	.56**	.31**	-.04	.24**	.32**	.37**	-.07	.35**	.39**	.08	1.00

Data Analysis

General Linear Model (GLM) analyses were used to test the effects of two independent variables (modality interactivity and message interactivity, fully crossed), one continuous moderator (issue involvement), and two control variables (smoking status and biased message processing) on dependent variables proposed in hypotheses. Pre-existing attitudes toward smoking were controlled in all analyses that used the attitudes toward smoking as a dependent variable. To examine the mediating effects proposed by hypotheses, this study adopted a bootstrapping method (Hayes, 2013; Preacher & Hayes, 2008).

RESULTS

The results will be organized based on hypotheses proposed in the literature review section and primary findings. The effects of modality interactivity are analyzed first. After manipulation check, the effects of modality interactivity on imagery engagement are reported first, as proposed by H1 to H6. Next, the effects of modality interactivity on cognitive engagement are reported, as proposed by H7 to H12 and RQ1. Next, we move on to the combinatory effects of message interactivity and issue involvement on cognitive engagement, as proposed by H15 to H23. As an answer to H13, H14, and RQ2, the combinatory effects of all three IVs (i.e. modality interactivity, message interactivity, and issue involvement) on cognitive engagement and emotional engagement are reported at the end. See Table 3 and Table 4 to overview the organization of results section and significant findings.

Manipulation Check

To test whether the manipulations for modality interactivity and message interactivity were psychologically effective, the level of interactivity of the website perceived by participants was analyzed. Modality interactivity and message interactivity were fully-crossed and entered as independent variables. The analysis showed that participants in the modality interactivity condition perceived the website as more interactive, allowing them to perform more actions, and enabling them to access information in more various ways (M = 5.74, SE = .24). The degree of perceived interactivity of those in the control condition was significantly lower than this (M = 4.36, SE = .23), F (1, 152) = 22.08, $p < .001$, $\eta^2 = .13$. For message interactivity, the ratings of high, medium, and low message interactivity conditions showed a marginally significant difference across conditions. Participants in the high message interactivity condition perceived the website the most interactive (M = 5.50, SE = .28), whereas those in the low message interactivity condition perceived the website the least interactive (M = 4.63, SE = .28). The rating of the medium message interactivity condition was in between (M = 5.00, SE = .28), F (2, 152) = 2.80, $p = .06$, $\eta^2 = .04$.

The analysis also revealed a marginally significant interaction effect between modality interactivity and message interactivity, F (2, 152) = 2.53, $p = .08$, $\eta^2 = .03$. Message interactivity positively predicts perceived interactivity, but only in the absence of modality interactivity. In the presence of the slider, participants' perception of the interactivity of the website was not affected by the degree of message interactivity, showing almost the same ratings in the three message interactivity conditions (high: M = 5.86, SE = .40; medium: M = 5.60, SE = .39; low: M = 5.70, SE = .39). In contrast, participants perceived the website with higher message

interactivity as more interactive when the site did not offer any modality interactivity (high: *M* = 5.13, *SE* = .38; medium: *M* = 4.41, *SE* = .37, low: *M* = 3.47, *SE* = .37) (Figure 8).

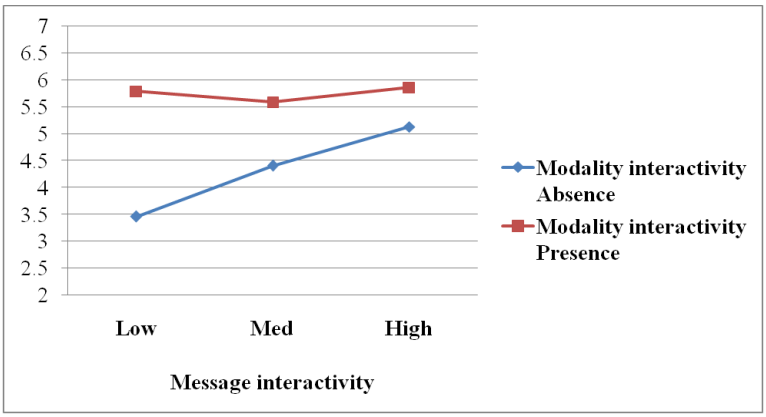

Figure 8. Modality interactivity X message interactivity interaction on perceived interactivity

Effects of Modality Interactivity on Presence, Imagery Engagement, and Attitudes

H1 to H6 predicted (1) positive effects of modality interactivity on the degree of presence and imagery engagement, and (2) mediating effects of presence and imagery engagement (H3 to H6). Figure 9 summarizes the hypothesized relationships between the variables proposed by H1 to H6.

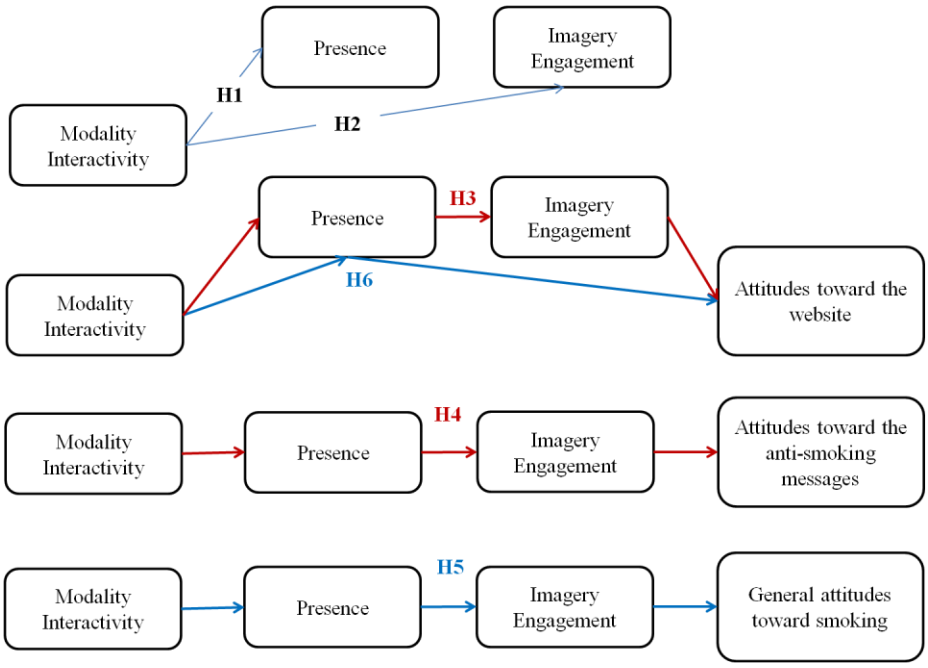

Figure 9. H1 to H6

Presence. H1 hypothesized that modality interactivity, operationalized as the slider, will lead to greater feeling of presence compared to the control condition. In the modality interactivity condition, participants drag the slider to see the continuous changes in faces, brain activity, and lungs after years of smoking. In the control condition, participants scrolled down to see the same set of pictures that describe the negative outcomes of smoking on faces, brain activity, and lungs. In keeping with H1, participants in the modality interactivity condition reported feeling greater degree of presence while they were browsing the website (M = 7.16, SE = .20) compared to those in the control condition (M = 5.78, SE = .19), F (1, 152) = 30.79, p < .001, η^2 = .17. In other words, they were more likely to say that they felt as if they moved or manipulated objects, and engaged all of their senses when interacting with the website, compared to when they were merely scrolling down the static pictures. Thus, H1 was supported.

Imagery engagement. H2 hypothesized that modality interactivity would also lead to greater degree of imagery engagement in participants' mind. The data supported this hypothesis. Participants in modality interactivity condition more easily pictured and visualized the effects of smoking in their mind (M = 7.64, SE = .15) than those who were in the control condition (M = 7.20, SE = .15), F (1, 152) = 5.40, $p < .05$, $\eta^2 = .03$. Thus, H2 was supported.

Attitudes toward the website. Modality interactivity also enhanced participants' attitudes toward the website. Participants in the modality interactivity condition evaluated the whole website as more exciting, cool, imaginative, entertaining, and having higher quality (M = 5.44, SE = .24) than did those in the control condition (M = 4.78, SE = .24), F (1, 152) = 4.75, $p < .05$, $\eta^2 = .03$.

To test H3 and H6, the indirect effects of modality interactivity on attitudes toward the website through presence and imagery engagement was examined. A bootstrapping procedure using 5000 bootstrap samples and bias-corrected confidence intervals (Hayes, 2013) was employed. Modality interactivity was entered as an independent variable in the mediation analysis. Presence and imagery engagement were entered as mediators that operated either separately or in serial. Participants' smoking status and the degree of biased message processing were entered as the same control variables as in the GLM analysis.

As hypothesized, the mediation analysis revealed a significant indirect effect for presence (B = .56, SE = .17, 95% C.I. from .26 to .92). Thus, H6 was supported. Modality interactivity increased the feeling of presence during the browsing task, which in turn, enhanced participants' attitudes toward the website such that the site is more exciting, cool, imaginative, entertaining, and having higher quality.

The result did not reveal any significant indirect effect for imagery engagement (*B* = .03, *SE* = 05, 95% C.I. from -.02 to .18). Although participants in modality interactivity condition reported more easily picturing and visualizing the effects of smoking in their mind than the control condition as revealed by the GLM analysis, this heightened degree of imagery engagement, without the aid of presence, did not translate into more positive attitudes toward the website. The indirect effect through both presence and imagery engagement when they operated in serial was not significant, either (*B* = .05, *SE* = .05, 95% C.I. from -.02 to .17). Thus, H3 was not supported.

Attitudes toward anti-smoking messages. Beyond the attitudes toward the website, the presence of modality interactivity positively influenced participants' attitudes toward the anti-smoking messages that were delivered by the website. Participants in the modality interactivity condition more likely agreed that the anti-smoking messages on the site were believable, informative, insightful, objective, interesting, and clear (*M* = 6.99, *SE* = .13) than did those in the control condition (*M* = 7.38, *SE* = .13), *F* (1, 152) = 5.47, $p < .05$, $\eta^2 = .04$.

To test H4, the indirect effects of modality interactivity on attitudes toward the anti-smoking messages through presence and imagery engagement were tested by the same bootstrapping procedure. In the GLM analysis of the attitudes toward the ant-smoking messages, message interactivity emerged as a significant predictor in addition to modality interactivity. Thus, message interactivity was entered as a controlling variable in the mediation analysis, in addition to the existing two control variables (i.e. smoking status, and the degree of biased message processing). The analysis revealed a significant indirect effect through both mediators in serial (*B* = .11, *SE* = 04, 95% C.I. from .04 to .23).The presence of modality interactivity on the website increased the feeling of presence during the browsing task, which in turn, enabled

participants to more easily picture and visualize the effects of smoking in their mind. This heightened imagery engagement subsequently led to more positive attitudes toward the anti-smoking messages that were delivered by the website. Thus, H4 was supported.

General attitudes toward smoking. Attitudes toward health effects of smoking did not yield any significant result. For attitudes toward attractiveness of smoking, modality interactivity successfully persuaded participants that smoking is not an attractive behavior even after controlling for individuals' pre-existing attitudes toward smoking. After browsing the website, participants who interacted with the slider were less likely to say that smoking, in general, is sexy, pleasant, sociable, glamorous, calming, positive, or favorable (M = 2.29, SE = .10) than those in the control condition (M = 2.55, SE = .10), F (1, 151) = 4.45, $p < .05$, $\eta^2 = .03$. The analysis also revealed a marginally significant interaction between modality interactivity and message interactivity, F (2, 151) = 2.81, $p = .06$, $\eta^2 = .04$. Under high message interactivity condition, participants who interacted with modality interactivity less likely believed that the smoking is an attractive behavior (M = 2.09, SE = .17) than did participants in the control condition (M = 2.74, SE = .16). The difference between two conditions was significant by Tukey HSD's post-hoc test. Thus, the main effect of modality interactivity on attitudes toward attractiveness of smoking was attributed to its effect under the high message interactivity condition (Figure 10).

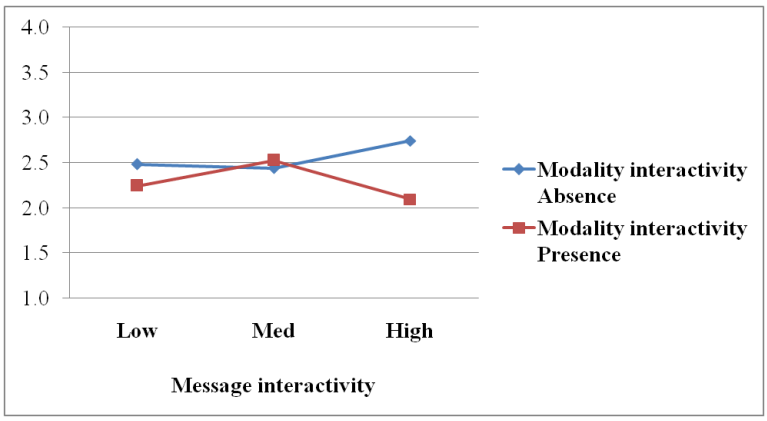

Figure 10. Modality interactivity X message interactivity interaction on attitudes toward attractiveness of smoking

The indirect effects of modality interactivity on attitudes toward attractiveness of smoking were examined to test H5. In addition to participants' smoking status and the degree of biased message processing, their pre-existing attitudes toward attractiveness of smoking, message interactivity, and the interaction between modality interactivity and message interactivity were entered as control variables in the mediation analysis. The result shows that neither presence nor imagery engagement is a significant mediator. The degree of imagery engagement and the feeling of presence enhanced by modality interactivity did not explain any difference in participants' attitudes toward attractiveness of smoking. Thus, H5 was not supported. Figure 11 summarizes findings from H1 to H6. Supported hypotheses are marked by solid lines.

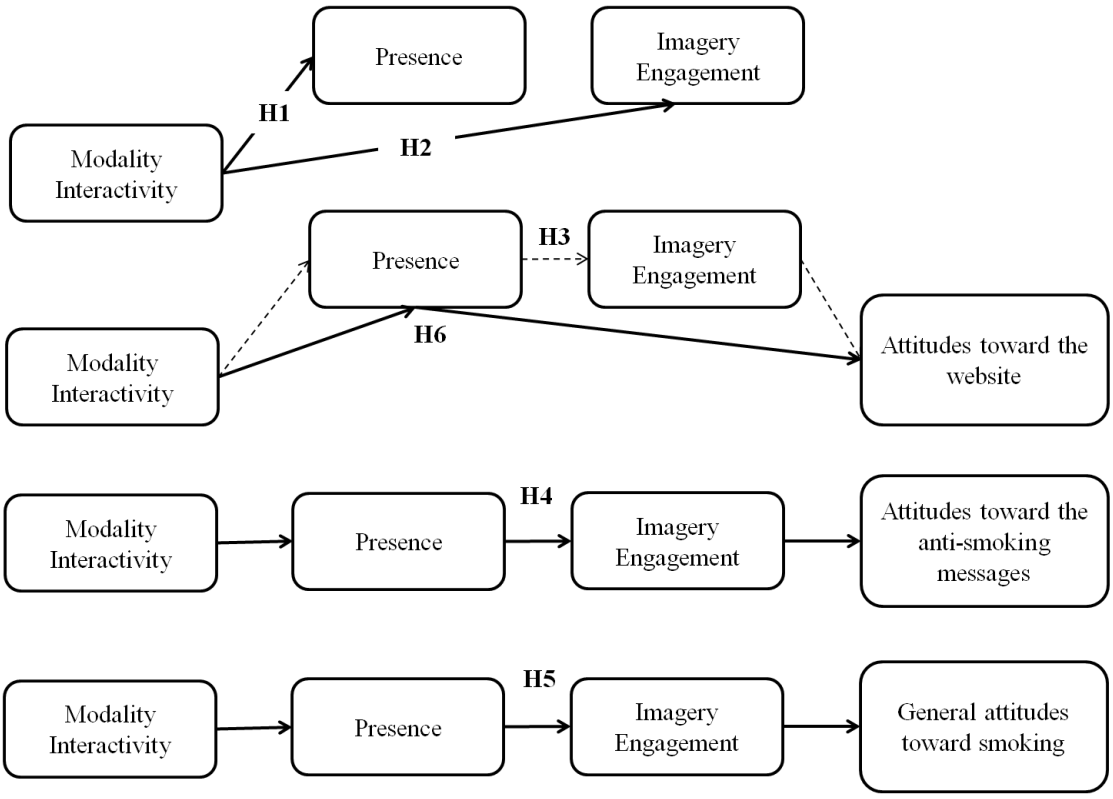

Figure 11. Findings from H1 to H6

Effects of Modality Interactivity on Interface Assessment, Cognitive Absorption, and Attitudes

Thus far, this dissertation has analyzed the effects of modality interactivity on imagery engagement and attitudes. Next, we will turn to the effects of modality interactivity on cognitive engagement and related variables. H7 to H12 proposed (1) positive effects of modality interactivity on interface assessment and cognitive absorption, and (2) indirect, positive effects of modality interactivity on individuals' attitudes through interface assessment and/or cognitive absorption. Figure 12 summarizes the relationships hypothesized by H7 to H12.

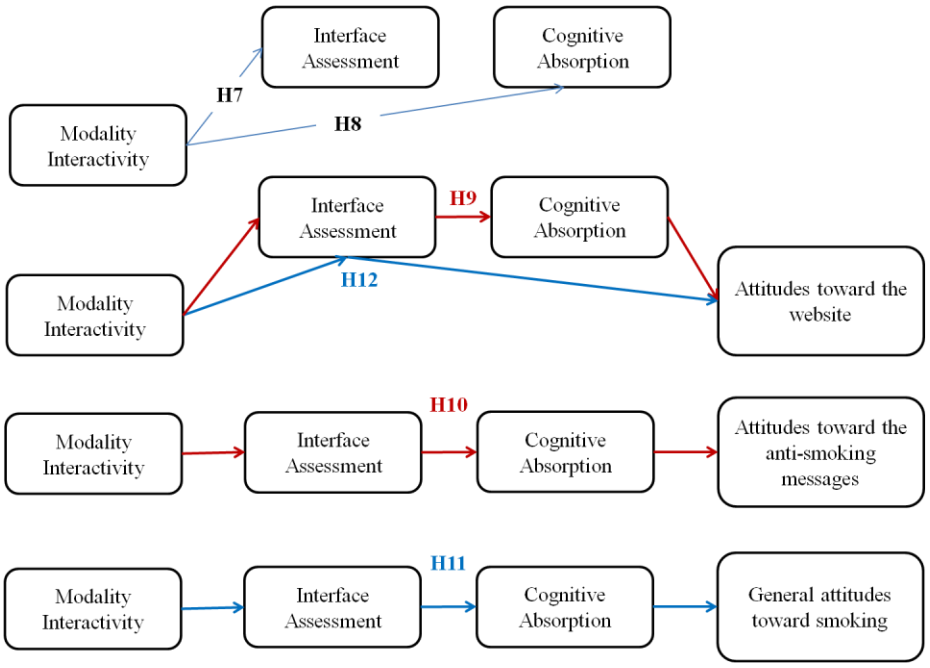

Figure 12. H7 to H12

Interface assessment. Modality interactivity successfully enhanced individuals' interface assessment. The analysis found that participants in the modality interactivity condition evaluated the interface as more intuitive, natural, and easy to interact with (M = 7.36, SE = .16) compared to those in the control condition (M = 6.61, SE = .15), F (1, 152) = 14.66, $p < .001$, $\eta^2 = .09$. Thus, H7 was supported.

Cognitive absorption. Individuals reported being more absorbed while browsing the website when the site was equipped with the slider. Participants in the modality interactivity condition agreed that they were more absorbed in the browsing task and that their attention was less diverted while they were browsing the website (M = 5.58, SE = .18), compared to those in the control condition (M = 5.07, SE = .17), F (1, 152) = 5.30, $p < .05$, $\eta^2 = .03$. Thus, H8 was supported.

Attitudes toward the website. The indirect effect of modality interactivity on attitudes toward the website was examined. The result shows that interface assessment cannot mediate the relationship between modality interactivity and individuals' attitudes toward the website by itself, without going through cognitive absorption (*B* = .14, *SE* = .09, 95% C.I. from -.01 to .36). Thus, H12 was not supported.

Instead, the indirect effect through both interface assessment and cognitive absorption was significant when these mediators operated in serial (*B* = .08, *SE* = .05, 95% C.I. from .01 to .22). Individuals perceived the website with modality interactivity as more intuitive, natural, and easy to interact with, and these positive perceptions of the interface increased their level of cognitive absorption while browsing. Subsequently, this heightened level of cognitive absorption led to better attitudes toward the website, leading participants to rate it as more exciting, cool, imaginative, entertaining, fun, and having higher quality. Therefore, H9 was supported.

Attitudes toward anti-smoking messages. The indirect effect of modality interactivity on individuals' attitudes toward the anti-smoking message through interface assessment and cognitive absorption was also examined. Message interactivity, smoking status, and the degree of biased message processing were entered as control variables. The analysis revealed that interface assessment and cognitive absorption mediated the effect of modality interactivity in serial (*B* = .04, *SE* = .02, 95% C.I. from .01 to .10). The slider gave rise to more positive assessments of the interface, which subsequently leads to greater feelings of being absorbed in the browsing task. This increased cognitive absorption ultimately was associated with greater agreement that the anti-smoking messages on the site are believable, informative, insightful, objective, interesting, and clear. Therefore, H10 was also supported.

General attitudes toward smoking. The indirect effect of modality interactivity on general attitudes toward smoking was not significant. For both interface assessment and cognitive absorption, the analyses did not reveal any significant mediating effect. Thus, H11 was not supported. Figure 13 summarizes findings from H7 to H12. Supported hypotheses are marked by solid lines.

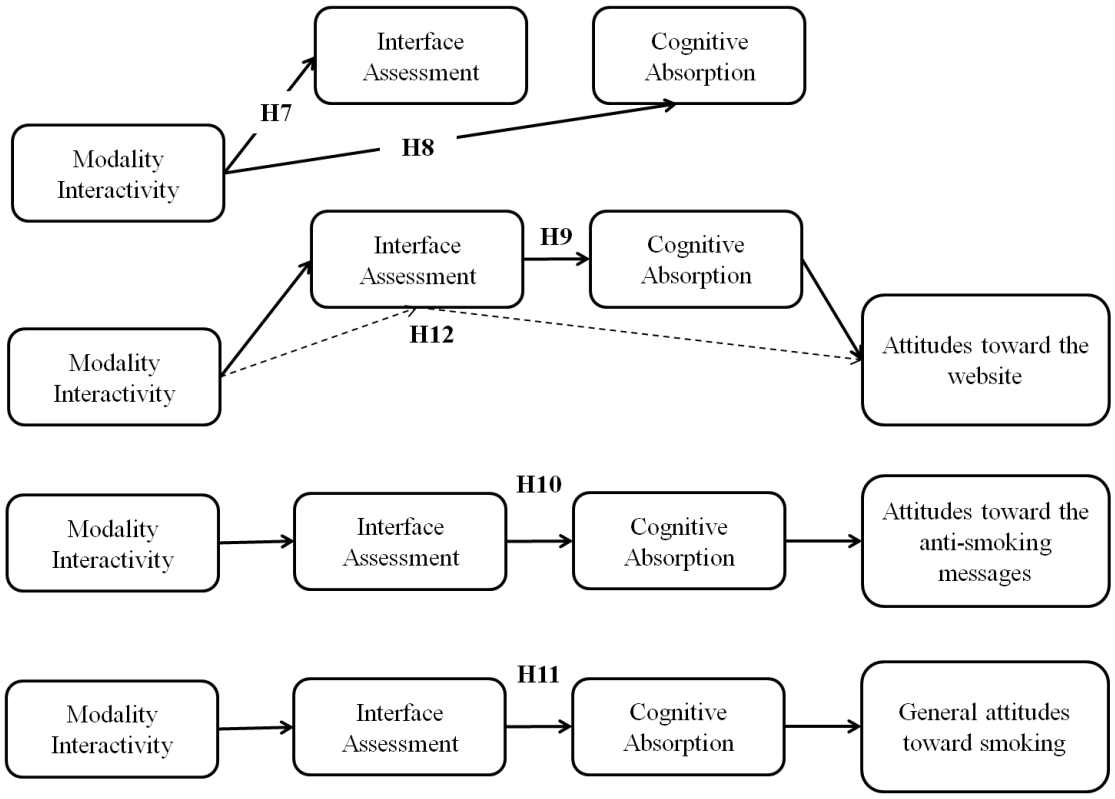

Figure 13. Findings from H7 to H12

Effects of Modality Interactivity on Message Elaboration

Message elaboration. RQ1 asks the effect of modality interactivity on individuals' message elaboration. The total number of thoughts participants generated after browsing the website showed a significant difference between the modality interactivity condition and the

control condition, F (1, 151) = 4.11, $p < .05$, $\eta^2 = .03$. The presence of the slider inhibited participants from generating thoughts about the anti-smoking messages. In the thought-listing measures, participants in the modality interactivity condition generated less number of thoughts (M = 4.44, SD = .26), compared to the control condition (M = 5.10, SD = .26). Self-reported elaboration did not differ across two conditions.

Combinatory Effects of Modality interactivity, Message Interactivity and Issue Involvement on Perceived Contingency, Cognitive Absorption, Message Elaboration, Attitudes, and Beliefs

Thus far, we have analyzed the effects of modality interactivity. The analysis also revealed a number of combinatory effects of modality interactivity, message interactivity, and issue involvement. H15 and H16 proposed the positive effects of message interactivity on perceived contingency and cognitive absorption, respectively. H17 hypothesized that perceived contingency would mediate the positive effect of message interactivity on cognitive absorption. H18 to H20 proposed the positive effects of message interactivity on perceived contingency, message elaboration, attitudes toward the messages, and belief about the effects of smoking. H21 and H23 proposed moderating effects of issue involvement. Figure 14 summarizes H15 to H23.

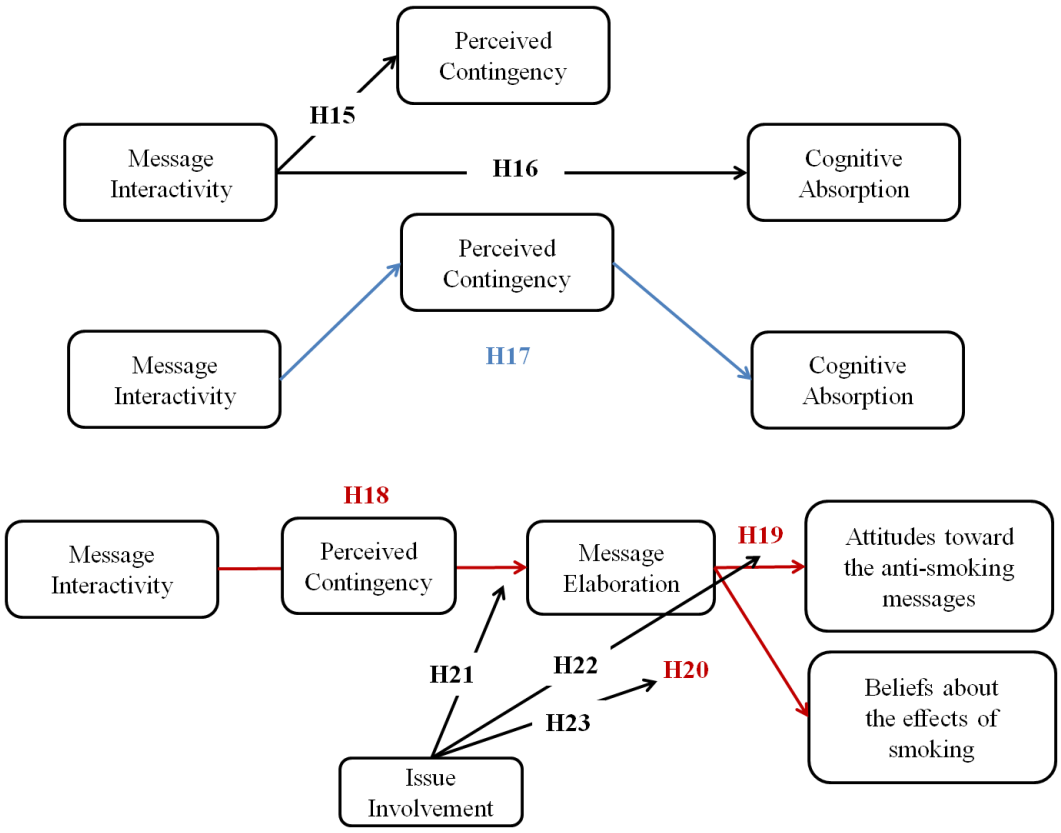

Figure 14. H15 to H23

Perceived contingency. In the low message interactivity condition, participants browsed the entire website simply scrolling to the bottom of the page without any hyperlinks. In the medium message interactivity condition, they had a homepage with three hyperlinks with which they were directed to three sub-topics relevant to smoking. After clicking one of three hyperlinks on the homepage, they were exposed to three paragraphs of information, and then able to click the next button to proceed the last layer where they could see pictorial information about the effects of smoking. In the high message interactivity condition, participants shared the same homepage with those in the medium message interactivity condition. Upon clicking one of three hyperlinks on the homepage, they were able to open three paragraphs of information by clicking three hyperlinks one by one. Clicking the next button directed them to proceed to the same last layer of the webpage with the medium interactivity condition. High message interactivity condition was also equipped with breadcrumbs that visualized the pages participants went through.

The perceived contingency showed a marginally significant difference across three conditions, F (2, 152) = 2.40, p = .09, η^2 = .03. Participants in the high message interactivity condition perceived the site as the most contingent to their actions, such that the site offered back and forth interactions with them, the information on the website was well connected to their actions, and the site was aware of the actions they performed (M = 5.16, SE = .29). The medium message interactivity condition yielded lower rating on the perceived contingency (M = 4.59, SE = .29), followed by the lowest rating of the low message interactivity condition (M = 4.33, SE = .29). Thus, H15 was marginally supported.

The interaction effect between modality interactivity and message interactivity was highly significant, F (2, 152) = 7.30, $p < .001$, η^2 = .09. It turned out that increasing message

interactivity enhanced perceived contingency only when there was no modality interactivity on the website (Figure 15). The main effect of modality interactivity was also highly significant, showing that participants perceived the website as more contingent to their actions in the modality interactivity condition (M = 5.45, SE = .25) than in the control condition (M = 3.94, SE = .24), F (1, 152) = 23.17, $p < .001$, $\eta^2 = .13$.

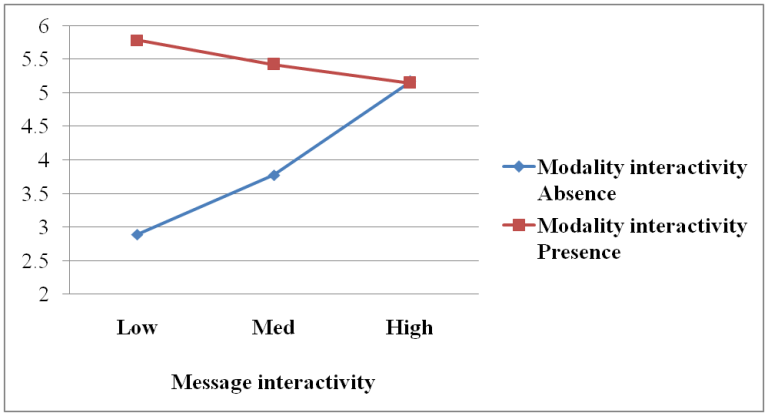

Figure 15. Modality interactivity X message interactivity interaction on perceived contingency

Cognitive absorption. In the analysis of cognitive absorption, message interactivity did not yield any significant result. A mediation test using the bootstrapping procedure did not show any significant mediating effect of perceived contingency on cognitive absorption. Thus, H16 and H17 were not supported.

Message elaboration. In the analysis of self-reported elaboration, a significant main effect of message interactivity emerged, F (2, 152) = 3.61, $p < .05$, $\eta^2 = .04$. Participants showed greater message elaboration under the high message interactivity condition (M = 7.87, SE = .16) than under the medium message interactivity condition (M = 7.29, SE = .16). The low message interactivity condition was in between (M = 7.61, SE = .17) (Figure 16). Tukey HSD post-hoc

test revealed that the difference between high and medium message interactivity conditions was significant.

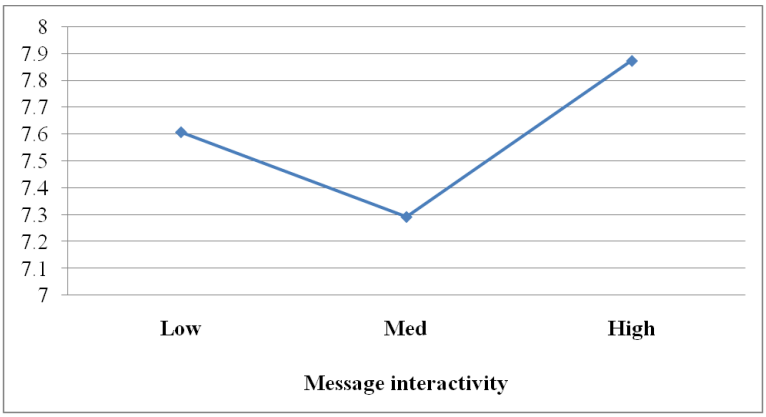

Figure 16. Main effect of message interactivity on self-reported elaboration

H21 hypothesized that issue involvement will moderate the effect of message interactivity on message elaboration. The analysis revealed that the interaction effect between message interactivity and issue involvement was not significant, F (2, 152) = 2.45, p = .09. Thus, H21 was not supported.

Attitudes toward anti-smoking messages. Message interactivity significantly influenced participants' attitudes toward the anti-smoking messages on the website, F (1, 152) = 4.80, p < .01, η^2 = .06. Participants more likely thought that the anti-smoking messages are believable, informative, insightful, objective, interesting, and clear under the low message interactivity condition (M = 7.30, SE = .16) than under the medium message interactivity condition (M = 6.83, SE = .16). The difference between low and medium message interactivity conditions was significant by Tukey HSD post-hoc test. The high message interactivity condition (M = 7.44, SE = .16) scored in the middle (Figure 17).

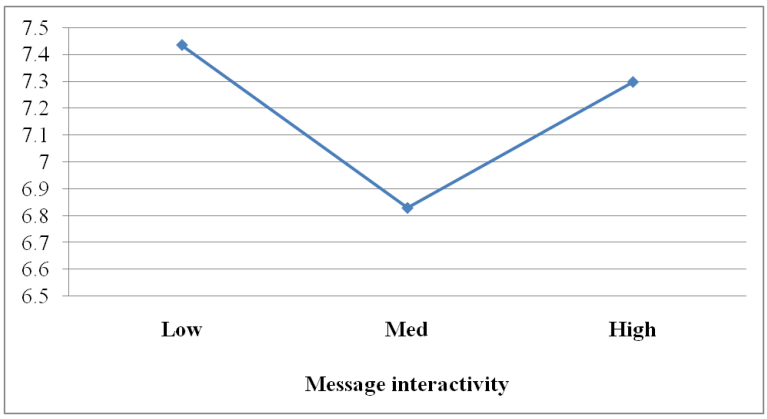

Figure 17. Main effect of message interactivity on attitudes toward the anti-smoking messages

H18 and H19 were tested by a mediation analysis with perceived contingency and self-reported elaboration as two mediators. Message interactivity was dummy-coded and entered as two independent variables. Given that medium message interactivity condition showed the lowest rating both for self-reported elaboration, it was used as a baseline for dummy-coding the other two conditions (i.e. D_1: Low = 1, Med = 0, High = 0; D_2: Low = 0, Med = 0, High = 1). Modality interactivity, smoking status, and degree of biased message processing entered as control variables.

The bootstrapping analysis showed that perceived contingency and message elaboration did not have a mediating effect on attitudes toward anti-smoking messages when both of the mediators were included in the model, *B* = .01, *SE* = .01, 95% C.I. from -.00 to .05. Thus, H18 was not supported. However, message elaboration showed a significant mediating effect on attitudes toward anti-smoking messages. Without perceived contingency, the bootstrapping analysis showed that the difference between the high- and the medium-interactivity condition (i.e. D_2) had a significant indirect effect on attitudes toward anti-smoking messages, *B* = .17, *SE* = .07, 95% C.I. from .06 to .34. High message interactivity increased message elaboration

compared to medium message interactivity, which in turn, enhanced participants' attitudes toward the messages such that the anti-smoking messages were deemed to be more believable, informative, insightful, objective, interesting, and clear.

Given that perceived contingency showed a significant difference among the three conditions of message interactivity only in the absence of the slider, the control condition (i.e. non-slider condition) was separately tested. Only for the participants who did not have the slider (N = 88), the indirect effects of perceived contingency and message elaboration were significant on their attitudes toward anti-smoking messages, for D_2 (i.e. the difference between medium and high message interactivity), B = .04, SE = .04, 95% C.I. from .00 to .16. In other words, high message interactivity condition significantly increased perceived contingency compared to medium interactivity condition, in the absence of the slider. This heightened sense of contingency translated into greater message elaboration, which finally resulted in more positive attitudes toward anti-smoking messages.

To test H22, a median split was performed to create the high- and low- involvement groups. The median score was 5.1 on a 9-point scale. Separate bootstrapping analyses were performed for the high- and low- involvement groups. As hypothesized by H22, degree of self-reported elaboration showed a significant mediating effect only for the low-involvement group. The differences between (1) low and medium message interactivity (D_1) and (2) the difference between high and medium interactivity (D_2) were significantly mediated by the degree of self-reported elaboration (for D_1: B = .20, SE = .11, 95% C.I. from .03 to .49; for D_2: B = .27, SE = .12, 95% C.I. from .08 to .57). Low and high message interactivity led to greater message elaboration compared to medium message interactivity, such as thinking about what actions they could take based on what they browsed, making connections between the website content and

what they have read or heard about elsewhere, and thinking of practical applications of what they browsed, compared to the medium message interactivity condition. Subsequently, the greater elaboration by low and high message interactivity enhanced participants' attitudes toward the anti-smoking messages delivered by the website, such that the messages are more believable, informative, insightful, objective, interesting, and clear.

In sharp contrast, there was no mediating effect of elaboration for the high-involvement group (for D_1: B = -.03, SE = .11, 95% C.I. from -.25 to .19; for D_2: B = .06, SE = .01, 95% C.I. from -.01 to .01). For high-involvement participants, only the direct effect of message interactivity on attitudes toward the anti-smoking messages was significant, F (2, 73) = 5.13, p < .01. The effect of message interactivity was highly significant on high-involvement individuals' attitudes toward the message even after the degree of elaboration was controlled. High (M = 7.58, SD = .18) and low (M = 7.80, SD = .20) message interactivity elicited more favorable attitudes toward the message than medium message interactivity (M = 6.97, SD = .21).

Beliefs about the effects of smoking. To examine H18 and H20, a mediation analysis with self-reported elaboration as a mediator was performed. The analysis found that compared to medium message interactivity, low or high message interactivity led to greater message elaboration, which in turn, formed stronger beliefs about the effects of smoking described by the website (for D_1: B = .09, SE = .06, 95% C.I. from .01 to .24; for D_2: B = .11, SE = .06, 95% C.I. from .02 to .28).

H23 hypothesized that the degree of systematic message processing can affect participants' beliefs about the effects of smoking only for low-involvement participants, in that the engaging potential of message interactivity would work for the low-involvement individuals. Separate mediation analyses for the low-involvement group and the high-involvement group

were performed to examine this hypothesis. The result did not support H23. Neither the mediation analysis of the low-involvement group (for D_1: B = .11, SE = .10, 95% C.I. from -.01 to .43; for D_2: B = .17, SE = .12, 95% C.I. from -.002 to .48) nor the analysis of the high-involvement group (for D_1: B = .06, SE = .10, 95% C.I. from -.09 to .35; for D_2: B = .06, SE = .10, 95% C.I. from -.09 to .35) yielded a significant mediating effect of systematic processing.

Instead of a mediated moderating effect of issue involvement, a significant moderating effect of issue involvement was found. A significant interaction between message interactivity and issue involvement on participants' belief about the effects of smoking emerged, F (2, 152) = 3.45, $p < .05$, $\eta^2 = .04$ (Figure 18). For low-involvement participants, high message interactivity led to more beliefs about the negative effects of smoking, such that smoking would result in reduced IQ, brain shrinkage, premature aging and wrinkles, lung cancer, mucus congestion, emphysema, and stained teeth, compared to low or medium message interactivity. For high-involvement participants, higher message interactivity led to less belief about these outcomes. They more likely believed that smoking could cause the negative health outcomes under the low message interactivity condition than under the medium condition, and more likely believed it under the medium condition and under the high condition (Figure 18).

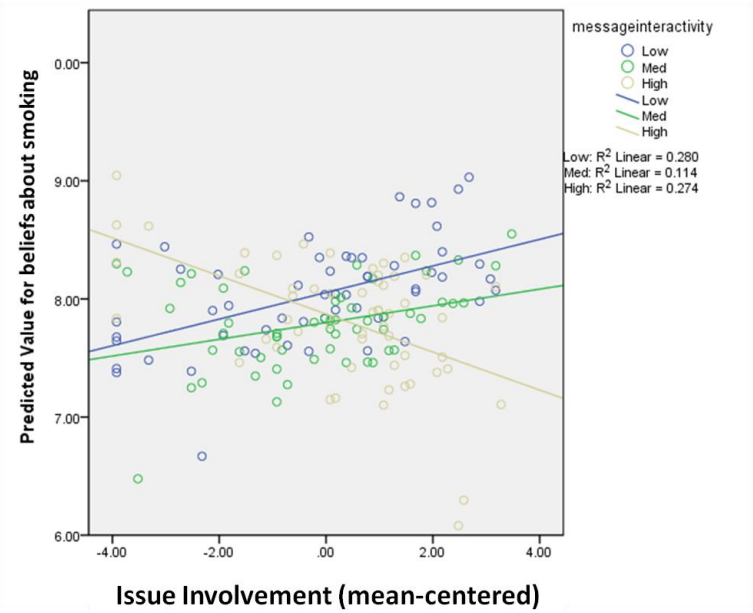

Figure 18. Interaction between message interactivity and issue involvement on beliefs about the effects of smoking

The two-way interaction was further qualified by a marginally significant three-way interaction of modality interactivity, message interactivity, and issue involvement, F (2, 152) = 2.67, p = .07, η^2 = .03. Separate analyses for the modality interactivity group and the control group were performed to probe the three-way interaction. The two-way interaction of message interactivity and issue involvement remained valid only for the modality interactivity group, F (2, 69) = 4.69, p < .05 (right graph in Figure 19). For participants in the control group, no interaction effect of message interactivity and issue involvement was found, F (2, 80) = .06, p = .94 (left graph in Figure 19). Figure 20 summarizes findings from H15 to H23. Supported hypotheses are marked by solid lines. H19 to H22 received supported only for the high- and medium-interactivity conditions.

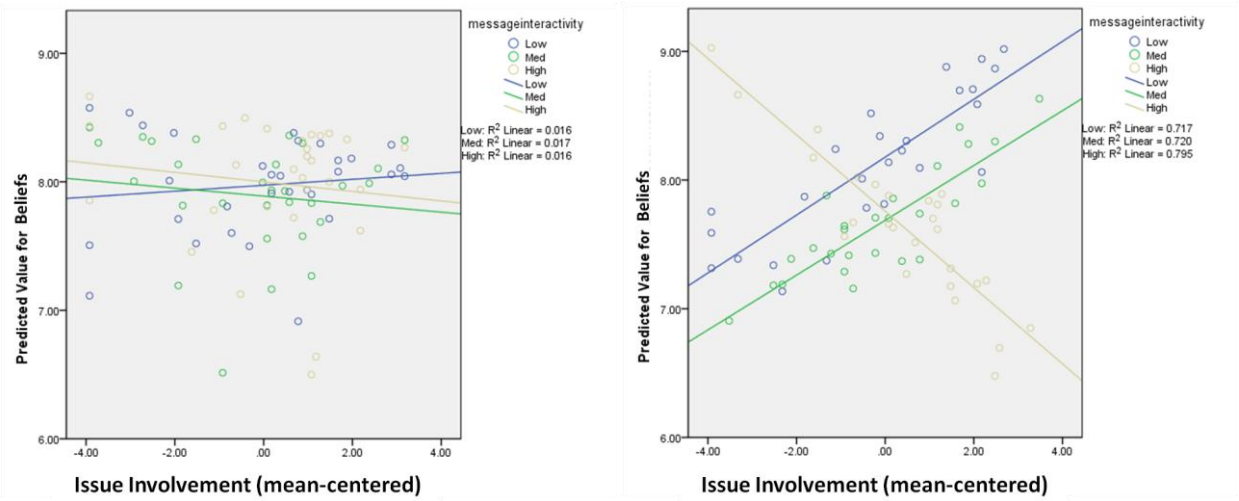

Figure 19. Modality interactivity X message interactivity X issue involvement interaction on beliefs about the effects of smoking (left: control condition, right: modality interactivity condition)

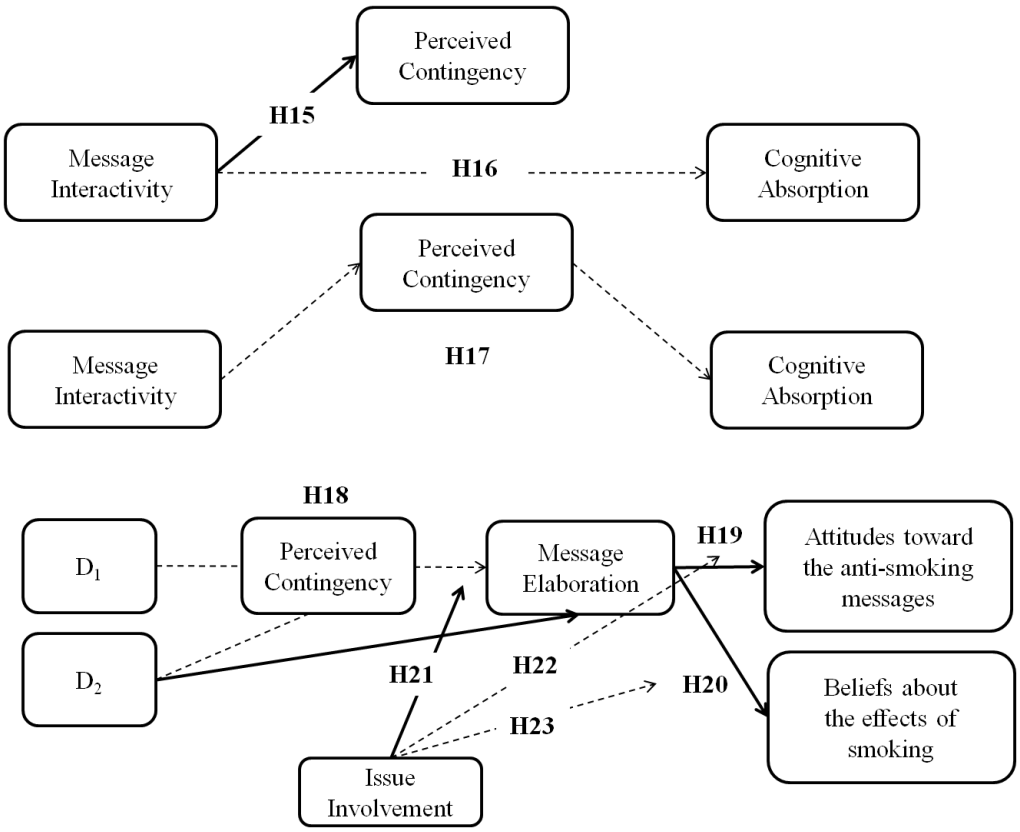

Figure 20. Findings from H15 to H23 (D_1: Low = 1, Med = 0, High = 0; D_2: Low = 0 , Med = 0 , High = 1)

Combinatory Effects of Modality Interactivity, Message Interactivity, and Issue Involvement on Emotional Engagement and Behavioral Intention

Thus far, the combinatory effects of modality interactivity, message interactivity, and issue involvement on cognitive engagement have been reported. Now we turn to the combinatory effects of all three IVs on emotional engagement and other related variables. H13a and H13b proposed that modality interactivity would lead to more emotional engagement with the website by arousing participants and by eliciting fear. H14 hypothesized that modality interactivity would have an indirect effect on participants' behavioral intention through fear. Figure 21 summarizes H13a to H14.

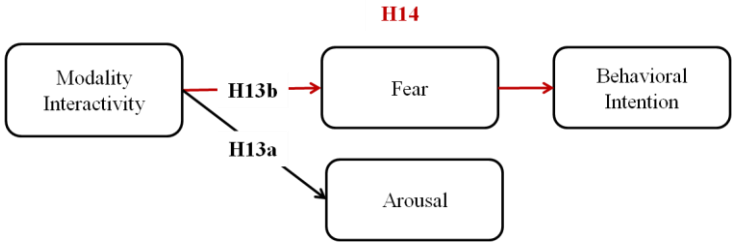

Figure 21. H13 and H14

Arousal. H13a proposed that modality interactivity can arouse participants with its ability to emotionally engage them. As hypothesized, the analysis revealed a significant main effect of modality interactivity on the level of arousal, F (1, 152) = 4.56, $p < .05$, $\eta^2 = .03$. Participants in modality interactivity condition reported feeling more aroused, wide-awake, and stimulated while browsing the website (M = 4.62, SE = .19) than did participants in the control condition (M = 4.12, SE = .18).

In addition, the analysis revealed a significant three-way interaction of modality interactivity, message interactivity, and issue involvement, F (2, 152) = 4.18, $p < .05$, $\eta^2 = .05$. To probe the three-way interaction, separate analyses for modality interactivity condition and the control condition were performed. For participants in the control condition (left graph in Figure 24), increasing issue involvement enhances the level of arousal under the low and high message interactivity conditions. However, it rather decreases the level of arousal under the medium interactivity condition. The two-way interaction between message interactivity and issue involvement was marginally significant, F (2, 80) = 3.08, p = .05. For participants in the modality interactivity condition (right graph in Figure 22), the message interactivity X issue involvement interaction was not significant, suggesting that issue involvement generally enhances arousal regardless of message interactivity conditions, F (2, 69) = 1.10, p = .34.

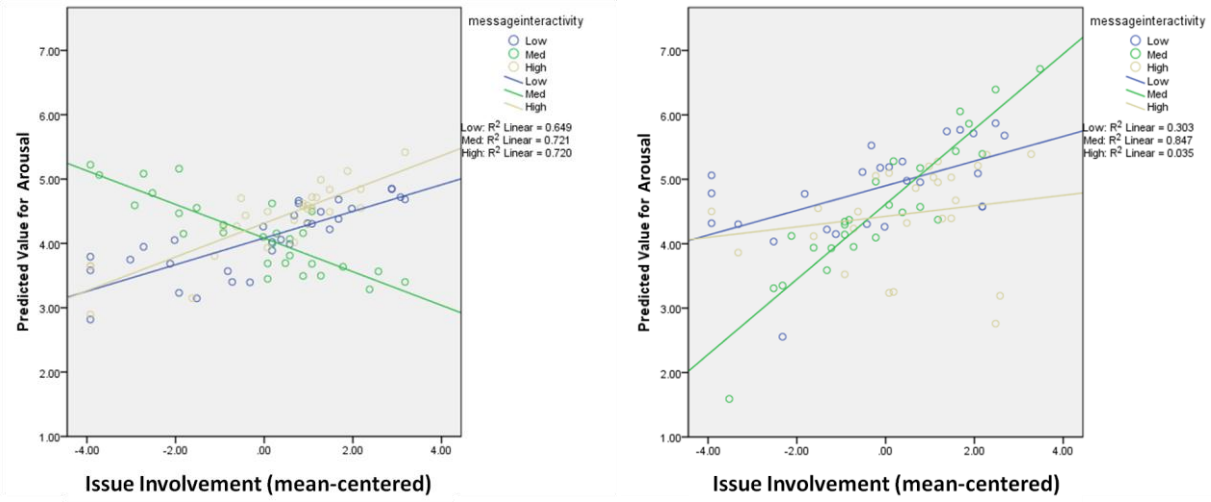

Figure 22. Modality interactivity X message interactivity X issue involvement interaction on arousal (left: control condition, right: modality interactivity condition)

*Fear***.** H13b hypothesized that participants would feel more fearful while browsing when there is the slider on the website. Instead of finding a main effect of modality interactivity, two

interaction effects were found. First, the analysis revealed a marginally significant two-way interaction between modality interactivity and message interactivity, F (2, 152) = 2.83, p = .06, η^2 = .04. Compared to the control condition, the presence of the slider aroused fear under the low message interactivity condition, but it reduced fear under the high message interactivity condition (Figure 23).

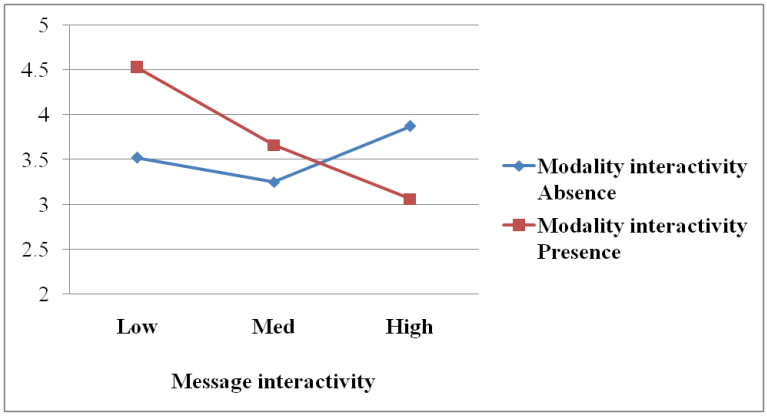

Figure 23. Modality interactivity X message interactivity interaction on fear

Secondly, a significant three-way interaction of modality interactivity, message interactivity, and issue involvement was found, F (2, 152) = 3.40, $p < .05$, η^2 = .04. Separate analyses for the modality interactivity condition and the control condition were performed to probe the three-way interaction. Under the control condition, the two-way interaction between message interactivity and issue involvement was not significant, F (2, 80) = .07, p = .93 (left graph in Figure 24). In contrast, under the modality interactivity condition, the message interactivity X issue involvement interaction was significant, F (2, 69) = .4.23, $p < .05$. For the low message interactivity condition, increasing issue involvement rather reduced fear, whereas it aroused fear for the medium message interactivity condition. For high message interactivity condition, issue involvement did not affect the level of fear.

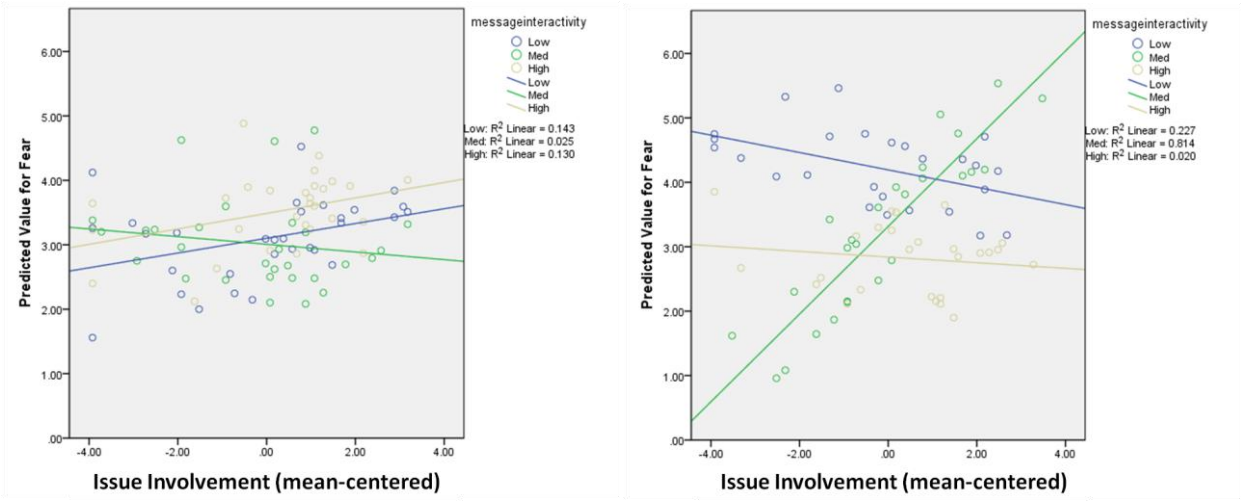

Figure 24. Modality interactivity X message interactivity X issue involvement interaction on fear (left: control condition, right: modality interactivity condition)

Behavioral intention to seek further information. A significant three-way interaction was found in the analysis on participants' behavioral intention to seek more information about smoking, F (2, 152) = 4.24, $p < .05$, $\eta^2 = .05$. In the absence of modality interactivity, increasing issue involvement generates more behavioral intention to seek information regarding smoking only under the low and high message interactivity conditions, whereas it does not create any difference under the medium message interactivity condition, F (2, 80) = 1.93, $p = .15$ (left graph in Figure 25). In the presence of modality interactivity, the pattern was the opposite – increasing issue involvement enhances behavioral intention to seek more information only under the medium message interactivity condition, whereas it does not strongly predict individuals' behavioral intention under the low and high message interactivity conditions, F (2, 69) = 2.26, $p = .11$ (right graph in Figure 25).

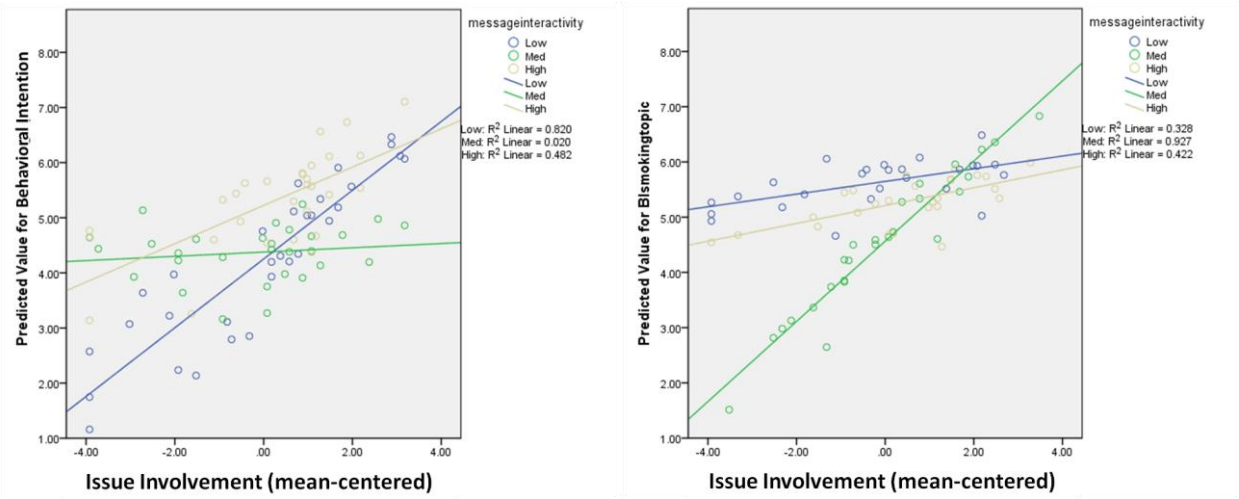

Figure 25. Modality interactivity X message interactivity X issue involvement interaction on behavioral intention to seek information (left: control condition, right: modality interactivity condition)

Given that H14 proposes the mediating effect of fear on participants' behavioral intention to seek further information, a mediation analysis was employed with fear as a mediator. The result showed that the three-way interaction effect created by the difference between medium message interactivity and low message interactivity was mediated by fear, *B* = -.31, *SE* = .19, 95% C.I. from -.80 to -.02. In the absence of modality interactivity, increasing issue involvement arouses fear only under low message interactivity condition, and reduced fear under medium interactivity condition. However, when the site is equipped with modality interactivity, it is under medium interactivity condition where increasing issue involvement can arouse fear. Subsequently, this three-way interaction effect on fear translates into almost the same three-way interaction effect on behavioral intention to seek more information – at the absence of modality interactivity, it is low message interactivity with which increasing issue involvement induces greater fear. At the presence of modality interactivity, it is medium message interactivity

condition under which higher issue involvement creates greater fear. Figure 26 summarizes findings from H13 to H14.

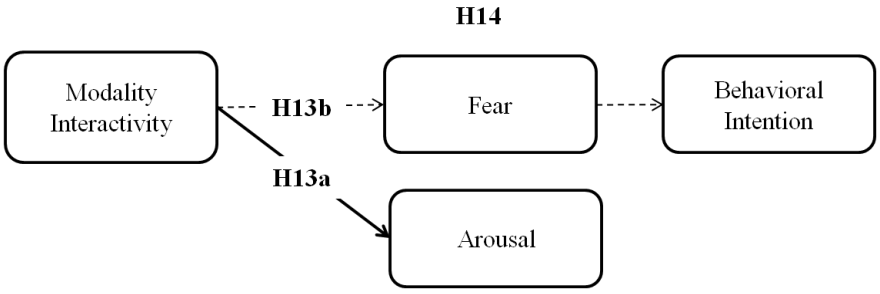

Figure 26. Findings from H13 to H14

Effects of Control Variables

Biased message processing. The degree of biased message processing negatively predicted most of the outcome variables. It negatively predicted the feeling of presence (t (151) = -2.40, $p < .05$, $\eta^2 = .03$), and interface assessment (t (152) = -2.25, $p < .01$, $\eta^2 = .05$). If individuals processed the message in a biased way, thinking that the message was distorted, overblown, boring, and manipulative, they were less likely to experience the state of presence while they were browsing the website, and less likely agree that the interface is natural, easy to use, and intuitive. Biased message processing also negatively predicted the degree of imagery engagement with the website (t (152) = -3.79, $p < .001$, $\eta^2 = .09$), and self-reported elaboration (t (152) = -3.38, $p < .001$, $\eta^2 = .07$). If individuals processed the message in a defensive way, they were less likely able to picture or visualize the outcomes of smoking in their mind, and less likely to make connections between what they browsed and what they experienced before. The attitudes toward the website (t (152) = -3.25, $p < .01$, $\eta^2 = .07$), attitudes toward the anti-smoking messages (t (152) = -5.62, $p < .001$, $\eta^2 = .17$), and beliefs about the effects of smoking (t (152) =

-3.39, $p < .001$, $\eta^2 = .07$) were also negatively influenced by the biased message processing. Individuals who were involved in biased message processing were less likely thought that the anti-smoking website were exciting, cool, entertaining, etc.. When participants processed the messages in a biased way, they less likely thought that the messages are believable, informative, insightful, objective, interesting, and clear, and less likely believed that smoking can cause negative outcomes described by the website. In addition, biased message processing led to more favorable attitudes toward smoking such that smoking is sexy, pleasant, sociable, glamorous, calming, positive, and favorable (t (151) = 4.00, $p < .001$, $\eta^2 = .10$), after controlling their pre-existing attitudes.

Smoking status. Smoking status made significant differences on several dependent variables. The differences among established smokers, experimenters, and nonsmokers were examined by Tukey's HSD Post-hoc test. Participants' smoking status significantly affected fear. Established smokers were more likely feel afraid and scared than nonsmokers or experimenters while browsing (F (2, 152) = 4.30, $p < .05$, $\eta^2 = .05$). Smoking status also adjusted their attitudes toward attractiveness of smoking, F (2, 152) = 4.47, $p < .05$, $\eta^2 = .06$. Established smokers more likely believed that the smoking is sexy, pleasant, sociable, glamorous, calming, positive, and favorable than nonsmokers, after controlling the preexisting attitudes. In the analysis of thought-listing measures, established smokers generated less favorable thoughts about the message compared to nonsmokers, F (2, 150) = 3.37, $p < .05$, $\eta^2 = .06$.

An additional analysis examined smoking status as a moderator instead of issue involvement. In short, arousal and behavioral intention to seek further information revealed significant moderating effects of smoking status. First, there was a significant interaction effect between smoking status and modality interactivity on arousal, F (2, 149) = 3.19, $p < .05$.

Established smokers reported being less stimulated, excited, frenzied, wide-awake, jittery, and aroused while browsing the website with the slider. For experimenters and nonsmokers, the presence of slider showed a positive effect on the level of arousal (Figure 27).

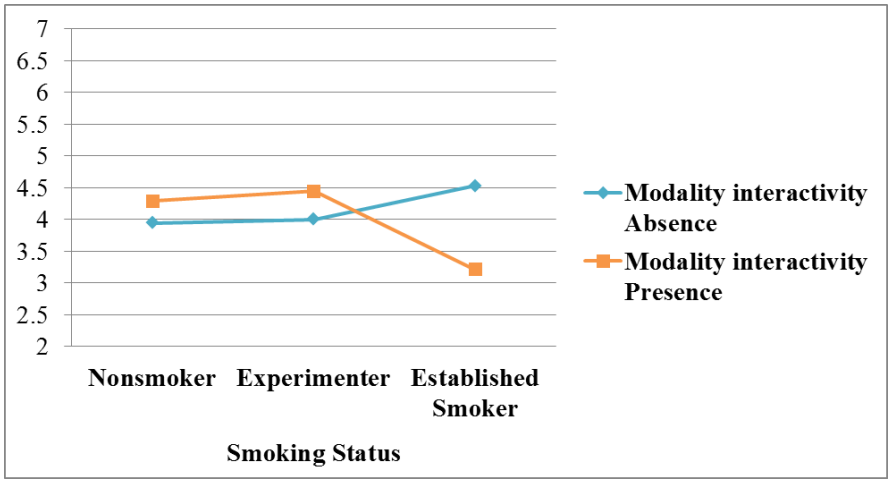

Figure 27. Modality interactivity X smoking status interaction on arousal

A significant three-way interaction was found in behavioral intention to seek further information, F (4, 149) = 2.70, $p < .05$. For nonsmokers, the presence of slider boosted their behavioral intention to seek further information only in the absence of message interactivity on the website, showing that the sliders can effectively attract nonsmokers when they are the only interactive features on the website (left graph in Figure 28). Experimenters and established smokers showed a drastic difference in the modality interactivity X message interactivity interaction. For experimenters, the low and high message interactivity conditions equally increased their behavioral intention, only in the absence of sliders (middle graph in Figure 28). However, for established smokers, the low and high message interactivity condition could increase their behavioral intention only in the presence of sliders (right graph in Figure 28). Refer to Oh and Sundar (2013) for further discussion of these findings.

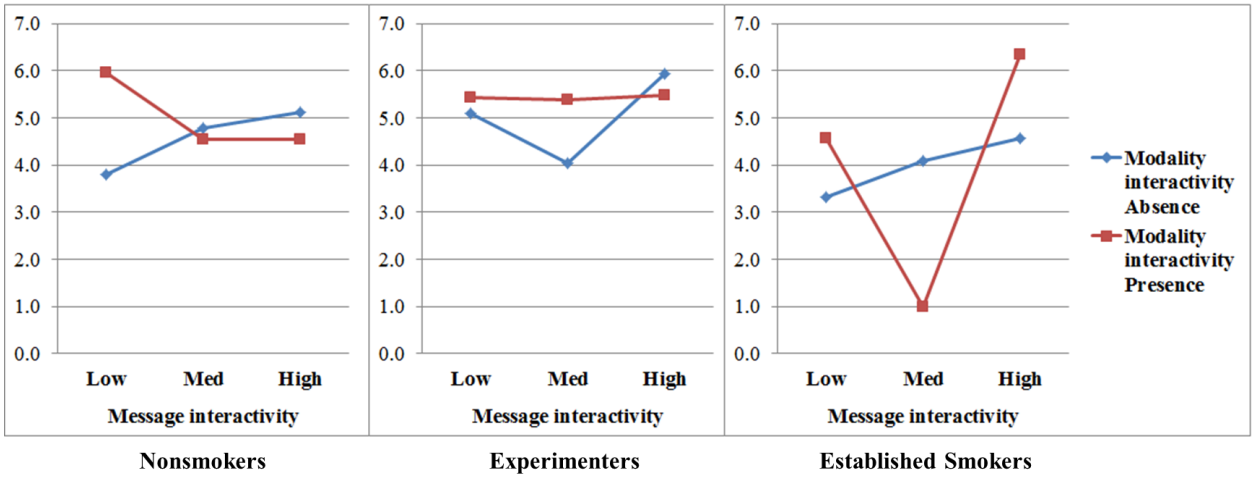

Figure 28. Smoking status X modality interactivity X message interactivity interaction on behavioral intention

Table 3 lists stated hypotheses and actual support of findings.

Table 3. List of hypotheses and support

Hypotheses	Support
Effects of Modality Interactivity on Imagery Engagement	
H1: Modality interactivity will lead to greater feeling of presence compared to the control condition.	Y
H2: Modality interactivity will lead to greater imagery engagement compared to the control condition.	Y
H3: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more positive attitudes toward the website.	N
H4: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more positive attitudes toward anti-smoking messages that are delivered by the website.	Y
H5: Greater feeling of presence and imagery engagement created by modality interactivity will, in turn, lead to more negative attitudes toward smoking, after controlling pre-existing attitudes toward smoking.	N
H6: Greater feeling of presence created by modality interactivity will directly lead to more positive attitudes toward the website.	Y
Effects of Modality Interactivity on Cognitive Engagement	
H7: Modality interactivity will lead to more positive interface assessment compared to the control condition.	Y
H8: Modality interactivity will lead to higher cognitive absorption compared to the control condition.	Y
H9: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more positive attitudes toward website.	Y
H10: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more positive attitudes toward anti-smoking messages that are delivered by the website.	Y
H11: More positive interface assessment and higher cognitive absorption created by modality interactivity will, in turn, lead to more negative attitudes toward smoking, after controlling pre-existing attitudes toward smoking.	N
H12: More positive interface assessment created by modality interactivity will directly lead to more positive attitudes toward website.	N
RQ1: Does higher modality interactivity, operationalized as slider, lead to greater message elaboration compared to the control condition?	N
Effects of Modality Interactivity on Emotional Engagement	
H13: Higher modality interactivity will create greater emotional engagement with the content compared to the control condition as indicated by greater level of arousal (H13a) and greater level of fear (H13b) among participants.	H13a: Y H13b: N
H14: Greater fear induced by modality interactivity will leads to greater behavioral intention to seek information.	N
Effects of Message Interactivity on Cognitive Engagement	
H15: Higher message interactivity will lead to greater perceived contingency*.	Y
H16: Higher message interactivity will lead to greater cognitive absorption while browsing.	N
H17: Greater perceived contingency resulted from message interactivity will lead to greater cognitive absorption while browsing.	N
H18: Greater perceived contingency resulted from message interactivity will lead to greater elaboration of anti-smoking messages.	N
H19: Greater message elaboration will mediate the relationship between message interactivity and attitudes toward messages*.	Y
H20: Greater message elaboration will mediate the relationship between message interactivity and belief about the effects of smoking*.	Y
Combinatory Effects of Message Interactivity and Issue Involvement on Cognitive Engagement	
H21: Higher message interactivity will result in greater message elaboration of anti-smoking messages, only for low-involvement participants.	N
H22: Message elaboration will mediate the relationship between message interactivity and attitudes	N

toward messages, only for low-involvement participants.

H23: Message elaboration will mediate the relationship between message interactivity and beliefs about messages, only for low-involvement participants. N

* These hypotheses were supported only for D_2, the difference between high message interactivity and medium message interactivity.

Summary of Findings

First, modality interactivity, in the form of slider tool, enhanced both the feeling of presence while browsing and imagery engagement, which in turn, resulted in more favorable attitudes toward the anti-smoking messages. Modality interactivity also directly affected participants' attitudes toward attractiveness of smoking such that they perceived smoking as a less attractive behavior after interacting with the slider to see the changes in a smoker's face, brain activity, and lungs after years of smoking.

Modality interactivity led to better interface assessment and higher cognitive absorption in the website. These two factors, in turn, contributed to more favorable attitudes toward the anti-smoking site as well as its messages.

The effect of modality interactivity on message elaboration was negative. The presence of the slider significantly reduced the amount of message-related thoughts after browsing. In contrast, message interactivity enhanced message elaboration for participants. High level of message interactivity successfully elicited greater elaboration, as reflected by the self-reported measure of elaboration, compared to medium level of message interactivity. The greater elaboration elicited by the high level of message interactivity translated into both more favorable attitudes toward the anti-smoking messages and stronger beliefs about the negative effects of smoking than the medium message interactivity. The greater message elaboration elicited by high message interactivity transferred over to better attitudes toward the anti-smoking messages

only for low-involvement participants. For high-involvement individuals, message interactivity was not associated with their level of elaboration.

Participants' beliefs about the effects of smoking were influenced by the combinatory effect of modality interactivity, message interactivity, and issue involvement. For those who have low personal involvement with the smoking issue, all the interaction possibilities provided by high message interactivity led to greater beliefs about the information described by the website. However, for those who were already involved in the issue of smoking, the fact that the website was full of action possibilities reduced their beliefs about the effects of smoking described by the website.

Modality interactivity moderates the effect of message interactivity on the level of fear. In the presence of modality interactivity, there was a clear negative effect of message interactivity on the level of fear such that the higher the message interactivity, the less fearful the participants felt. The psychological effect of the slider, with its vivid depiction of negative outcomes of smoking, was most pronounced when other parts of the website contained no message interactivity.

The medium message interactivity condition allowed increasing issue involvement to enhance level of fear in participants' mind when the slider was absent. Under low or high message interactivity conditions, the effect of issue involvement on fear was negligible. This three-way interaction effect on level of fear transferred over participants' behavioral intention to seek more information. Table 4 summarizes significant findings.

Table 4. Summary of significant findings

Significant Findings*
Perceived Interactivity • Slider > Control • High > Medium > Low + (only in the absence of modality interactivity)
Perceived Contingency • Slider > Control • High > Medium > Low + (only in the absence of modality interactivity)
Presence and Imagery Engagement • Slider > Control
Interface Assessment and Cognitive Absorption • Slider > Control
Message Elaboration • Slider < Control • High > Low > Medium
Valence of message-related thoughts • High > Medium > Low +
Arousal • Slider > Control • Increasing issue involvement enhanced the level of arousal under the low and high message interactivity conditions. Issue involvement decreased the level of arousal under the medium interactivity condition (only in the absence of modality interactivity)
Fear • The slider aroused fear under the low message interactivity condition, but it reduced fear under the high message interactivity condition • Issue involvement reduced fear for low message interactivity, but it aroused fear for medium message interactivity
Attitudes toward the website • Slider → Greater feeling of presence → More positive attitudes toward the website • Slider → More positive interface assessment and higher cognitive absorption → More positive attitudes toward the website
Attitudes toward the anti-smoking messages • Slider → Greater feeling of presence and imagery engagement → More positive attitudes toward the anti-smoking messages • Slider → More positive interface assessment and higher cognitive absorption → More positive attitudes toward the anti-smoking messages • Low > High > Medium • High (vs. Medium) → Greater message elaboration → More positive attitudes toward the anti-smoking messages (only for low-involvement participants)
Attitudes toward attractiveness of smoking • Slider < Control (only under high message interactivity condition)
Beliefs about the negative effects of smoking • Low or High (vs. Medium) → Greater message elaboration → Stronger beliefs about the negative effects of smoking • For low-involvement participants, high message interactivity led to stronger beliefs, whereas for high-involvement participants, low or medium message interactivity led to stronger beliefs (only in the presence of modality interactivity)
Behavioral Intentions to seek further information • In the absence of modality interactivity, increasing issue involvement generates more behavioral intention to seek information regarding smoking only under the low message interactivity conditions • The three-way interaction effect was mediated by fear

[*] Slider denotes modality interactivity condition, and Control denotes the control condition. High, Medium, and Low denote the high, medium, and low message interactivity conditions.
[+] Marginally significant findings.

DISCUSSION

Interpretation of Findings

The two types of website interactivity employed by the stimulus website led to a number of different psychological outcomes in user engagement. The levels of imagery engagement, cognitive engagement, and emotional engagement shaped by the two species of website interactivity significantly influenced participants' attitudes, beliefs, and behavioral intention.

Effects of modality interactivity on presence, imagery engagement, and attitudes. Modality interactivity led to greater imagery engagement. When users were able to make changes in a smoker's face, brain, and lungs by interacting with the slider, the interaction significantly enhanced the feeling of presence – they felt like moving or manipulating objects, felt involved by the visual aspects of the website, and felt that all of their senses were engaged while browsing. Compared to three static pictures delivering the same information, this heightened sense of presence allowed them to more easily visualize the negative effects of smoking in their mind. In turn, this enhanced imagery engagement was a determinant of attitudes toward the anti-smoking messages delivered by the website. The more imagery engagement users experienced, the more positive attitudes toward the anti-smoking messages were formed, leading them to say that the messages are believable, informative, objective, interesting, and clear.

This finding suggests that even the simple addition of the slider on the website can create the feeling of presence. Compared to the elaborately developed virtual worlds or augmented

reality in previous presence literature (e.g. Gorini, Gaggioli, Vigna, & Riva, 2008), the slider feature employed in the study website involved only a simple motion of dragging the slider over three different pictures. Still, observing the changes across three pictures while moving the slider was enough for eliciting greater feelings of presence in participants' mind. A widely-used definition of presence is "a sense of being there" in a mediated environment (Biocca, 2002; IJsselsteign, de Ridder, Freeman, & Avons, 2000). The consequence of interacting with the slider approaches this notion of presence perhaps because the gradual changes in the smoker's looks, brain, and lungs accompanied by the mouse movement replicate the feeling of manipulating objects in real world. Schlosser (2003) points out that the direct manipulation enabled by interactivity is key to the formation of vivid imagery in the user's mind. In her experiment, actually manipulating a virtual product with the aid of modality interactivity yielded more imagery about purchasing behavior in participants' mind, compared to watching a film of the same interactive site without any interaction. The current study further decomposes the process of shaping imagery in individuals' mind – it is the feeling of presence induced by interactivity that can facilitate the visualization process.

Consistent with previous literature on imagery engagement (Babin & Burns, 1998), greater level of imagery engagement transferred to more favorable attitudes toward the anti-smoking messages, leading participants to say that the messages are more believable, informative, objective, interesting, and clear. This finding suggests that when individuals are enabled to easily shape the mental imagery of the content described by media, the imagery provides more vivid, richer cues to clearly understand and receive the information. As a result, their attitudes toward the message can become more favorable. Previous literature has found that the primary effect of mental imagery is to adjust individuals' behavioral intention rather than their attitudes toward the

message because mental imagery tends to help them simulate their behaviors (Schlosser, 2003). The finding from this study suggests that mental imagery can also shape individuals' attitudes toward the message perhaps because it provides additional cognitive cues for processing the information.

Modality interactivity also positively affected participants' attitudes toward the website, by enhancing the feeling of presence. The degree of imagery engagement did not play a mediating role in shaping more favorable attitudes toward the website. This result is expected given that imagery engagement addressed how easily individuals pictured or visualized the content or message delivered by the website, rather than evaluations of the website. Adding a modality interactivity feature can make the entire website more exciting, high-quality, fun, cool, imaginative, and entertaining, owing to its potential to enhance the feeling of presence.

Effects of modality interactivity on cognitive engagement, interface assessment, and attitudes. Participants' cognitive engagement was also affected by modality interactivity. In terms of cognitive absorption while browsing, users felt more absorbed and attentive while browsing the website with modality interactivity. A mediation analysis found that this positive effect of modality interactivity is attributable to the fact that it creates a more natural, intuitive, and easy-to-use interface for users. The final outcomes of enhancing cognitive absorption in the website included better attitudes toward the anti-smoking messages delivered by the website, as well as better attitudes toward the website itself. It turned out that the perception of the interface as natural, intuitive, and easy-to-use could not directly influence website attitudes, unless it increased participants' cognitive absorption.

This finding is consistent with the theoretical model of interactivity effects proposed by Sundar (2007). When the website enables natural, easy, and intuitive interactions, the chances of

being absorbed in browsing will be most heightened because users can allocate more cognitive resources toward the browsing task, rather than operating the interface. Thus, one of the mechanisms by which modality interactivity can increase individual's perceptual bandwidth is attributed to the fact that it makes the interaction between the user and system more natural and easy to handle. With this increased perceptual bandwidth, users would feel more absorbed in the browsing, which can transfer over more favorable attitudes toward the entire website, such that the site is more exciting, high-quality, fun, cool, imaginative, and entertaining.

The more intriguing finding about the interface assessment and cognitive absorption is their mediating effects on participants' attitudes toward the message. According to dual process models, it is systematic processing, not absorption, that can adjust attitudes toward a message. In fact, Green and Brock (2000) point out an important conceptual difference between the feeling of immersion (e.g. cognitive absorption and transportation) and systematic processing. The state of being immersed is a convergent process in that it requires users to be solely focused on the interaction with the media, by investing all perceptual and cognitive resources to follow the media content. Systematic processing is a more divergent process in that it requires users to diverge from the focused involvement in the media and make connections to their previous knowledge or experiences.

The findings of the current study suggest that not only systematic processing of the messages, but also the cognitive absorption into the browsing task elicited by modality interactivity can shape more favorable attitudes toward the messages. In a sense, this is consistent with what transportation theory has suggested. Transportation theory has pointed out that the feeling of absorption into a story can elicit greater beliefs consistent with the story, both when it contains a fictional narrative or facts. However, the unique contribution of this study is

that the cognitive absorption measured in this study is at the level of medium (i.e. the website), rather than at the level of the message or content. The findings of the current study suggests that playing with a modality interactivity feature on the website has the potential to absorb users into interacting with the website, and the interaction itself is enough to create better attitudes toward the messages, without necessarily going through systematic processing of the messages.

This potential of modality interactivity is further qualified by the number of thoughts that participants generated during the thought-listing procedure. The interaction with the slider actually decreased the total number of thoughts, suggesting that it inhibited participants from engaging in further message elaboration. Nevertheless, the aforementioned findings suggest that interacting with the slider can enable users to become absorbed in the browsing task, which ultimately leads to more favorable attitudes toward the persuasive messages as well as better attitudes toward the website.

Effects of message interactivity on message elaboration and attitudes. It is notable that the way message interactivity persuades users is different from modality interactivity. The data suggest that high message interactivity increased message elaboration for participants compared to medium message interactivity. High level of message interactivity successfully elicited higher elaboration reflected by the self-reported measure of elaboration, compared to the medium level of message interactivity. The greater elaboration elicited by the high level of message interactivity translated into both more favorable attitudes toward anti-smoking messages and stronger beliefs about the negative effects of smoking.

Consistent with previous findings (Sundar, Kalyanaraman & Brown, 2003; Tremayne & Dunwoody, 2001), this result suggests that contingency-based interactivity can actually trigger central processing of the website rather than function simply as a peripheral cue. Compared to

the medium condition, the high message-interactivity condition had two distinctive features: the presence of hyperlinks for three sub-issues of the selected topic, and the presence of breadcrumbs that allowed users to keep track of their locations on the website. These contingent responses from the website, such as opening each sub-issue upon clicking and showing them their locations on the site led to more message elaboration of the content.

Sundar et al (2003) found that interactivity predicted users' attitudes toward the message in non-linear pattern - moderately interactive website led to the most positive perception about the political candidate, showing an inverted-V pattern. They said that the higher navigational load for the high message interactivity condition inhibited participants from generating positive attitudes about the message. The current study rules out this confounding factor. The current study website had two important distinctions from the study design of Sundar, Kalyanaraman, and Brown (2003). In Sundar et al (2003)'s study, participants in the high interactivity condition had to go through more layers of webpage than the medium interactivity condition since clicking sub-issues of each topic directed them to another webpage. In contrast, the current study design enabled users to open each sub-issue on the same page, without moving to another layer of webpage (see Figure 7 for screenshot). Also, Sundar et al (2003) did not adopt any navigational aid for the high-interactivity condition, whereas the current study employed breadcrumbs for the high message interactivity condition. The effectiveness of this study design is evidenced by a null relationship between message interactivity and usability measures, F (2, 152) = 1.97, p = .14. The null finding suggests that the current study design successfully evens out the navigational load across three message-interactivity conditions. Thus, the finding of this study implies that the high level of message interactivity can significantly enhance participants'

elaboration about the message and the subsequent attitudes and beliefs about the message when it does not endanger more navigational load for users.

Another intriguing finding of this study is the negative psychological effects of the medium message-interactivity condition. When participants had two layers of hyperlinks and no breadcrumb that could guide their navigation, they were least likely to engage in message elaboration. The negative effects of moderate level of interactivity can be attributed to the nature of interaction users performed under the medium interactivity condition. First, it is noticeable that the medium and high conditions shared the same homepage and the same website structure except for the hyperlinks for sub-issues and breadcrumbs. Taking the website at face value, the medium condition is as interactive and as well-organized, as the high condition. However, upon clicking one of the three links embedded on the homepage under the medium-interactivity condition, users would notice that this seemingly interactive website does not provide any further contingent interaction between them and the website, except for the "back" and "next" button. In other words, the website promises high level of interactivity at the beginning, but only ends up discouraging users to further interact with any aspect of the website. This discouragement is actually worse than providing them no interactivity in the first place (as in the low message interactivity condition). The data suggest that frustration prevented them from further message elaboration, such as thinking about what actions they might take and making connections between the website content and what they already know. Xu and Sundar (2012)'s argument also supports this prediction. They found that the medium interactivity condition, in which their participants could only click different product images (without any additional layers of interaction) led to the least amount of motivation to further explore the site. They argued that the

"click to change picture" function in the medium interactivity condition merely served as "false affordances" (p. 23) in that it could not match user expectations for action possibilities on the site.

Further, the medium interactivity condition provided only a minimal level of interaction, such as selecting one of the three issues on the homepage, and clicking the "back" and "next" buttons, which were not central to understanding the anti-smoking messages embedded on the website. In contrast, the high message interactivity condition allowed users to interact with the most important aspects of the anti-smoking messages – the three sub-issues for each topic by opening the sub-issues one by one. Compared to this, the interaction under the medium interactivity condition only distracted users from thinking about the message, without helping them elaborate on the information. Thus, the finding suggests that when contingency-based interactivity does not provide any meaningful interactions with the content, it can actually reduce users' message elaboration and result in negative attitudinal outcomes.

The positive impact of low message interactivity is surprising. The low level of message interactivity actually elicited almost the same degree of message elaboration as the high level of message interactivity, suggesting that mere scrolling without any hyperlinks can help users engage in thinking about the message. In addition, the greater elaboration created by low message interactivity transferred over to greater beliefs about the effects of smoking described by the website. Given that the study design successfully ruled out navigational load or usability as a confound, the positive effect of low interactivity condition can be attributed to the fact that simple scrolling can be a way to stay focused on the subject while reading three different topics about smoking. Even though participants perceived the low message interactivity condition as least contingent and least interactive, the simplicity of the website (by requiring very little user interaction) actually allowed them to focus on the advocated message while reading the content.

It is also noteworthy that the two measures of message elaboration yielded different results in this study. Whereas self-reported elaboration showed the aforementioned positive effects of both low and high message interactivity, an indicator of message elaboration emerged from the thought-listing measure (i.e. valenced message-related thoughts) showed a linear increase across three message interactivity conditions at a marginally significant level. The effects of modality interactivity also showed difference across the two measures. The slider condition yielded less number of thoughts than the control condition in the thought-listing measure, but the self-reported measure did not show any significant difference between the two conditions. In this study, self-reported message elaboration focuses on the degree to which participants consciously tried to make connections between new information and what they already knew about the topic, whereas thought-listing measure captures broader reactions from the new information, including either consciously or unconsciously generated thoughts. In addition, the thought-listing measure taps into not only the depth of thinking but also the valence of their thoughts. When interactivity works as a heuristic appeal such as the slider, the thought-listing technique might be better choice to capture rich data from participants than the narrowly defined self-reported elaboration measure. When interactivity operates through contingency (i.e. message interactivity), two measures would capture two different aspects of the effects of interactivity on message elaboration – one is the conscious cognitive effort to mobilize previous knowledge, and the other is a broader range of cognitive responses.

Combinatory effects of message interactivity and issue involvement on message elaboration and beliefs about the effects of smoking. The effects of message interactivity were moderated by issue involvement. The greater elaboration elicited by high and low levels of message interactivity transferred over better attitudes toward the anti-smoking messages, only for

low-involvement participants. Sundar et al (2003) already pointed out that message interactivity could yield the same level of engagement for apathetic users and highly involved users in a political campaign website, based on the null finding for the interaction effect of issue involvement on participants' attitudes. The current study further underscores the potential of message interactivity to engage low-involvement individuals, by revealing that its effects on message elaboration and attitudes are more pronounced for those apathetic users. According to the well-established dual-process models, low-involvement individuals are supposed to be more receptive to heuristic cues, and less prone to systematically process the persuasive messages. The current finding suggests that there is a way to direct these apathetic users to perform more message elaboration – providing well-designed message interactivity, which allows them to interact with the core content of persuasive messages. When message interactivity successfully enhances elaboration, it subsequently enhances their attitudes toward the anti-smoking messages, showing evidence that central processing by high message interactivity can actually occur for low-involvement individuals.

For high-involvement individuals, message interactivity did not make any difference in their level of message elaboration. This is to be expected given that the average level of message elaboration was already quiet high (M = 6.4, SD = .81, N = 83). Therefore, message elaboration did not yield any mediating effect on their attitudes toward the anti-smoking messages. Interestingly, however, message interactivity significantly predicted their attitudes toward the message even after controlling for the degree of elaboration such that high and low message interactivity yielded more favorable attitudes toward the persuasive messages than medium message interactivity. This suggests that there is another factor apart from systematic processing that can determine high-involvement participants' attitudes toward the messages. One

speculation could be that high- and low-interactivity condition equally aid participants to stay focused on reading the given materials, whereas moderately interactive condition distracts them from reading the content. The high-interactivity condition can make users attentive by its ability to unfold each sub-issue one by one upon their clicking, i.e., by chunking content for them. The low-interactivity condition can engage high-involvement participants in reading the material with its simple, linear alignment of text. Given that high-involvement individuals are already motivated to scrutinize the content, the website designs of high and low message interactivity can ensure that they can pay attention to the content without being distracted, thus leading to positive attitudes toward the content.

Participants' beliefs about the effects of smoking on their looks, brain, and respiratory system were also affected by the combinatory effect of message interactivity and issue involvement. It was under the high message interactivity condition where the relationship between issue involvement and beliefs showed the unexpected pattern, such that issue involvement *negatively* predicted beliefs about the effects of smoking described by the study website. Low-involvement participants more likely believed the negative outcomes of smoking under the high-interactivity condition, whereas high-involvement participants less likely believed the information about smoking under the same condition. Under the low and medium interactivity condition, increasing issue involvement simply led to greater beliefs.

Given that degree of elaboration did not yield any mediating effect on beliefs about smoking, this finding shows evidence of heuristic processing. According to Heuristic-systematic model (Chaiken, 1987), heuristic processing and systematic processing can occur simultaneously. On one hand, high message interactivity can lead to systematic processing for low-involvement participants as evidenced by the mediating effect of self-reported elaboration on their attitudes

toward the message, owing to the engaging capability of message interactivity. On the other hand, high message interactivity has its heuristic value. The high message interactivity condition takes into account what users went through by providing breadcrumbs, and offers more action possibilities. For those who have low personal relevance about the smoking issue, all the interaction possibilities provided by high message interactivity might function as heuristic cues that can lead them to greater beliefs about the information described by the website. However, for those who are already highly involved in the issue of smoking, website interactivity does not appear to hold any positive heuristic value. Instead, the fact that the website is full of action possibilities reduced their beliefs about the effects of smoking described by the website because the presence of hyperlinks and breadcrumbs can be considered as bells-and-whistles, rather than as credible tools that can engage them further.

The three-way interaction finding further supports this theory. The two-way interaction between message interactivity and issue involvement on participants' beliefs about the effects of smoking turned out to be significant only under the modality interactivity condition. When the modality interactivity group was separately tested, the pattern was far clearer such that high message interactivity, combined with the modality interactivity, significantly *reduced* beliefs of highly involved participants. Sundar (2008) suggests one possible mechanism for the negative effects of the presence of website interactivity – bells- and-whistles heuristic. High-involvement individuals might not appreciate the presence of interactive features given that they are more interested in the content itself, and also they might have seen enough similar websites before. In this case, the interactive features can be considered as mere bells and whistles, which can lead them to less likely believe the content delivered by the website.

Combinatory effects of modality interactivity and message interactivity on perceived interactivity, perceived contingency, and attitudes toward smoking. One of the unique contributions of this study is that it examines the combinatory effect of two different types of website interactivity. Indeed, modality interactivity interacts with message interactivity in a number of interesting ways. First, the level of perceived interactivity and contingency of the website were significantly affected by the combinatory effect of modality interactivity and message interactivity. The presence of the slider boosted participants' perception of interactivity so much so that the level of message interactivity hardly made a difference. Increasing message interactivity enhanced their perception of interactivity of the website only in the absence of modality interactivity. It seems that modality interactivity provides more evident "interactive" features such as manipulating the slider across different pictures, whereas message interactivity offers more subtle ways of interacting with the content like the presence of hyperlinks to open the content. Clearly, users are more likely to appreciate the different ways of accessing information enabled by modality interactivity when they evaluate a website's interactivity potential.

Perceived contingency was also boosted by modality interactivity. Interestingly, it also altered the direction of the effects from message interactivity. When the website had modality interactivity, increasing message interactivity had a slight negative effect on the contingency of the website, whereas it enhanced the contingency of the website in the absence of modality interactivity. The psychological comparison between modality interactivity and message interactivity can explain this finding. Modality interactivity, with its ability to manipulate the slider, provides extremely high level of responsiveness to the entire website, leading them to perceive that they are involved in several back and forth interactions with the site, and the

information on the website is well connected to their actions. Compared to the immediate changes of pictures that participants could observe by dragging the slider, clicking hyperlinks in the high message interactivity condition or clicking the back and next button in the medium interactivity condition might be considered as significantly less contingent upon their actions – they do not visibly produce a prominent change in the website. Thus, these simple clicking tools reduce their sense of contingency compared to the low interactivity condition where they do not even try to take any action, thereby do not have anything to be perceived as more or less contingent.

Perceived contingency bridged the relationships between message interactivity, message elaboration and attitudes toward anti-smoking messages only in the absence of the slider. In contrast, perceived contingency emerged as a significant mediator in a previous study (Sundar, Bellur, Oh, Jia, & Kim, 2012). In Sundar et al (2012), providing a chatting tool or showing participants' interaction history significantly enhanced participants' evaluation of contingency of the website, which created more positive attitudes toward the website. Compared to having participants chat with an agent or visualizing their interaction history in real time, the manipulation of message interactivity in this study is rather subtle when it is compared with the slider. Thus, the finding from this study suggests that perceived contingency can be a significant psychological mediator that can explain the effects of message interactivity only when the website does not provide other stronger interactivity appeals such as the slider. Slider is a feature that is highly responsive to users' input. The result suggests that users might consider reactive responses from the system (i.e., the changes in pictures according to their motion to move the slider) as truly interactive message exchanges. The immediacy of this responsiveness by the system perhaps overpowered the more subtle forms of contingency signaled by hyperlinks and

breadcrumbs. Although employing hyperlinks and breadcrumbs is conceptually consistent with the definition of message interactivity, users would need clearer indications that they are involved in an active dialogue, or that the system takes into account their previous actions, such as a chatting tool or real time interaction history. Another explanation of the strong effect of the slider on perceived contingency is the recency effect. The slider tool was included on the last page of the stimulus websites, which made the slider as the most recent component of the website participants were able to recall. Future research ought to test whether the level of perceived contingency can be affected by the synchronicity of interactive features.

Modality interactivity and message interactivity had an effect on individuals' general attitudes toward smoking. After taking into account pre-existing attitudes toward smoking, participants perceived smoking as a less attractive behavior when they interacted with the slider compared to the control condition. However, this effect of modality interactivity on their attitudes toward attractiveness of smoking was found only under the high message interactivity condition. This finding suggests a way in which the potential of message interactivity can be used to boost the effect of modality interactivity. When the website is equipped with high message interactivity, users get motivated to interact with the website – they are led to open the hyperlinks one by one, observe breadcrumbs, and become more used to the fact that the website is responding to their actions. As a result of it, when the modality interactivity in the form of slider tool is provided, users are fully engaged in interacting with the slider, absorbing the information from the interaction more effectively. Given that the sliders in the stimulus website provided the images of a smoker's deteriorating face, brain, and lungs, this increased receptivity successfully altered their attitudes toward smoking.

Combinatory effects of modality interactivity, message interactivity, and issue involvement on emotional engagement and behavioral intention. Findings related to emotional engagement were nothing but simple. Modality interactivity elicited more arousal regardless of the degree of message interactivity on the website and the degree of issue involvement of participants. This is intuitive given that modality interactivity involves controlling mouse and observing changes in the picture of a smoker's face, brain, and lungs. Physical motion and visual changes are all known to lead to orienting responses (Lang, 2000; Reeves & Nass, 2000). Thus, only in the absence of this prominent orienting feature, the two-way interaction between message interactivity and issue involvement was significant. Low-involvement participants felt most aroused, wide-awake, and stimulated when the website was moderately interactive. In contrast, high-involvement participants felt more aroused when the website had either high- or low-interactivity. This finding can be attributed to the fact that the structure of the medium message interactivity condition poses some frustration for users, such that it promised interactivity on the homepage but later in the browsing enabled no further interaction with the content. The frustration from the website structure is more pronounced for low-involvement individuals because they are the ones who seek quick ways to get the information rather than scrutinize the site. Perhaps this frustration is the cause of their heightened arousal while browsing the website. For high-involvement individuals, high- and low- interactivity conditions equally aid them to read the content as explained in the finding of attitudes toward the message. In other words, they might feel more aroused because they stayed more focused on reading the information.

Modality interactivity moderates the effect of message interactivity on the level of fear. In the presence of modality interactivity, there was a clear negative effect of message interactivity on the level of fear such that the higher the message interactivity, the less fearful

they felt. Especially, the website with the modality interactivity feature in the absence of any message interactivity (i.e. scrolling only) contained the strongest fear appeal, whereas the same modality interactivity feature significantly reduced fear when it was accompanied with high message interactivity. This finding suggests that the psychological effect of the slider, with its vivid depiction of negative outcomes of smoking, can be most pronounced when other parts of website contain no interactivity. Following Steuer (1992)'s definition of vividness, slider can be said to have more vividness than the static pictures. First, using the slider feature involves more sensory breadth since it requires users to employ both visual and motor sensor. It also involves more sensory depth by showing users the drastic changes in face, looks, brain, and lungs. Thus, without any message interactivity, the slider stands alone as a prominent and vivid feature of the website, which can boost its fear appeal.

When the website contained high level of message interactivity, however, the presence of the slider reduced fear compared to the same website without any slider. After they are saturated with other interactive features such as hyperlinks and breadcrumbs, the stand-alone effect of the slider is no longer effective. Further, the addition of the slider onto high message interactivity can offset the elaboration effect of message interactivity by leading them to focus on the interface feature rather than the anti-smoking messages. This is also supported by the fact that modality interactivity actually inhibited participants from generating message-related thoughts in the previously reported finding. Consequently, high message interactivity combined with the slider triggered the least amount of fear. Without the slider feature on the website, individuals' fear simply does not vary enough to make any difference as a function of message interactivity.

Three-way interaction further qualifies the finding from the two-way interaction. Again, in the absence of slider, the level of fear does not show any difference by issue involvement and

message interactivity. However, when there is the slider that contains the strong fear appeal to participants, issue involvement could enhance level of fear in participants' mind only under the medium message interactivity condition. Under the low message interactivity condition, issue involvement does not predict participants' fear because the stand-alone, fear appeal of the slider overrides the effect of issue involvement. The high message interactivity condition provides enough message elaboration going on, which offset the effect of issue involvement.

Further, the data suggest that the three-way interaction effect on level of fear transfers over participants' behavioral intention to seek more information. The relationship between fear and behavioral intention has been well-established (e.g. Witte & Allen, 2000). More intriguing finding emerged from this study is that the aforementioned three-way interaction of modality interactivity, message interactivity, and issue involvement replicates in participants' behavioral intention. High and low message interactivity suppresses the positive effect of issue involvement on the level of behavioral intention to seek more information, whereas medium interactivity sustains the positive effect of issue involvement on participants' behavioral intention.

Theoretical Implications

Persuasive potential of interactivity. First of all, the findings of this study clearly show that the difference in website interactivity can contribute to persuasion outcomes. Previous persuasion literature has focused on message features that can either increase or decrease the persuasive potential of the message. This study represents a step away from this paradigm. Instead of revealing what variations in a persuasion messages can create better attitudinal and behavioral outcomes, this study attempts to find the variations in website interactivity that can make a significant contribution in the persuasion process. The website structure and its interactivity are not merely vessels for delivering the content. Rather, these technological factors

significantly predict psychological responses from users. As Sundar at al (2013) note, there are at least five mechanisms by which technological affordances can persuade individuals: triggering cognitive heuristics, enabling the users to be the source of information, generating greater user engagement with mediated content, constructing alternative realities by providing enhanced vividness of content, and providing greater accessibility to information. When users have a more interactive way to access information, such as with a slider, it can trigger heuristics, generate greater engagement in browsing activities, and afford more vivid depiction of persuasive messages. As a result of these mechanisms, modality interactivity creates more favorable attitudes toward the website, more favorable attitudes toward the anti-smoking messages, and further, changes their attitudes toward smoking itself, even after controlling their pre-existing attitudes. High level of message interactivity can also yield persuasion outcomes. The contingent, back-and-forth interaction between users and persuasive messages can engage users in the persuasive messages, by triggering greater message elaboration. As a result of the enhanced message elaboration, users have more favorable attitudes toward the anti-smoking messages when the site is equipped with high message interactivity. Together, modality interactivity and message interactivity serve to moderate the fear appeal of a persuasive message, which can affect individuals' behavioral intention to seek more information about smoking.

User engagement as a key mediator. The findings of this study also imply that user engagement is indeed a significant variable to explain persuasion outcomes. User engagement has been known to be an important phenomenon in the contexts of persuasion, entertainment, and human-computer interaction. This study explicated the concept of user engagement, and proposed three species of user engagement that can play crucial roles in explaining why website interactivity can persuade users. All the three types of user engagement proposed by this study,

imagery engagement, cognitive engagement, and emotional engagement, were significantly affected by the two types of website interactivity. Also, mediation analyses found that the three species of user engagement were significantly associated with persuasion outcomes. For instance, greater imagery engagement triggered by modality interactivity led to more positive attitudes toward the anti-smoking messages. Greater cognitive absorption created by modality interactivity resulted in more favorable attitudes toward the entire website. High message interactivity led to greater message elaboration, which successfully translated into greater attitudes toward the persuasion messages. Modality interactivity and message interactivity together influenced emotional engagement, which significantly predicted individuals' behavioral intention to seek further information about smoking.

Decomposing the persuasion process. The results from this study also contribute to decomposing the effects of each type of website interactivity in the persuasion process. Apart from the three key mediators (i.e. imagery engagement, cognitive engagement, and emotional engagement), several precursors of user engagement were found. Imagery engagement was affected by the feeling of presence heightened by modality interactivity. Modality interactivity was also found to significantly enhance users' interface assessment, such as whether the interface is natural, intuitive, and easy to use. This enhanced interface assessment led to greater cognitive absorption while browsing. Although previous studies have already pointed out imagery engagement and cognitive absorption as mediators that can explain persuasion outcomes, the findings from this study provide more detailed theoretical mechanisms, answering what exactly in website interactivity can lead to differences in individuals' imagery engagement and cognitive engagement.

Extending the model of website interactivity. The model of website interactivity by Sundar (2007) provided a framework for operationalizing the two types of website interactivity, and for adopting user engagement as a key mediator. In keeping with Sundar (2007) and Sundar et al (in press), interface assessment and cognitive absorption significantly mediated the effect of modality interactivity on attitudinal outcomes. Apart from supporting the effect of modality interactivity proposed by Sundar (2007), this study contributes to explicating the concept of user engagement, and showing the persuasion effect of each type of user engagement as mentioned earlier. By doing this, the current study constructs a more comprehensive model of website interactivity mediated by three different species of user engagement, in the context of persuasion.

Also, the findings from this study suggest that the effect of one type of website interactivity can depend on the effect of another type of website interactivity. The study found several combinatory effects of modality interactivity and message interactivity on individuals' perceived interactivity and perceived contingency of the website, beliefs about the effects of smoking, fear and arousal, and behavioral intention to seek information. Thus, this study proposes a way to extend the model of website interactivity by Sundar (2007), by highlighting the interaction effects between different types of website interactivity.

Practical Implications

Usefulness of modality interactivity. The study findings speak to the strong potential of modality interactivity as a persuasion tool. Interacting with pictures of a smoker's face, brain, and lungs by the slider was found to be far more effective in enhancing individuals' attitudes toward the website, toward the anti-smoking messages, and even changing their general attitudes toward smoking itself. A slider is designed to observe gradual changes along a linear dimension, such as a timeline or a set of different pictures. Employing the slider on the website is nothing

but an expensive option for website designers. However, when the slider contributes to delivering information related to persuasion messages, the presence of this simple interactive feature can significantly affect users' attitudes. The slider was found to be more natural, intuitive, and easy-to-use for the study participants. Also, the website was evaluated as far more interactive and contingent when it was equipped with the slider. Thus, deploying slide-based interaction techniques can add significant value to the website, especially when the goal of the site is consistent with what the slider can afford, as exemplified by the current study.

Meaningful interaction with the content rather than promising interactivity. The negative psychological impact of the medium message interactivity condition implies that the interaction between user and the website should be designed in a way that the interaction is closely related to the central goal of the website – in this study, understanding information about smoking. When the hyperlinks embedded on the website lead users to read central information about the effects of smoking one by one, it is highly appreciated by users, as demonstrated by the positive effects of the high message interactivity condition. When the medium interactivity condition shared almost the same structure with the high message interactivity condition, individuals perceived the website more interactive than a website with only scrolling, as evidenced by the manipulation-check findings. However, when this promise of interactivity did not translate into any meaningful interaction with the website content, it seem to have inhibited users from further message elaboration and contributed to negative attitudes toward the messages. Thus, interactive features should be designed carefully so that the interactions allowed by the interactive features can manifest their value in achieving users' goal. Otherwise, it might lead to worse outcome than a website without any interaction.

Persuasive potential of message interactivity for low-involvement individuals. The current study revealed several intriguing patterns with regard to the moderating role of message interactivity in the relationship between issue involvement and persuasion outcomes. Low-involvement individuals can be cognitively more engaged by high message interactivity, which can actually predict their attitudes toward anti-smoking messages. This suggests that high message interactivity can lead low-involvement individuals to systematically process the messages, shaping their attitudes based on message elaboration rather than heuristic cues. The current data imply that high message interactivity can be especially useful for designing websites where low-involvement individuals are the target audience. Given that younger population, such as college students, would have fairly low issue involvement for health topics, the message interactivity feature suggested by the current study will be an effective persuasion tool for the health-related websites targeting younger users.

Fear appeal. The stand-alone effect of the slider implies that health website designers can use the slider as a strong fear-appeal tool when it is embedded in a non-interactive interface. However, the highly interactive feature such as the slider needs to be employed with caution. When other parts of the website are capable of inducing greater message elaboration (i.e., in the case of high message interactivity), the presence of a highly interactive, vivid feature serves to decrease the emotional effect. Thus, when it comes to emotional impact of the website, designers need to think how to balance between the highly interactive feature such as the slider and more subtle interactive features such as the hyperlinks and breadcrumbs.

Limitations

Manipulation of message interactivity. The manipulation of message interactivity in this study included two components: hyperlinks and breadcrumbs. Given that the message

interactivity features are more subtle than a prominent feature such as the slider, one might question whether these features were actually used by participants. In this study, web log data were collected on breadcrumbs, but not on the hyperlinks. The instruction of the study clearly indicated that participants had to browse all the information provided by the website. Given that the laboratory setting enables participants to focus on the task, it is likely that they followed the instruction and opened all the hyperlinks provided by the stimulus website. The positive effect of high message interactivity on message elaboration also indirectly supports this. However, future studies may want to address this issue by employing more precise measure so that they can make sure that study participants actually click the hyperlinks embedded in the website or at least track their clicking behaviors.

Also, the effect of breadcrumbs cannot be separated from the effect of hyperlinks in the current study design. Although both of them were operationalized as message interactivity, future research might further investigate the psychological difference between these two different interface features.

Conceptual clarifications. Some concepts employed in this study may need further clarifications. Under the construct of user engagement, cognitive engagement was operationalized as cognitive absorption and elaboration. As mentioned in the interpretation of findings, these two measures may capture very different phenomena– cognitive absorption addresses a convergent process where all senses are immersed into the media content, whereas elaboration taps into a more divergent process where the connections between the media content and what users have experience are created. These two measures did not show the same outcome in the current data. For instance, while self-reported elaboration was primarily influenced by message interactivity, cognitive absorption was affected by modality interactivity. The

conceptual and empirical differences between these two indicators of user engagement need to be considered in future research.

Unexplained persuasion outcomes. Some of the findings emerged from the current study cannot be fully explained within the scope of the current data set. For instance, three-way interaction findings on the level of fear and arousal might need further explanation. If indeed, the high message interactivity condition provided enough message elaboration which could offset the emotional effect of issue involvement, why was the zero-order correlation between message elaboration and fear positive? Future research ought to attempt to find more psychological factors that can explain the fear appeal of website interactivity and its interaction with issue involvement.

External validity. Website interactivity has been operationalized as the presence of the slider, hyperlinks, and breadcrumbs in this study. This study focused on revealing several psychological mechanisms by which the interactive features affected user attitudes and beliefs. However, one might question if these mechanisms emerging from the study data can be applied to other examples of website interactivity. Future research needs to address this concern by examining other types of website interactivity under the same conceptual categories: modality interactivity and message interactivity. Also, the website content included only one type of health messages – the anti-smoking message stating the effects of smoking on individuals' looks, brain activity, and lungs. Future research needs to validate the persuasion effect of website interactivity with other types of health messages.

The study sample included very few established smokers. About a half of the study sample never tried smoking. Thus, the result might have been different if the study had recruited more smokers. Future research should address this concern by applying the theoretical models

from this study to smoker samples. Finally, it should be noted that the current study employs interactive features for an online interface accessed with mouse as the pointing device. With the rise of haptic interfaces, a tactile feedback technology can yield different results. For instance, a slider tool in haptic interfaces might have stronger psychological effects on users' attitudes given that the user's finger as the pointing device involves less mediation and can further enhance their sense of presence, naturalness and easiness of the interaction. Thus, employing interactive features suggested by this study in haptic interfaces will be an important task for future research.

CONCLUDING REMARKS

Interactive technology is now ubiquitous in our daily lives. Users have far more ability to interact with media and to communicate freely with other users than ever, via their smart phones, smart TVs, social media, and 3D virtual worlds, just to name a few. This study shows the significant psychological effects of technological affordances provided by new media, but more importantly delves into the theoretical mechanisms of those effects. The current study examined two fundamental aspects of interactive media technologies in the context of human-website interaction – the ability to control the medium and the ability to control the messages. The study findings revealed several key mechanisms by which the two types of website interactivity create significant persuasion outcomes with anti-smoking messages. It is clear that interactive media can go well beyond simply facilitating greater access to message content. They can indeed play an important independent role in informing, inspiring, and persuading individuals.

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Appendix A: Stimulus Website

No modality interactivity, Low message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition7/index.php

No modality interactivity, Medium message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition8/index.php

No modality interactivity, High message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition9/index.php

Modality interactivity, Low message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition10/index.php

Modality interactivity, Medium message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition11/index.php

Modality interactivity, High message interactivity:

http://portal.vmhost.psu.edu/jeeyun/v4/condition12/index.php

Appendix B: Study Instruction

"Tobacco Free State College" website is designed to help you learn some facts about the effects of smoking cigarettes. Find answers to important questions you may have. These facts will arm you with the truth about the harmful effects of smoking. You can also help your loved one quit by learning more facts. 1) Please make sure that you fully browse the entire website and spend as much time as you need. 2) The site that you will see today has three topics. Please explore all three topics and try to learn as much as you can about the effects of smoking cigarettes. 3) After you finish browsing the website, please make sure to click the "log out"

button on the right top corner of the website.

Appendix C: Measurement Instruments

[Issue involvement]

To me, information about smoking is...

Unimportant (1) - Important (9)

Irrelevant (1) - Relevant (9)

Means nothing to me (1) - Means a lot to me (9)

Worthless (1) - Valuable (9)

Not needed (1) - Needed (9)

Boring (1) - Interesting (9)

Unexciting (1) - Exciting (9)

Uninvolving (1) - Involving (9)

Unappealing (1) - Appealing (9)

Mundane (1) - Fascinating (9)

[Smoking status]

Have you ever tried smoking?

Yes (1)

No (0)

Have you smoked at least 100 cigarettes in your lifetime?

Yes (1)

No (0)

[Attitudes toward health effects of smoking]

Please indicate your attitudes towards the following statements about smoking. In general, smoking is....

Bad (1) – Good (9)

Unhealthy (1) – Healthy (9)

Harmful (1) – Harmless (9)

[Attitudes toward attractiveness of smoking]

Please indicate your attitudes towards the following statements about smoking. In general, smoking is....

Unsexy (1) - Sexy (9)

Unpleasant (1) - Pleasant(9)

Unsociable (1) - Sociable(9)

Ugly (1) - Glamorous (9)

Stressful (1) – Calming (9)

Negative (1) – Positive (9)

Unfavorable (1) – Favorable (9)

[Biased message processing]

Please indicate your attitudes toward the messages that were delivered by this website. I thought the messages were....

Not distorted (1) - Distorted (9)

Not overblown (1) - Overblown (9)

Not exaggerated (1) - Exaggerated (9)

Not boring (1) – Boring (9)

Not manipulative (1) - Manipulative (9)

Not exploitative (1) - Exploitative (9)

[Perceived interactivity]

Please indicate your attitudes towards the following statements about the website.

The website is…. Not at all interactive (1) – Highly interactive (9)

This website allows me to perform a lot of actions.

Strongly disagree (1) – Strongly agree (9)

This website allows me to access information in a variety of ways.

Strongly disagree (1) – Strongly agree (9)

[Perceived contingency]

Please indicate how well you think each of the following statements describes the website.

I was involved in several back and forth interactions with the site.

I felt as if the information on the website was well connected to my actions.

The website was aware of the actions I performed.

Describes very poorly (1) - Describes very well (9)

[Presence]

While browsing the website,

How well could you move or manipulate objects while browsing? Not very well (1) - Very well (9)

How much did the visual aspects of the website involve you? Not at all (1) – A lot (9)

How completely were all of your senses engaged while browsing? Not completely (1) – Completely (9)

[Interface assessment]

Please indicate your feeling towards your interaction with the website.

My interaction with the website was intuitive.

The ways that I used to control the changes on the website seemed natural.

The website was easy to use.

Strongly disagree (1) – Strongly agree (9)

[Imagery engagement]

While browsing the website,

How much did the website have features to help you imagine the effects of smoking?

How much could you easily picture the effects of smoking in your mind?

How much did the website let you easily visualize the effects of smoking?

Not at all (1) – A lot (9)

[Cognitive absorption]

Please indicate your agreement with the following statements about the website content. While browsing the website,

Time appeared to go by very quickly.

I lost track of time.

I spent more time than I had intended.

I was able to block out most other distractions.

I was absorbed in what I was doing.

I was immersed in the task that I was performing.

My attention did not get diverted.

I had fun interacting with the site.

The site's features provided me a lot of enjoyment.

I was bored.

I felt in control.

I felt that I had no control over my interactions.

I felt as if my curiosity was excited.

I felt as if my imagination was aroused.

I felt that my interest was evoked.

Strongly disagree (1) – Strongly agree (9)

[Thought-listing measure]

Please list all the thoughts you had while browsing the website. You have 120 seconds to answer. After 120 seconds, you will move to the next page automatically.

[Self-reported elaboration]

While browsing the website,

I thought about what actions I myself might take based on what I browsed.

I found myself making connections between the website content and what I've read or heard about elsewhere.

I thought about how and what I had browsed related to other things I know.

I tried to think of the practical applications of what I browsed.

I tried to relate the ideas in the website to my own life.

Strongly disagree (1) – Strongly agree (9)

[Arousal]

Please indicate your feeling while you were browsing the website.

Relaxed (1) – Stimulated (9)

Sleepy (1) – Wide-awake (9)

Unaroused (1) – Aroused (9)

[Fear]

Please indicate your feeling while you were browsing the website. While browsing the website, I was....

Fearful

Afraid

Scared

None of this feeling (1) – A great deal of this feeling (9)

[Attitudes toward anti-smoking messages]

Please indicate how well the following words describe the messages that were delivered by this website.

Believable

Informative

Insightful

Objective

Interesting

Clear

Describes very poorly (1) - Describes very well (9)

[Attitudes toward the website]

Please indicate how well each of the following adjectives describes the WEBSITE that you interacted with.

Exciting

High quality

Fun

Cool

Imaginative

Entertaining

Describes very poorly (1) - Describes very well (9)

[Beliefs about the effects of smoking]

Compared to a nonsmoker, how likely do you believe that a smoker will develop the following conditions/symptoms if s/he continues to smoke?

reduced IQ

brain shrinkage

premature aging and wrinkles

lung cancer

mucus congestion

emphysema

stained teeth

much less likely (-4) - same as (0) - much more likely (+4)

[Behavioral intention to seek further information]

Please indicate your attitudes toward the messages that were delivered by this website.

I would like to know more about the topic of smoking.

I would like to browse more content about smoking.

I would discuss the topic of smoking with my friends.

Strongly disagree (1) – Strongly agree (9)

[Media use]

How many minutes on average do you spend on the Internet on a given day? (enter only numbers)

[Demographics]

1. Your age (enter only numbers)

2. Your gender

Male (1)

Female (2)

3. What ethnic group do you belong to?

Asian (1)

Pacific Islander (2)

African American (3)

Caucasian (4)

Hispanic (5)

Arab (6)

Other (7)

4. Your academic standing

Freshman (1)

Sophomore (2)

Junior (3)

Senior (4)

Graduate Student (5)

PSU staff (6)

State College Community member (non-PSU member) (7)

Other (8)

5. Is English your first language?

Yes (1)

No (2)

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