ABSTRACT

Title of Dissertation:	IMPACT OF WEB CONTENT FEEDBACK SYSTEM ON THE EFFECTIVENESS OF HEALTH PROMOTION MESSAGES ON YOUTUBE: A NORMS-BASED INQUIRY
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The widespread use of social media in health communication makes it important to understand how the media's characteristics impact health communication effectiveness. This dissertation used social norms theory to explain the persuasive impact of web content feedback system—a unique feature of social media—on people's responses to health promotion messages posted on a social media site YouTube. Three common social media content feedback cues (comments, aggregate ratings, and message view count) were examined. These cues were expected to influence people's health attitudes and behavioral intentions via the mediation of three types of perceived social norms (descriptive norms, injunctive norms and subjective norms).

Two experiments examined the norms-mediated model in three health contexts (smoking, binge drinking, and texting while driving). Experiment 1 examined the influence of proportion of positive comments (large, medium, vs. small)

and comment focus (message vs. behavior). As expected, proportion of positive comments was negatively related to people's perceived social approval of smoking and texting while driving (injunctive norms). However, it had a concave downward relationship with perceived social approval of binge drinking (i.e., injunctive norms). The results also suggested an important impact of comment focus on people's responses to health promotion messages. Experiment 2 examined the influence of proportion of thumbs-up (large, medium, vs. small) and message view count (high, medium vs. low). It was hypothesized that greater proportion of thumbs-up would lead to less favorable beliefs about problem behaviors. This hypothesis was supported only when the outcome variable was texting while driving intention. View count positively predicted people's smoking and binge drinking intentions and marginally, positively predicted texting while driving subjective norms. It had a concave downward relationship with binge drinking attitudes. Experiment 2 also found complex joint effects of view count and proportion of thumbs-up.

In spite of many findings about the influence of comments, ratings, and view count on norms, attitudes, or intentions, both study 1 and study 2 provided limited support for the hypothesized norms-based mediation. Limitations, theoretical and practical implications, and directions for future research are discussed.

IMPACT OF WEB CONTENT FEEDBACK SYSTEM ON THE EFFECTIVENESS OF HEALTH PROMOTION MESSAGES ON YOUTUBE: A NORMS-BASED INQUIRY

by

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Chapter 1. Introduction

In the last decade, social media have grown to be an important part of people's lives. As of 2016, 69% of U.S. people have used some form of social media sites (Pew Research Center, 2017). One notable feature of social media is interactivity, which has transformed the traditional pattern of communication (Chou, Prestin, Lyons, & Wen, 2013). Whereas in the past people are only passive information recipients, on social media platforms people are not only consumers of information but also active agents in the dissemination and production of many media contents (Flanagin & Metzger, 2013; Noar & Head, 2011; Shi, Messaris, & Cappella, 2014). Among the most significant consequences of the development of social media is the introduction of web content feedback system, which presents user-generated information, such as comments and recommendations, that can inform people of other users' opinions about social media contents (Walther, DeAndrea, Kim, & Anthony, 2010).

The ubiquitous use of social media raises questions about how their content feedback system might influence human judgment. This topic has been extensively examined in the domain of marketing and advertising (e.g., Chen & Lurie, 2013; Chevalier and Mayzlin, 2006; Doh & Hwang, 2009; Khare, Labrecque, & Asare, 2011; Wu, 2013). For instance, much research has investigated the influence of social media content feedback system on people's product choices (e.g., Lee, 2009; Liu, 2006; Purnawirawan, De Pelsmacker, & Dens, 2012; Park, Lee, & Han, 2007; Lee, Park, & Han, 2008; Senecal & Nantel, 2004; Sher & Lee, 2009). In the field of communication, studies have examined the role of web content feedback system in

people's responses to online news (Dong, 2012; Kim, 2012; Knoblock-Westerwick, Sharma, Hansen, & Alter, 2005; Lee, 2012; Lee & Jang, 2010; Sommer & Hofer, 2011) and perceptions of other social media users' profiles (Hong, Tandoc, Kim, Kim, & Wise, 2012; Lin, Spence, & Lachlan, 2016; Tong, Heider, Langwell, & Walther, 2008; Walther, van der Heide, Hamel, & Shulman, 2009). However, limited research has looked into how web content feedback system might influence people's responses to health promotion messages (Shi et al., 2014; Walther, DeAndrea, et al., 2010).

The Internet is an important place where people seek out health-related information, and user-generated contents are particularly valuable resources to aid people in health decision-making (Fox & Duggan, 2013; Fox & Purcell, 2010). For example, reading someone else's commentary about a health issue and reviews of doctors, hospitals, and drugs on online news websites and blogs constitutes an activity instrumental to achieving positive health outcomes for many people (Fox & Duggan, 2013; Fox & Purcell, 2010). Even for those whose primary purpose of using social media is not to look for health information, frequent social media use might also expose these people to some health information that may influence their health decisions. As social media become increasingly important in people's health management, they have been widely used by public health educators to deliver health promotion messages (Noar & Head, 2011). For instance, among 20 mediated interventions into adolescents' sexual health, twelve utilized new communication technologies including social media (Keller, 2008). This reality makes it important for health communication scholars to understand whether the participatory nature of

social media influences online health persuasion efforts. The main aim of this dissertation is to examine the role of web content feedback system in responses to health promotion messages on social media sites.

Social media encompass a number of different websites, such as social networking sites (e.g., MySpace and Facebook) where people focus on social interaction, blogs where opinion expression dominates, and content communities (e.g., YouTube and Slideshare) where people work towards sharing information (Kaplan & Haenlein, 2010). This dissertation chooses to study YouTube. There are two reasons for this choice. First, YouTube is the world's largest video-sharing website (Cha, Kwak, Rodriguez, Ahn, & Moon, 2007; Kim, Paek, & Lynn, 2010; Paek, Hove, & Jeon, 2013). It has more than one billion users and has exceeded any cable network regarding outreach to U.S. adults aged 18 to 34 (YouTube, 2017). The immense availability and broad outreach of YouTube have made it a popular communication channel in health promotion activities (Abroms, Schiavo, & Lefebvre, 2008). Thus, studying YouTube web content feedback systems will produce significant practical implications.

Second, YouTube's web content feedback system incorporates several types of social cues, such as view count, aggregate ratings, and user-generated comments. *View count* presents a single number showing how many times a video has been watched. It is generated by a system algorithm. *Aggregate ratings* are statistical summaries of "likes" (i.e., thumbs-up) and "dislikes" (i.e., thumbs-down) other video viewers have voted for a video. Hence, by reading aggregate ratings of a video, viewers can learn about public opinions of the video. Compared with view count and

aggregate ratings, user-generated comments provide more detailed information about public responses to a video (Shi et al., 2014). View count, aggregate ratings, and user-generated comments are typical content feedback cues on a social media site. Hence, examining YouTube social cues can contribute to a more comprehensive understanding of the influence of social media content feedback systems in general.

To understand the role of web content feedback system in persuasive communication, it is important to have a theoretical framework that can account for its underlying causes (Walther & Jang, 2012). Previous studies have approached this topic from multiple perspectives. For instance, to explore the persuasive effects of online comments, some study has used the Social Identity Model of Deindividuation Effects (SIDE; Walther, DeAndrea, et al., 2010). Also, other study has used the Influence of Presumed Influence (IPI) model (Lee & Jang, 2010). To understand the influence of aggregate ratings and number of message views, certain studies have utilized Sundar's (2008) Modality, Agency, Interactivity, and Navigability (MAIN) model as their theoretical foundation. These various theories help illustrate the process and effects associated with social media use in persuasive communication. However, an accumulation of evidence generated from different theoretical perspectives makes it difficult to unify literature and advance theory development. Hence, another purpose of this dissertation is to provide a theoretical framework that can integrate and expand prior studies on the persuasive effects of web content feedback system. One commonality of ratings, comments, and view count is that all of them could indicate general public attitudes toward a message. In the persuasion literature, there is strong evidence that others' opinions could influence people's

personal attitudes and behaviors (Chung & Rimal, 2016). Hence, social norms literature might provide an overarching account of how web content feedback system influences online message persuasiveness.

Drawing from previous literature on social norms and web content feedback system, this research proposes a norms-mediated model to study the influence of web content feedback system on the persuasiveness of health promotion messages on YouTube. Two experimental studies were implemented. Study 1 explored the influence of valence and focus of online comments on the effectiveness of health promotion messages. Based on prior studies (Shi et al., 2014; Walther, DeAndrea, et al., 2010), viewers' comments on a health promotion message posted on YouTube could focus either on the quality of the message (message-focused comments) or the health behavior depicted in the message (behavior-focused comments). Compared with comment valence, the persuasive effect of comment focus has not received any attention. However, some interpersonal health communication literature suggested that interpersonal communication about a health message or a health behavior in the message had different effects on health outcomes (Hendriks & de Bruijn, 2015; van den Putte, Yzer, Southwell, Bruijn, & Willemsen, 2011). Accordingly, it may be beneficial to differentiate between behavior- and message-focused comments. Study 2 examined the influence of aggregate ratings and view count on the effectiveness of YouTube health promotion messages. Both study 1 and study 2 tested three types of social norms—descriptive norms, injunctive norms, and subjective norms—as mediator variables operating in the persuasion process. Furthermore, the two studies

were conducted in several health behavior domains. Hence, findings from this study can inform various public health education practices.

The rest of the dissertation is organized as follows. It begins with a systematic review of web content feedback systems on social media sites. Then, previous research about the persuasive effects of social media content feedback system is described, following which the role of social norms in attitude and behavior research and the study propositions are presented. After that, three pilot studies and two experimental studies are detailed. The dissertation concludes with a discussion of its primary findings, limitations, theoretical and practical implications as well as directions for future research.

Chapter 2. Literature Review

Social Media and Web Content Feedback System

Social media are "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (Kaplan & Haenlein, 2010, p. 61). Due to their use of the Web 2.0 technology, social media can support simultaneous presentation of multiple sources and types of contents on a web page. Walther and Jang (2012) have distinguished between three types of contents that could co-appear on a social media site: proprietor content, user-generated content, and aggregate user representations.

Proprietor content refers to the messages made by an individual or institutional web page proprietor. Messages posted by people on their own Facebook home page or health promotion messages shared by health agencies through their YouTube channel are examples of proprietor contents. Proprietor content could take many forms, such as videos, texts, pictures or a combination of these elements. On traditional media, all contents are proprietary (Walther & Jang, 2012, p. 4). Hence, the way how people consume proprietor content resembles their traditional media content consumption pattern.

However, on social media sites, proprietor content is usually accompanied by user-generated responses, which might alter people's interpretations of proprietor content. User-generated response is unique to social media. It includes messages responding to a proprietor content on a web page and is usually composed by general

Internet users, who are usually not proprietors of the web page. For example, people's comments on a YouTube video are user-generated responses to proprietor content.

In addition to proprietor content and user-generated content, aggregate user representations—the "computer-generated descriptive statistics that a web page displays representing accumulations of users' ratings, votes, or other site-related behaviors"—is another important content on social media sites (Walther & Jang, 2012). There are different types of aggregate user representations. *Deliberate aggregate user representations* provide data reflecting users' collective opinions of certain proprietor content, such as liking and perceived usefulness of the content. The data are usually generated by users' deliberate responses to a request for their assessment input (Walther & Jang, 2012, p. 5). *Incidental aggregate user representations*, on the other hand, do not originate from intentional opinion expression behaviors but are gathered unobtrusively from users' prior activities on a website, for instance, people's visits to a website. From this perspective, YouTube aggregating rating system (thumbs-up and thumbs-down) are deliberate aggregate user representations whereas view count of a video generated by a system algorithm is incidental in nature. Overall, compared with user-generated comments, aggregate user representations carry less information (Shi et al., 2014). However, they are more straightforward and require less cognitive efforts to process than user-generated comments.

Both user-generated responses and aggregate user representations indicate other users' activities surrounding a social media content and are central components of social media content feedback system. Given proprietor content and users'

feedback could appear on a social media web page simultaneously, whether these different contents interact with each other has become an interesting question for those who are interested in the effects of social media use. Much research has found that users' interpretations of social media contents are affected by user-generated comments (e.g., Hong et al., 2012; Lee & Jang, 2010; Lee, 2012; Purnawirawan et al., 2012; Shi et al., 2012; Sommer & Hofer, 2011; Veldhuis, Konijn, & Seidell, 2014; Walther, DeAndrea, 2010; Zhao, Wang, Wei, & Liang, 2013). For instance, Hong et al. (2012) found that others' comments displayed on the wall of a Facebook user significantly influenced people's impression of the Facebook user. Similarly, Veldhuis et al. (2014) found that media depiction of thin-body ideal significantly interacted with online peer comments to influence people's perceptions of ideal body shape. Lee and Jang (2010) found that dissenting public responses to a piece of online news affected people's evaluations of the news. In addition to user-generated responses, a growing body of evidence has demonstrated that aggregate user representations have persuasive effects on proprietor media content (e.g., Chen, 2008; Dong, 2012; Flanagin & Metzger, 2013; Huang & Chen, 2006; Kim, Brubaker, Kegerise, & Seo, 2010; Khare et al., 2011; Knoblock-Westerwick et al., 2005; Lee & Jang, 2010; Sundar, Oeldorf-Hirsch, & Xu, 2008).

Theoretical Frameworks on the Effects of Web Content Feedback System

While many studies are working towards uncovering the effects of web content feedback system in persuasion, in recent years, some have gone beyond simple fact-finding and attempted to provide a theoretical explanation for the effects

associated with social media use. For instance, three theoretical frameworks have been utilized to explain the persuasive influence of social media content feedback system: the SIDE model, the MAIN model, and the IPI model.

The SIDE Model

The SIDE model is developed from the social identity perspective on normative influence (Postmes, Spears, & Lea, 1998). The social identity perspective on normative influence suggests that people's self-concept is partially formed on their categorization of themselves as members of a relevant social group. Due to this group membership, people regulate their behaviors to be the same as other group members (Hong & Reid, 2006). The SIDE model focuses on conformity to group norms in a deindividuated setting. Specifically, it argues that in a social context where there lacks individuating information, interpersonal differences will become blurred and people will focus their attention on the defining characteristic (i.e., prototype or norm) of a salient social category and hence are more likely to conform.

Deindividuation in the SIDE model refers to "loss of self-awareness, dissolution of identity, and diminished capacity for self-regulation" (Prentice-Dunn & Rogers, 1980, p. 104). In the past, scholars suggested that loss of self-awareness in a social context would lead to anti-social and disinhibited behaviors (for a review, see Reicher et al., 1995). However, this view has received limited support. On the other hand, a meta-analysis that reviewed 60 studies about the behavioral consequences of deindividuation found that deindividuation could enhance people's responsiveness to situational norms, which was consistent with the proposition of the SIDE model (Postmes & Spears, 1998).

The lack of individuating cues is an important feature of computer-mediated communication (CMC). Ranging from online conversations, online shopping to rating, reviewing and sharing others' media messages, people can have many activities done on the Internet with their identity concealed. Hence, the SIDE model has been utilized extensively to study the social influence processes in anonymous CMC (Postmes et al., 1998; Reicher et al., 1995). Because the SIDE model argues that deindividuated context could increase people's responsiveness to situational group norms, it is expected that online communication with limited individuating cues may contribute to stronger normative influence. This expectation has been verified in a group of empirical studies (e.g. Dietz-Uhler, Bishop-Clark, & Howard, 2005; Hughes and Louw, 2013; Kim & Park, 2011; Kim, 2011; Lee, 2004; Lee, 2006; Lee, 2007; Postmes & Spears, 2002; Postmes, Spears, Sakhel, & de Groot, 2001; Spears, Lea, & Lee, 1990).

Postmes et al. (2001, study 1) primed participants for a group identity and different behavioral norms. They observed that anonymous participants demonstrated prime-consistent behaviors in their online group discussion. Nevertheless, this was not found among identifiable people. In a follow-up study, Postmes et al. replicated the findings of study 1. Furthermore, they found that in the anonymous group, neutrally primed participants conformed to the efficiency-oriented situational norm similarly as the individuals primed for efficiency before the experiment. Group identification mediated the effect of anonymity on norm-consistent behaviors. Hence, Postmes et al. (2001) provided more convincing evidence for the SIDE model. Similarly, Postmes and Spears (2002) found that activation of gender stereotypes

among a group of male and female participants led to greater sex stereotypical behaviors in an online discussion when people's identities were concealed.

Lee (e.g., 2004, 2006, 2007, 2008) has published many studies to explore the application of SIDE model in the context of small group online interaction. The majority of her findings were supportive of the SIDE model's predictions. For instance, in one study, Lee (2006) observed that deindividuated people reported more extreme perceptions of group norms, better recall of ostensible partners' messages, greater conformity than those individuated people. Group identification and extremity of perceived group norms mediated the influence of deindividuation on group conformity. In addition to lab experiment, a quasi-experimental study conducted by Hughes and Louw (2013) about the effects of visual anonymity on people' aggressiveness in online games also generated findings consistent with the SIDE model.

In the extant SIDE and CMC studies, scholars have used many approaches to manipulate deindividuation. For example, some study has manipulated deindividuation by means of physical isolation: People in the deindividuation condition were put into different rooms and could not see each other (Spears, Lea, & Lee, 1990). In other studies, deindividuation was manipulated by removing interactants' demographic information (Postmes & Spears, 2002) or images (Postmes et al., 2001). Also, other studies have manipulated deindividuation by asking people not to exchange personal profiles with ostensible partners before an online discussion (Lee, 2006). It was thought that when individuals did not know other people in a

group, they experienced depersonalization and were more likely to conform to the norms shown in the CMC.

Prior SIDE experiments were primarily focused on spontaneous small group CMC. This communication process differs from that of the web content feedback system where there is in general no live interaction. In spite of this, social media content feedback system is usually featured with the lack of individuating cues, much alike the small group online discussion system studied by prior SIDE studies. For instance, on YouTube, it is hard for people to know other viewers' identities by reading others' responses to a video. The lack of individuating cues in a social context is the key to apply the SIDE model. Also, prior SIDE research studying the influence of deindividuation on small group online interaction has exposed participants to a mock synchronous communication system, which delivered preprogrammed anonymous text messages to participants as though the messages were impromptu responses from real people (Lee, 2004; 2006). Such practice demonstrated that the SIDE model could be used to understand asynchronous online communication lacking individuating cues.

One communication study has successfully applied the SIDE model to examine the influence of YouTube commentary system on people's responses to health promotion messages. In their research, Walther, DeAndrea, et al. (2010) exposed college students to two anti-marijuana Public Service Announcements (PSAs) on YouTube and these PSAs were accompanied by either positive or negative comments. Walther, DeAndrea, et al. found that participants who were exposed to the positive comments reported more favorable evaluations of the PSAs than people who

were in the negative comment condition. However, comment valence did not influence people's perception of the risks of marijuana use. Further exploration showed only for those high on commenter identification, positive comments led to more positive PSA evaluations and greater perceived risks of the use of marijuana. Walther, DeAndrea, et al.'s findings were consistent with the SIDE model.

The MAIN Model

Previously, persuasion scholar (Chaiken, 1980) has identified that there are two modes of information processing—systematic and heuristic processing. Systematic processing involves careful evaluation of message arguments, effortful processing of message content, and extensive elaboration of all aspects of a persuasive message; on the other hand, in heuristic processing, thoughtful consideration of the message occurs to a lesser extent. People depend on available informational cue that "enables them to use referential rules, schemata, or cognitive heuristics to formulate their judgments and decisions" (Chaiken, Liberman & Eagly, 1989, p. 213). Sundar's MAIN model was developed from a heuristic approach to persuasion. According to Sundar (2008), Web 2.0 technology affords a variety of features endorsing a great breath of information acquisition. Nevertheless, plentiful information on a website might easily cause information overload (Sundar, Knobloch-Westerwick, & Hastall, 2007). Humans are cognitive misers (Fiske & Taylor, 1990). Hence, when evaluating the quality and appropriateness of online contents, amongst a plethora of information, people are inclined to use some simple mental short-cuts (Fu, 2012; Fu & Sim, 2011).

Sundar's (2008) MAIN model summarized four technological affordances—modality, agency, interactivity, and navigability. It suggests that each affordance offers multiple cues that can trigger different heuristics to influence people's assessment of online message credibility. For example, social media message could be presented either in text or video format. Compared with text, video can activate the *realism heuristic*. As a result, the message presented in video format is perceived as being more credible (Li, Zhang, Sundar & Duh, 2013; Kim, Park, & Sundar, 2012). Similarly, the ease of locating certain information on a social media site is a feature of website navigability and is associated with the *helper heuristic*, which may influence people's perception of a website (Sundar, 2008). Agency in the MAIN model primarily deals with the source of a message. Given message source is closely associated with perceived message credibility (O'Keefe, 2002), agency is usually treated as being more important than other affordances in shaping people's credibility judgment and has received substantial research attention. Whereas the MAIN model was originally developed to focus solely on people's evaluation of online information credibility, studies have expanded the model to account for the influence of technological affordances on other persuasion outcome, such as personal attitudes and behavioral intentions (Sundar et al., 2008; Sundar, Xu, & Oeldorf-Hirsch, 2009; Xu 2013; Xu & Sundar, 2014).

As aforementioned, aggregate user representations are simple social cues that can help people evaluate public opinion climate without spending too many cognitive efforts. Hence, the MAIN model is particularly useful to understand the influence of aggregate user recommendation cues. Because aggregate ratings convey information

about others' attitudes towards a web content and view count is a popularity metric, these two information signals are critical *agency* cues and might influence people's evaluation of a web content by activating the *bandwagon heuristic* (Fu, 2012; Fu & Sim, 2011; Sundar, 2008). Bandwagon heuristic suggests if people realize that something has received many favorable responses, they will respond favorably as well.

Many studies have supported the bandwagon effects of web content ratings and view count on persuasion outcomes. In their research, Flanagin and Metzger (2013) exposed participants to a fictitious movie website that displayed a movie rated on a 10-point scale ranging from low (2 of 10), medium (5 of 10), to high (9 of 10). Flanagin and Metzger found that people's evaluations of the movie increased as a function of the increase of the user-generated movie ratings. Similarly, Khare et al. (2011) found that people's preferences for a movie were swayed directionally by the valence of the average approval ratings the movie had garnered. Sundar et al. (2008) tested the impact of star ratings on people's evaluation of an electronic product on amazon.com and found that people reported more favorable product evaluation when the product was given a high (vs. low) buyer rating. Similar findings were produced by Sundar et al.'s (2009, 2013) studies. Chen (2008) found favorably rated books were more likely to be selected by consumers. In addition to influencing people's product choices, consumers' ratings were also able to influence people's responses to online news. For instance, Knobloch-Westerwick et al. (2005) exposed participants to multiple news articles associated with different levels of favorability ratings on a web page. They found a linear relation between the time people spent on reading an article

and the level of the approval rating. More positive ratings contributed to greater news exposure.

As many studies examined the direct effects of aggregate recommendation system, some studies also attempted to account for its underlying cause. Several studies have verified bandwagon perception as the significant mediator in the persuasion process of online recommendation system (Sundar et al., 2008; Xu, 2013, 2014), strengthening the MAIN model as a valid theoretical explanation of the effects.

The IPI Model

The IPI model is an important theoretical framework in media effects research. It proposes a social influence-mediated indirect media influence process. That is "people perceive some effects of a message on others and then react to that perception" (Gunther & Storey, 2003, p. 199). The IPI model is usually regarded as an extension of the third-person effect (Shen & Higgins, 2013; Sun, 2012). Originally proposed by Davison (1983), the third-person effect is one of the most vigorous research topics in mass communication (Perloff, 2009; Sun, Pan, & Shen, 2008). It posits that people hold asymmetrical beliefs about the effects of a media message on self and others and think that others are more influenced by the media message than themselves (Davison, 1983). The self-other perceptual gap might influence people's attitudes and behaviors (Sun et al., 2008). Since its proposition, third-person effect has been tested on a wide array of communication topics and was found to be a robust phenomenon (Eisend, 2017; Sun et al., 2008; Paul, Saiwen, & Dupagne, 2011).

Although the IPI model was proposed within the third-person framework, it is different from the third-person propositions (Gunther & Storey, 2003). The most critical difference between the third-person framework and the IPI model is that IPI model does not examine self-other perceptual gap as most third-person studies do; on the other hand, what the IPI model is interested in is how people react to their preconceived notion about the influence of media contents on other people. The IPI model has been examined in a large number of contexts, including health communication (e.g., Chia, 2006; Chia, Ting, Chay, Cheong, Cheong, & Lee, 2012; Cho & Choi, 2011; Gunther, Bolt, Borzekowski, Liebhart, & Dillard, 2006; Ho, Lee, Ng, Leong, & Tham, 2016; Ho, Poorisat, Neo & Detenber, 2014; Park & Gunther, 2007; Yoo, Yang, & Cho, 2016), advertising (Jiang & Chia, 2009), journalism (Bernhard, & Dohle, 2014), political communication (Barnidge & Rojas, 2014; Lin, 2014; McKeever, Riffe, & Carpentier, 2012; Tsfati & Cohen, 2005;), and science communication (Tsfati, Cohen, & Gunther, 2011). These studies generated evidence largely consistent with the predictions of the IPI model.

A central assumption underlying the IPI model is that people are not fully aware of how others respond to a media content but have to make inferences based on their own perceptions of the media content and "their assumptions that such content has a substantial influence on others" (Gunther & Christen, 1999, p. 277). While this assumption may hold in traditional media, on social media platforms where there are multiple types of user-generated information suggestive of public opinion, it is possible that people will use the user-generated information to extrapolate the influence of media on other people and modify their own attitudes or behaviors

accordingly. This possibility makes the IPI model an appropriate theory to understand the influence of web content feedback system.

Lee has conducted several studies to explore the influence of online news comments using the IPI framework. In one study (Lee, 2010), she found that people who were exposed to online comments incongruent with the position of a news article reported greater perceived public opinion discrepancy and less presumed media influence than people being exposed to congruent comments. In another research, Lee and her colleague investigated the impact of two forms of online commentary formats—online comments and aggregate disapproval ratings—displayed alongside some news articles on people's perceived public opinion, news influence, and their personal opinions about the issues depicted in the news articles (Lee & Jang, 2012). Lee and Jang (2012) found that both online comments and aggregate ratings influenced people's attitudes toward the news. Also, compared with the control group and the group exposed to the aggregate disapproval ratings, those who were exposed to dissenting online comments reported greater perceived discrepancy between the public opinion and the news position. Additionally, people who read dissenting comments disagreed more with the news positions than those who read only the news. Similarly, based on the IPI model, Sommer and Hofer (2011) found that online user comments that tolled down the threat of Internet pornography advocated in a news article significantly influenced people's evaluation of the influence of Internet pornography on other people, which in turn influenced people's attitude and behavioral intention towards supporting media content censorship.

To understand the influence of presumed media influence on people's behaviors, many studies have tested the IPI framework as a four-step causal chain: self-exposure → perception of other-exposure → presumed influence on others → (own) behavior (Shen & Higgins, 2013). Other studies have expanded the model by adding perceived social norms in between presumed influence and behavior to better explain how media exposure indirectly influences individual behavior via social influence (Chia, 2006; Chia et al., 2012; Cho & Choi, 2011; Gunther et al., 2006; Ho, Lee, et al., 2016; Ho, Poorisat, et al., 2014; Yoo et al., 2016).

Summary

In summary, the SIDE model, the MAIN model, and the IPI model contribute to a better understanding of how and why web content feedback system might influence people's responses to a social media message. Nonetheless, studies conducted from these different theoretical angles make the literature fragmented. Integrating these different theories into one model could not only streamline current research but also promote theory development.

Walther, Carr, et al. (2010) pointed out that social media are a convergence of mass and interpersonal communication process. Online referral systems, discussion boards, and chat rooms provide "salient group dynamics" (Walther, Carr, et al., 2010, p. 25) and make normative influence exceptionally prominent. Consequently, the effects of proprietor contents on social media involve a social influence process. Actually, the SIDE model, the MAIN model and the IPI model all appear to suggest people's normative perception as a mechanism underlying the influence of web content feedback system on persuasion outcomes. For instance, the SIDE model

argues that in deindividuated CMC, individuals conform to common behaviors or attitudes of other users. Similarly, the MAIN model proposes that due to bandwagon heuristic (i.e., "If other people have done this, I should do this as well."), one type of normative perception, social recommendation cues influence people's assessment of online information. Also, the IPI studies suggest that media exposure could influence individuals' judgment and behaviors through their normative perceptions. Hence, this dissertation integrates previous theories using social norms theories and proposes social norms as the mechanism to account for how web content feedback system influences persuasive health communication. The next section reviews prior research on the influence of social norms.

The Effects of Social Norms

Definition and Early Studies About Social Norms

Social norms are widely shared rules, standards, and values by members of a group "that prescribes appropriate, expected or desirable attitudes and conduct in matters relevant to the group" (Turner, 1991, p.3). Many classic social influence studies were actually studies about conformity to the norms of a social group, such as Sherif's (1935) autokinetic effect experiment. In this experiment, Sherif asked participants to watch a stationery spot of light and then indicate the extent to which the light moved. Sherif found that when tested individually, people gave varied answers. However, when tested as a group, people changed their opinions to be in line with other people's. Asch's (1951) conformity experiment was another influential study about conformity to group norms. In that experiment, Asch (1951)

assigned each participant to a group of confederates, who were instructed to provide unanimously and apparently incorrect answers about which of three vertical lines matched the length of a target line. Asch found that across 12 trials in which unanimously incorrect answers were provided, nearly 75% of the participants agreed with the incorrect confederates at least once.

To better understand the social influence process, Deutsch and Gerald (1955) distinguished between informational and normative social influence. According to Deutsch and Gerald (1955), informational social influence stems from one's need to be correct in their decisions and normative social influence occurs when one seeks for social approval and avoids disapproval of a social group. Hence, normative social influence is more likely to occur than informational social influence, when people experience great conformity pressure. Deutsch and Gerald (1955) paid a particular attention to normative social influence in their study. They found that those who were given a group identity and those who gave their answers publicly were more likely to submit to normative social influence. Furthermore, Deutsch and Gerald (1955) found that even when normative social influence was impossible (i.e., people were asked to respond privately), people still followed incorrect group opinions, which demonstrated the existence of informational social influence.

Deutsch and Gerald's (1955) study well demonstrated that there were different normative influences and the strength of a particular normative influence depends on situations. Following Deutsch and Gerald's work, more theoretical frameworks have been developed to predict when and how social norms influence people's behaviors, among which the focus theory of normative conduct, the theory of reasoned action

(TRA), and the theory of planned behavior (TPB) have profound impacts on contemporary social influence literature.

Focus Theory of Normative Conduct

The focus theory of normative conduct distinguishes between two types of social norms: descriptive norms and injunctive norms (Cialdini, Reno, & Kallgren, 1990). Descriptive norms resemble informational social influence. It conveys information about what most people do in a situation and drives conformity when one's focal concern is to initiate an effective action. In contrast to descriptive norms, injunctive norms drive conformity by specifying what behaviors are socially desirable and what behaviors lead to social sanction. From this perspective, injunctive norms resemble normative social influence. Injunctive norms encourage behavioral change among individuals who seek to avoid social disproval and to maintain a positive social relation with other people (Cialdini & Trost, 1998). Because injunctive norms are sanction-based, compared with descriptive norms, injunctive norms usually entail greater conformity pressure and have a greater impact on those who are highly sensitive to the social environment (Cialdini & Goldstein, 2004).

Because descriptive norms and injunctive norms are conceptually and motivationally different, the focus theory of normative conduct suggests that scholars study the influence of the two types of social norms separately. Particularly, the focus theory points out that norms can only influence people's behaviors when they are salient in a situation. Cialdini et al. (1990) supported this idea through a series of experiments about littering. In one study, they found that though littering is widely known as a socially undesirable behavior (injunctive norms), when it was salient and

was recognized as a common practice (descriptive norms) in a situation, individuals littered more often. Conversely, in another study, though people were in an environment where littering was perceived common (descriptive norms), when they were reminded that littering was not socially desirable (injunctive norms), people were less likely to litter. According to these findings, Cialdini et al. concluded that descriptive norms and injunctive norms are independent constructs and compliance with each norm depends on which norm is salient at the moment of decision-making.

Following Cialdini's et al.'s (1990) study, more studies have been conducted to understand descriptive norms-behavior and injunctive norms-behavior relationship. Across a wide range of domains, scholars demonstrated that descriptive norms and injunctive norms could have differential influences on people's behaviors (Baumgartner, Valkenburg, & Peter, 2011; Cho, 2006; Crawford and Novak, 2011; Foster, Neighbors, & Krieger, 2015; Hong, Rice, & Johnson, 2012; Neighbors et al., 2010; Paek, 2009; Paek & Hove; 2012; Park & Smith, 2007; Yun & Silk, 2011). However, there is no definite answer with regard to which type of social norms is more influential. For instance, in college drinking context, some studies have found that descriptive peer drinking norms were more closely related to college students' drinking behaviors than injunctive peer drinking norms (Cho, 2006; Crawford and Novak, 2011; Foster, Neighbors, Krieger, 2015; Neighbors et al., 2010). By contrast, other research showed that college students' perceived injunctive peer drinking norms were more influential than descriptive peer drinking norms in shaping their drinking behaviors (Paek & Hove, 2012).

In addition to independently influencing behaviors, injunctive norms and descriptive norms may have joint effects on behaviors, which is the central focus of the theory of normative social behavior (TNSB; Rimal & Real, 2005). According to the TNSB (Rimal & Real, 2005), descriptive norms have greater influence on people's behavior or behavioral intentions at higher levels of injunctive norms. However, in their initial examination of the TNSB, Rimal and Real (2005) failed to find the expected interaction effect. Subsequent studies have suggested that the interaction between injunctive norms and descriptive norms is a function of several factors, such as individual differences and the reference groups of the social norms (Halim, Hasking, & Allen, 2012; Lee, Geisner, Lewis, Neighbors, & Larimer, 2007; Yang, 2017).

In a nutshell, based on Deutsch and Gerald's (1955) distinction between informational and normative social influence, the norms focus approach believes that there are two types of social norms and each norm is associated with a distinctive psychological need. Studies interested in the norm-behavior relationship should separate descriptive norms from injunctive norms.

TRA and TPB

According to the TRA (Fishbein, 1967), human behaviors are predicted by behavioral intentions, which then are a function of individuals' attitudes toward a behavior and subjective norms. Attitudes are aggregate products of people's beliefs about the possible outcomes of performing a behavior and their evaluation of those possible outcomes. Subjective norms are aggregate products of individuals' beliefs about whether important others expect them to perform a behavior and their

willingness to comply with these people. Some studies have suggested removing "motivation to comply" from the subjective norms construct because normative beliefs predict subjective norms better without considering people's motivation to comply (for a review, see O'Keefe, 2002). TPB is an extension of the TRA. By adding one additional predictor of behavioral intentions—perceived behavioral control, the TPB aims to account for the situations where individuals' behavioral intentions are determined by their perceived ease to perform a behavior (Ajzen, 1985). Overall, the TRA and TPB propose that people have greater intentions to perform a behavior if they believe performing the behavior brings about positive outcomes, important referents expect them to perform the behavior, and it is easy for them to implement the behavior.

Since their propositions, the TRA and TPB have become two of the most applied theoretical frameworks to explain and predict human behaviors. Numerical evidence in various behavior domains has been accumulated in support of the theories' propositions (for a review, see Hale, Householder, & Green, 2002; Montano & Kasprzyk, 2008; O'Keefe, 2002). Particularly, the TRA and TPB have been found to be useful in the health context. Ranging from smoking, drinking, to illicit drug use, screening and eating, multiple health behaviors could be explained by the TRA and TPB framework (Godin & Kok, 1996). In spite of the extensive support for the utility of the TRA and TPB, research has found that subjective norms in general have limited influence on intentions. For instance, a meta-analysis of the application of TPB in different behavioral domains found that the correlation between subjective norms and intentions was twice smaller than that between attitude and intentions

(Armitage & Conner, 2001). Similarly, Ajzen (1991) reviewed 19 applications of TPB and have found subjective norms were a significant predictor of intentions only in half of the cases. By contrast, attitude was significant in nearly all studies. Specific to health behaviors, Hausenblas and his colleagues (1997) examined the application of TRA and TPB in the context of exercise though a meta-analysis. They found the average correlation between attitudes and intentions and between perceived behavior control and intentions were .52 and .43, respectively. However, the correlation between subjective norms and intentions was .27. Godin and Kok (1996) analyzed earlier TPB studies in seven health contexts and found that subjective norms were overall less predictive of intentions than attitudes and perceived behavioral control.

Scholars have offered several explanations for the weak relationship between intentions and subjective norms (Fekadu & Kraft, 2002; Hale et al., 2002). One account suggests that subjective norms and attitudes might share the same underlying construct. However, this view conflicted with prior empirical evidence (Trafimow & Fishbein, 1995). Other account holds that subjective norms predict behavioral intentions only among certain people (Finlay, Trafimow, & Moroi, 1999; Trafimow & Finlay, 1996). This view has been verified by previous studies. For example, Trafimow and Finlay (1996) found that subjective norms were a more important predictor of intentions among individuals who had high collective self. But this finding was not replicated in other research (Fekadu & Kraft, 2002; White, Smith, Terry, Greenslade, & Blake, 2009). Besides these two accounts, scholars argued that conceptualization of subject norms was the primary problem (Sheeran & Orbell, 1999). Besides others' expectations, TRA and TPB should also consider other

normative constructs, and one important construct is the behaviors of other people, that is, descriptive norms (Ajzen, 2006). Indeed, Rivis and Sheeran's (2003) conducted a meta-analysis of the studies of TPB across different domains. They found that descriptive norms performed better than subjective norms in predicting intentions and have added 5% of additional variance over other predictors in the TPB. Also, the correlation between descriptive norms and intentions was particularly stronger among younger samples and for health-risk behaviors.

Subjective Norms vs. Injunctive Norms

As studies attempted to increase the predictive power of normative construct in TRA and TPB by adding descriptive norms, they commonly assume that descriptive norms and subjective norms are independent constructs. However, studies disagree whether injunctive norms and subjective norms are different constructs. Without theory-driven explanation, many studies tended to treat subjective norms and injunctive norms as the same construct (Bergstrom & Neighbors, 2006; Mcmillan & Conner, 2003; McMillan, Higgins, & Conner, 2005;.Rimal, 2008; Sheeran & Orbell, 1999; Smith et al., 2008; White et al., 2009). Admittedly, both subjective and injunctive norms indicate that people experience social pressure to conform (Rimal & Real, 2005; Rivis & Sheeran, 2003). However, the cause of conformity pressure for these two norms might be different. For injunctive norms, punishment associated with disconformity is the primary source of conformity pressure (Cialdini & Trost, 1998). Hence, injunctive norms are usually defined as one's perceived social approval of a behavior. On the other hand, subjective norms were assessed as one's perceptions of what important others expect them to do. Others' expectation is instrumental in

helping people decide whether they should perform a behavior but not fulfilling other's expectation might not necessarily indicate that one will experience social sanctions (Rimal & Real, 2005). Subjective norms and injunctive norms have distinctive motivational sources and should not be treated as the same construct (Rimal & Real, 2005; Chung & Rimal, 2016). Additionally, compared with subjective norms, the reference group for injunctive norms could be large, unspecific group, such as the whole society (Ho, Poorisat, et al., 2014; Rimal & Real, 2005). Thus, injunctive norms allow scholars to evaluate how perceived societal approval influences individuals' behaviors.

The distinction between subjective norms and injunctive norms has also been supported by empirical evidence. For instance, Park, Klein, Smith, and Martell (2009) performed a confirmatory factor analysis. They supported that subjective norms, university-level and U.S.-level descriptive norms, and university-level and U.S.-level injunctive norms were distinctive constructs. Subsequent analysis also showed that those five types of social norms had different influences on college students' intentions to limit their alcohol consumption. Park and Smith (2007) generated similar finding by studying different types of social norms in the context of organ donation.

To sum up, various theoretical perspectives and empirical studies have demonstrated social norms as an important antecedent of people's behaviors or behavioral intentions. However, the norm-behavior relationship varies across different types of social norms. To have a full understanding of normative influence, it is important to differentiate between these norms. This dissertation studies

descriptive norms, injunctive norms, and subjective norms as separate explanatory mechanisms of the influence of web content feedback system.

Social Norms and Communication

While much social norms research is concerned about the relationship between social norms perceptions and behaviors, how people construct social norms also interests many scholars. Just as Rimal and Lapinski (2015, p. 393) noted: "norms are communication phenomena." Without communication, it is hard for people to know other people's expectations, behaviors, and attitudes." Among different communication activities that can shape people's normative perceptions, interpersonal communication and media exposure are undoubtedly critical sources (Lapinski & Rimal, 2005). Much research has examined the establishment of social norms through interpersonal communication. For instance, Dulop, Kashima and Wakefield (2010) in their study instructed half of the participants to engage in interpersonal discussion about some HPV vaccine advocacy. They found that for those individuals who had talked the issue with a vaccinated friend, they developed more favorable normative perceptions about HPV vaccine. Similarly, Frank et al. (2012) found that Indian men's discussion about the use of condom significantly predicted their subjective norms and descriptive norms perceptions. More favorable discussion was associated with more favorable norms perceptions about the use of condoms. Real and Rimal (2007) studied peer communication about alcohol as a moderator of the influence of descriptive norms on college students' use of alcohol. They found that high levels of friends groups' talk about alcohol consumption were

associated with a stronger relationship between college students' descriptive norms perceptions and their drinking behaviors.

In addition to interpersonal discussion, media messages also play a significant role in shaping individuals' normative perceptions and many studies examining this topic were conducted within the IPI framework. For example, using the IPI model, Gunther et al. (2006) found that adolescents' own exposure to prosmoking media messages positively predicted their perception of their peers' exposure to the prosmoking messages and such perception was positively related to their estimates of the prevalence of smoking among their peers. Finally, greater perceived smoking prevalence led to greater perceived susceptibility to smoking. Similar to Gunther et al. (2006), Chia (2006) found late adolescents' own exposure to sex-related TV programs significantly influenced their perception of their peers' exposure to the programs and the influence of the programs on their peers, which in turn influenced their estimates of their peers' permissiveness toward sexual activities. Perceived peer norms predicted adolescents' sexual attitudes and behavioral intentions. Similar findings were also obtained in Cho and Choi's (2011) study that examined peer norms-mediated media influence on college students' use of tanning beds. Besides, Ho, Poorisat, et al. (2014) used the IPI model to examine how Thailand adolescent' exposure to anti- and pro-drinking messages influenced their drinking attitudes and intentions. Descriptive norms, injunctive norms, and subjective norms were all included as mediators in the model. They found that different drinking-related messages were associated with different normative perceptions and different types of social norms had different effects on people's drinking attitudes and intentions. Alike

Ho, Poorisat, et al., Nan and Zhao (2015) tested both descriptive norms and injunctive norms as mediators of adolescents' exposure to various smoking-related media messages on their smoking intentions. They found that not only different types of smoking-related messages had distinctive influences on adolescents' perceived injunctive norms and descriptive norms but also the two types of social norms were differentially related to adolescents' intentions to smoke.

In a nutshell, a large amount of empirical evidence supports interpersonal and mediated communication as critical sources of people's normative perceptions. As mentioned previously, social media featured with web content feedback system merge mass and interpersonal communication. Hence, exposure to the web content feedback system accompanying health promotion messages on YouTube should be able to influence people's normative perceptions.

The Impact of Web Content Feedback System: A Norms-Mediated Model

Based on a thorough review of prior studies on the influence of web content feedback system and social norms, the current research proposes a norms-mediated model to study how a series of social cues constituting YouTube content feedback system influence people's responses to health promotion messages posted on the website. The conceptual model is shown in Figure 2.1. In this model, the web content feedback system this dissertation assesses includes comments, aggregate ratings, and view count of health promotion messages on YouTube. The normative construct includes perceived descriptive norms, injunctive norms, and subjective norms about health behaviors depicted in the health promotion messages. Persuasion outcomes are

assessed through two variables: attitudes and intentions toward the behaviors described in the health promotion messages. Attitudes and intentions are used regularly by health communication scholars to assess health message effectiveness (e.g., Kim & Nan, 2016; Nan, 2012; Nan, Zhao, Yang & Iles, 2015, Zhao, Nan, Yang, Iles, 2014).

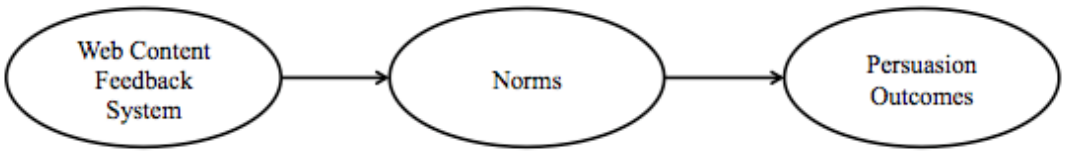


Figure 2.1. The norms-mediated model.

As mentioned early, many IPI studies have suggested that descriptive norms, injunctive norms, and subjective norms are able to mediate the relationship between people's estimates of media influence on other people or other people's media exposure and people's personal attitudes and behaviors (Chia, 2006, 2012; Cho & Choi, 2011; Ho, Lee, et al., 2016; Ho, Poorisat, et al., 2014; Liao et al., 2016). Comments and ratings could provide information about the extent to which other people are influenced by a media message and the number of message views suggests others' media exposure. Based on prior IPI studies, these feedback cues may then influence people's health attitudes or intentions by informing them of the prevalence, social approval, and expectations with regard to a behavior. Also, the SIDE model argues that deindividuated online communication fosters people to develop a salient group identity and conform to the norms of the group in an online communication. In Walther, DeAndrea, et al.'s (2010) study, they found that people exposed to anonymous online comments could identify the commenters as an important social

group and those who identified strongly with the group conformed to the commenters' opinions. Comments, ratings, and view count of YouTube videos did not reveal much personal information about viewers of the videos. Hence, exposure to these social cues might make people identify other viewers as important others and conform to these people's opinions. Similarly, prior MAIN studies have found that people's perceptions of other people's attitudes or behaviors (i.e., bandwagon perception) as mediators of the influence of user-generated responses to a social media message on people's attitudes or behavioral intentions (Sundar et al., 2008; Xu, 2013). Taken prior evidence together, the proposed norms-mediated model expects that web content feedback system is able to influence the effectiveness of health promotion messages via the mediation of societal level descriptive norms, injunctive norms and people's perceived subjective norms. To increase the generalizability of the findings, this study examines the norms-mediated model in a series of health contexts.

The Influence of Comment and Rating Valence

As aforementioned, a large number of studies have established that when comments and aggregate ratings suggest positive collective opinions of a social media message, people reported more favorable responses to the message (e.g., Chen, 2008; Dong, 2012; Flanagin & Metzger, 2013; Huang & Chen, 2006; Lee & Jang, 2010; Lee, 2012; Khare et al., 2011; Shi et al., 2012; Sommer & Hofer, 2011; Sundar et al., 2008; Walther, DeAndrea, 2010). According to these studies, it is expected that as comments and aggregate ratings associated with health promotion messages become increasingly favorable towards the messages, people are more likely to believe that

the health recommendations are widely performed, approved, and expected. As a result, people are also more likely to hold positive attitudes towards the health recommendations and perform the recommended behaviors.

However, many prior studies have manipulated comment and rating valence at two levels (e.g., positive comments vs. negative comments; Go, Jung, & Wu, 2014; Kareklas, Muehling, & Weber, 2015; Khare et al., 2011; Lee & Jang, 2010; Walther, DeAndrea, et al., 2010). Due to this, it is unclear whether proportional increase of comment or rating positivity will progressively enhance people's affirmative responses towards the messages posted on social media. Some studies argued that online reviews or ratings characterized by moderate positivity are more persuasive than extremely positive or negative reviews or ratings because extreme reviews or ratings are unrealistic (Chou & Banerjee, 2013). Also, moderate reviews usually highlight both the benefits and drawbacks of an object. Such two-sided arguments are more persuasive than one-sided arguments, such as extremely negative or positive reviews (Eisend, 2006). This proposition has been supported by a large number of studies in the marketing domain. For example, Schindler and Bickart (2012) found that the proportion of positive commentary on books and automobiles had an inverted U-shaped effect on perceived value of the comments. Similarly, Mudambi and Schuff (2010) found that for experience products, such as a music CD and an MP3 player, consumers' reviews that were extremely positive (5 stars on a 5-star scale) or negative (1 star on a 5-star scale) were rated as being less helpful than those reviews with medium ratings (e.g., 3 stars on a 5-star scale). Chua & Banerjee (2013) arrived at similar conclusions by examining the influence of review valence on customers'

perceived review diagnosticity across three experience product categories: books, music, and skin care. Purnawirawan, Eisend, de Pelsmacker, and Dens (2015) conducted a meta-analysis of the influence of review valence on customers' perceived review usefulness. They further supported that moderately positive reviews were rated as being more useful than extremely negative or positive reviews. By contrast, other studies pointed out another possibility: Moderate reviews including equal number of pros and cons are too vague and thus they are less helpful than those clearly positive or negative reviews in people's decision making. This view was also supported by a couple of empirical studies (e.g., Forman, Ghose, & Wiesenfeld, 2008; Purnawirawan et al., 2012)

Although the above studies suggest a possible curvilinear relationship between review or rating valence and people's cognitive perceptions, their conclusions might not be applicable to this study for two reasons. First, the majority of the above studies aiming to explore the influence of review valence on perceived review diagnosticity examined extremely positive (5 stars on a 5-star scale) and extremely negative ratings (1 star on a 5-star scale). Compared with consumer products, however, health promotion messages are designed to reinforce an idea and promote actions that could be difficult to implement sometimes (e.g., asking smokers to quit smoking). In general, health promotion messages are unlikely to be accompanied by extremely positive and negative comments. Exclusion of the review or review sets that are purely negative or positive might change the nature of relationship between comments/rating valence and persuasion outcomes discovered in the aforementioned studies. Second, the main focus of this study is the influence of comment and rating

valence on people's normative perceptions, attitudes and intentions towards a health behavior. However, most studies mentioned above studied people's perceived usefulness of reviews about a consumer product. The way how review valence influences review usefulness might not be the same as the way how review valence influences people's opinions and actions towards a promoted object. For instance, Forman et al. (2008) found that rating valence curvilinearly influenced people's perceptions of review usefulness but it did not have an effect on the final sales of a product.

Prior research has suggested that people in general have ambivalent attitudes about various health-related issues (Zhao & Cappella, 2008). Also, compared with purchasing a consumer product, performing a health behavior promoted by a health promotion message usually requires more physical and mental efforts. Thus, other people's sentiments on a health behavior may serve as an important source shaping people' attitudes and intentions toward the behavior. Therefore, more positive comments and ratings associated with a health promotion message should be associated with less normative perceptions, less favorable attitudes and less intentions toward a problem behavior. Positive comments in this study are defined as the comments that support the propositions of a health promotion message. If a health promotion message suggests that people stay away from a health-risk behavior, comments going against the behavior will be regarded as positive comments. The following hypotheses are proposed:

H1: A greater proportion of positive comments will be associated with the following responses toward a problem behavior: a) lower perceived prevalence

(descriptive norms), b) lower perceived social approval (injunctive norms), c) lower perceived expectation (subjective norms), d) more negative attitudes, and e) lower behavioral intentions.

H2: A greater proportion of thumbs-up will be associated with the following responses toward a problem behavior: a) lower perceived prevalence (descriptive norms), b) lower perceived social approval (injunctive norms), c) lower perceived expectation (subjective norms), d) more negative attitudes, and e) lower behavioral intentions.

The Influence of View Count

Compared with comment and rating valence, it is hard to predict the persuasive impact of view count on people's responses to health promotion messages. On one hand, a large number of message views could indicate a broad reach of the message. According to the IPI model, broader media reach is associated with greater perceived media influence on other people. Hence, highly viewed messages would produce greater normative perceptions for the recommended behavior. Indeed, Liao, Ho, and Yang (2016) found that people's perceptions of other people's exposure to some pro-environmental messages positively predicted their presumed media influence on other people, which in turn positively predicted their perceived descriptive norms, injunctive norms and subjective norms surrounding pro-environmental behaviors. Also, high message views indicate that other people have collectively focused on the health issue, which might suggest less social acceptance and prevalence of the behavior. For instance, Ho, Poorisat, et al. (2014) found greater perceived peer attention to antidrinking media messages predicted less perceived subjective and

injunctive drinking norms among Thailand adolescent drinkers. Similarly, Chia et al. (2012) found that Singaporean college females' perceived female peers' exposure to skin-lightening advertisements positively predicted their perceptions of female peers' skin-lightening favorable attitudes.

On the other hand, people might hold a naive theory that health promotion messages are designed for those people currently not performing the recommended behavior. Hence, being exposed to a health promotion message with high view count, people might process the information through the heuristic: This message is for people not currently engaged in the healthy behavior. So if many people have watched this message, it means that less people are performing the recommended behavior right now. Although there was no direct evidence in support of this view, prior studies have found people's exposure to nationwide anti-smoking messages positively predicted their perceived prevalence and social approval of smoking (Jacobson, 2007; Nan & Zhao, 2015; Wang & Jiang, 2016).

As the above two perspectives support either a negative or positive impact of message view count, other studies propose that message view count might also have a curvilinear effect on people. For instance, Knobloch-Westerwick et al. (2005) found the number of times a piece of news was viewed by other people had a U-shaped effect on the probability that the news was selected. Moderately viewed news articles were least likely to be selected.

Compared with comment and aggregate ratings, message view count to date has received less research attention (Fu & Sim, 2011; Paek, Hove, & Jeon, 2013).

Given several possible relationships between view count and people's normative perceptions, attitudes and behavioral intentions, a research question is proposed:

RQ1: How is view count of a health promotion message related to the following responses toward a problem behavior: a) perceived prevalence (descriptive norms), b) perceived social approval (injunctive norms), c) perceived expectation (subjective norms), d) attitudes, and e) behavioral intentions?

The main proposition of this research is that social norms mediate the influence of web content feedback system on people's responses to health promotion messages. The following hypotheses are proposed:

H3: The impact of the proportion of positive comments on attitudes and behavioral intentions is mediated by perceived a) descriptive norms, b) injunctive norms, and c) subjective norms.

H4: The impact of the proportion of thumbs-up on attitudes and behavioral intentions is mediated by perceived a) descriptive norms, b) injunctive norms, and c) subjective norms.

H5: The impact of view count on attitudes and behavioral intentions is mediated by perceived a) descriptive norms, b) injunctive norms, and c) subjective norms.

Comment Focus

Comments associated with health promotion messages on YouTube can be classified into two categories based on their focus: behavior-focused comments and message-focused comments. Behavior-focused comments are people's evaluations of

a behavior depicted in a health promotion message. For instance, for one of the most watched anti-smoking message on YouTube, people commented on the issue of smoking below the video: “People in this day and age know full well that cigarettes produce nothing but COMPLETE DESTRUCTION of your entire body,” “Although smoking kills, doesn't living kill you anyway? We all have a 100% chance of death,” and “although I am not necessarily defending smoking, I don't think it's right for people to falsify the effects of smoking.” These comments reflect people’s attitudes toward smoking. Different from behavior-focused comments, message-focused comments are public opinions about the quality and impact of a health promotion message. For instance, for the same anti-smoking video, some people said: “Hard hitting adverts are helping to get people to quit smoking,” “This video make me stop smoking. Thanks =),” and “wow, what disgusting, hyperbolic fear tactics.”

Although prior studies were aware of the difference between behavior- and message-focused comments, they did not set apart the influences of the two types of comments (Shi et al., 2014; Walther, DeAndrea, et al., 2010). However, to have a comprehensive understanding of the impact of online comments on the persuasiveness of health promotion messages on social media, this dissertation argues it is important to add comment focus as another independent variable. This argument is developed from two research perspectives.

First, in the advertising literature, it is an important practice to differentiate between ad- and brand-related cognitive responses because these different cognitive responses could influence people’s purchase decisions in different ways (Batra & Ray, 1986; Coulter & Punj, 1999; Homer, 1990; Mackenzie, Lutz, & Belch, 1986;

Rose, Miniard, & Bhatla, 1990). Health promotion messages are carefully designed messages to influence people's attitudes and behaviors. They are similar to advertisements. Behavior- and message-focused comments might respectively influence people's behavior- and message-related cognitive responses, which in turn differentially influence people's responses towards the health promotion messages. Hence, it is important to separate behavior-focused comments from message-focused comments.

Second, conversational content is an important topic in the studies about the role of interpersonal communication on health outcomes. Several scholars have explored whether conversations about a health message or a health behavior in the message differentially influenced people's responses to the message. In van den Putte et al.'s (2011) study, they distinguished between interpersonal communication about anti-smoking campaigns and interpersonal communication about smoking cessation. They found that compared with interpersonal discussions about anti-smoking campaigns, communication about smoking cessations was more strongly and positively related with people's quitting intentions. In another research, scholars (Hendriks & de Bruijn, 2015) found that college students' talk about their personal drinking experiences were significant predictors of their drinking-related attitudes, feelings of control, and subjective norms. However, their talk about alcohol-related media messages only influenced their perceived alcohol-related subjective norms. As aforementioned, social media are a combination of interpersonal communication and mass communication. Social media commentary system presents a pseudo interpersonal communication experience. Hence, it is important to separately study

the effect of behavior- and message-focused comments on the effectiveness of health promotion messages.

Because no literature so far has examined the persuasive impact of comment focus, two research questions are proposed:

RQ2: Is comment focus related to the following responses toward a problem behavior: a) perceived prevalence (descriptive norms), b) perceived social approval (injunctive norms), c) perceived expectation (subjective norms), d) attitudes, and e) behavioral intentions?

RQ3: Does comment focus (behavior-focused vs. message-focused) interact with the proportion of positive comments to influence people's responses to a health promotion message?

The Interaction Between Aggregate Ratings and View Count

Many social media sites present more than one content feedback cues, making it possible for different cues to influence message effectiveness jointly. Given people have the tendency to heuristically process various technological affordances, it is generally expected that several cues having consistent meanings might have augmented persuasive effects (Chen & Chaiken, 1999)**.** However, other studies have suggested that people might treat certain social cues as being more important than others. For instance, according to the warranting theory, easily manipulated cues are generally less trusted than the ones that are difficult to manipulate and hence will be ignored in the presence of those with greater warranting value (Walther, van der Heide, Hamel, & Shulman, 2009).

Empirical studies overall did not suggest a clear pattern of the interaction between different social cues. For instance, Xu (2014) examined people's responses to online reviews of a fake brand as a function of a series of review features: review valence, presence of reviewer's picture, the number of people who trusted the reviewer. She found when a product review was positive, presence of reviewer's picture and number of trusted people did not interact with each other. On the other hand, when a product review was negative and the profile of the reviewer did not contain pictures, a larger number of trusted people increased participants' trust in the reviewer. In another study, Xu (2013) explored the influence of the number of diggs, source credibility and news recency on people's responses to some online news on digg.com. She found complicated interaction effects between different social cues. A combination of a low credible news source and more recent news articles made the news most persuasive. However, news from a highly credible source and that was recent was perceived as being more credible. When the outcome variable was intentions to share news, news from a low credible source and having more diggs was most effective. In their research, Flanagin and Metzger (2013) found that when rating volume was high, people perceived a greater congruency between their own and others' ratings even when the source of the ratings was laypeople other than experts.

Due to the above mixed evidence about the combinatory effects of different social cues, a research question is proposed to explore how view count and aggregate ratings might interact with each other to influence health promotion message effectiveness.

RQ4: Does view count interact with the proportion of thumbs-up to influence people's responses to a health promotion message?

Two experimental studies were conducted to examine the hypotheses and research questions. Study 1 examined the influence of online comments on the effectiveness of health promotion messages. Hence, H1, H3, RQ2, and RQ3 were addressed in study 1. Study 2 examined the influence of view count and aggregate ratings. H2, H4, H5, RQ1, and RQ4 were tested in study 2. Before the main studies, pilot studies were conducted to select the study contexts and health promotion messages and assure the successful manipulation of comment valence and focus, rating valence, and view count.

Chapter 3. Participants, Health Promotion Messages, Study Contexts, and Pilot Studies

This chapter first explains the participants and health promotion messages of all studies. Then, four health contexts and the rationale for choosing these contexts are presented. After that, this chapter details three pilot studies that preceded the main experiments. All studies were approved by the Institutional Review Board at the University of Maryland (UM).

Participants

All studies of this dissertation recruited college students as participants. This population is appropriate for two reasons. First, college students are vulnerable to a variety of health risks (Center for Disease Control and Prevention [CDC], 2014, 2016) and are the target audiences of many social media-based public health campaigns. Consequently, studying college students' responses to health promotion messages on YouTube holds practical significance. Second, prior research has found young adults are the most active users of social media and are more likely to watch, post, rate, and review online videos than the middle-aged and older adults (Chou, Hunt, Beckjord, Moser, & Hesse, 2009; Purcell, 2010). As such, studying the current topic among college students would make it more possible to identify the hypothesized effects.

Health Promotion Messages

Health promotion messages can be shown in different forms, such as an educational video or an interview video between a journalist and a health professional. This dissertation chooses to study health promotion PSAs. PSAs or public service advertisements are non-paid advertisements used by non-profit organizations and governments to disseminate persuasive messages with the objective of increasing people's awareness about a social issue and eliciting positive attitude and behavioral change (Bator & Cialdini, 2000). Aired through a diversity of media avenues, PSAs can "efficiently and repeatedly penetrate a large target population" at a low cost (Bator & Cialdini, 2000, p. 527). Because of this advantage, PSAs are an important communication format in public communication campaigns (O'Keefe & Reid, 1990). Though in the past, a substantial number of studies have been conducted to understand the determinants of health-related PSA persuasiveness (see Nan & Zhao, 2010), few have examined the influence of web content feedback system. Given the important role of PSAs in health communication practice, this dissertation chooses to study health promotion PSAs.

Study Contexts

Four health issues were initially selected as possible study contexts for this research, including cigarette smoking, binge drinking, texting while driving, and getting human papillomavirus (HPV) vaccine. These four issues were chosen because CDC Youth Risk Behavior Surveillance System identified tobacco and alcohol use, texting while driving, and HPV infection as leading health challenges faced by young

adults. It is important to understand communication-related factors that drive people to stay away from smoking, binge drinking, texting while driving and not getting vaccinated against HPV. Also, the focus of this dissertation is the effects of YouTube video feedback system on people's responses to health promotion messages posted on the website. Due to this focus, it is expected that the health contexts chosen for this research should have already had some coverage and aroused a moderate level of public discussion on YouTube. A search of existing health promotion videos on YouTube demonstrated that cigarette smoking, binge drinking, texting while driving, and HPV vaccine best satisfied the above criteria.

Pilot Study 1

Pilot study 1 served several purposes. First, although preliminary research has identified four possible study contexts, it is important to assure that the contexts are appropriate for the current participant group. Specifically, because attitudes and behavioral intentions are two important outcome variables of this research, it is expected that for the selected health behaviors, people have various attitudes toward it and are likely to perform the behavior in the future. Second, pilot study 1 was conducted to choose the appropriate PSA videos for each health context. Based on prior research (Dong, 2012; Joyce & Hardwood, 2014; Lee, 2010; Xu, 2013), the selected PSAs are expected to meet the following criteria: 1) the PSAs have not been seen many people; 2) the PSAs can lead to a moderate level of involvement; 3) the PSAs are believable and clear (e.g., people can quickly identify an anti-smoking PSA as an ad advocating against cigarette smoking). In addition to the above two purposes, pilot study 1 also assessed people's prior experiences of using YouTube content

feedback system in order to prepare other experimental stimuli (e.g., comments and view count).

Participants

A total of 59 undergraduate students taking communication classes at UM participated in pilot study 1 in exchange for course credit. Seven, who only answered the first several questions, were deleted from the final analysis. The average age of the rest 52 people was 19.77 (*SD* = 2.07) and their racial distribution was: 61.5% White, 21.2% Black or African American, 11.5% Asian or Pacific Islander, and 5.8% other.

Procedure

This study was conducted through an online survey. Participants gained an access to the survey via the Department of Communication research web portal. The survey first presented participants with a consent form. Only those who gave an informed consent were allowed to proceed. During the study, participants were first asked about their demographic information. Then, a series of questions assessed participants' attitudes towards the four initially selected health issues, including cigarette smoking, binge drinking, texting while driving, and getting HPV vaccine. Following that, participants were presented with 20 health-related PSAs. Among these 20 health-related PSAs, seven focused on cigarette smoking, four focused on binge drinking, six were about texting while driving, and three were about getting HPV vaccine. These 20 PSAs were shown in a random order and following the presentation of each PSA, participants were asked about their previous exposure to

the PSA, their perceived PSA involvement, PSA credibility, and PSA clarity. Finally, participants answered several YouTube-related questions as well as the questions regarding their prior engagement in each health behavior.

PSA Videos

To increase the external validity of this research, all of the 20 PSAs tested in pilot study 1 were professionally produced PSAs from actual health communication campaigns[1]. These PSAs were collected from an extensive search on YouTube by entering keywords such as "commercial" "PSA" and "ad" of each health issue. Each PSA video was about 30-second long.

Key Measures

Attitudes towards the health behavior. Based on Dillard, Shen, and Vail's (2007) research, five 11-point semantic differential scales assessed people's attitudes towards each health behavior. The word pairs were bad(1)/ good(11), unfavorable(1)/favorable(11), negative(1)/positive(11), undesirable(1)/desirable(11), and detrimental(1)/beneficial(11). Responses to the five scales for each health behavior were averaged into a composite score.

Prior engagement in the health behavior. Questions assessing people's prior engagement in smoking, binge drinking, and texting while driving were adopted from the national Youth Risk Behavior Survey (YRBS; CDC, 2015). For each of these three behaviors, people were asked about whether they have ever been engaged

[1] Three HPV vaccine videos were slightly modified though a video editing software so that all video messages had equal length (30 seconds) and were appropriate for current audiences.

in the behavior any time in their lifetime (e.g., "Have you ever tried cigarette smoking, even one or two puffs?) and during the past 30 days (e.g, "During the past 30 days, on how many days did you smoke cigarettes?"). The YRBS (CDC, 2015) defined those who had performed these health-risk behaviors on at least one day during the past 30 days as current performers of the behaviors. Questions assessing people's prior experience with HPV vaccine were from Nan's (2012) study. People were asked: "Have you received at least one dose of HPV vaccine?"

Prior PSA exposure. To assess this variable, following the presentation of each PSA, participants were asked: "Have you ever watched this PSA before?"

PSA involvement. Based on prior studies (Cheah, 2006; Pfau et al., 2009; Zaichkowsky, 1985), following the presentation of each PSA, people were asked how they thought about the PSA. Answers were provided on four 11-point scales ranging from 1(important to me/irrelevant to me/of no concern to me/means a lot to me) to 11(unimportant to me/relevant to me/of concern to me/means nothing to me). A composite score of PSA involvement was created by averaging answers made on the four scales. Before the averaging procedure, responses to the first and fourth item were reverse coded so that greater values of all items indicated higher perceived PSA involvement.

PSA credibility. According to prior studies (Beltramini, 1988; Greer, 2003; MacKenzie & Lutz, 1989), four 11-point scales ended with unbelievable/unconvincing/not credible/untrustworthy (1) and believable/convincing/credible/trustworthy (11) were used to measure perceived PSA

credibility. Responses were averaged across the four scales to generate an index for each PSA.

PSA clarity. This variable was assessed through one single question. For each video, people were asked to indicate whether they disagree or agree that the PSA advocates certain behavior (e.g., not smoking). Answer was requested on an 11-point Likert-type scale (*1 = strongly disagree, 6 = neutral, 11 = strongly agree*).

Two YouTube relevant measures. To help create experimental stimuli for the other studies involved in this research, pilot study 1 asked people to indicate the number of comments they typically read on YouTube (e.g., 1-5, 6-10, and 10-20). Additionally, they were asked to indicate how many views a video has received on YouTube would indicate the video has been watched by a large number of people, moderate number of people and only a few people. Several categories of the video view count were provided to the participants (e.g., 1-100, 101-500, and 501-100). These categories were developed based on previous research (Chatzopoulou, Sheng, & Faloutsos, 2010). People were asked to check all the categories that applied.

Results

Attitudes and prior engagement. Table 3.1 shows the descriptive statistics of people's attitudes toward each health behavior and their prior engagement in the behavior. Given that smoking, binge drinking, and texting while driving are widely known health-risk behaviors, it is not surprising that people's attitudes towards these behaviors are skewed towards very negative. In spite of the skewness, people's attitudes towards these behaviors still had some variance, particularly their attitudes towards binge drinking. As for getting HPV vaccine, people's attitudes towards it

were overall positive. As for people's prior engagement in each health behavior, 42.3% of people were ever-smokers, and 17.3% were current smokers; 88.5% of people were ever-binge drinkers and 71.2% were current binge drinkers; 73.1% of people had ever texted while driving and 46.2% had performed this behavior on at least one day during the past 30 days. 61.5% of people have received at least one dose of HPV vaccine.

Table 3.1

Pilot Study 1: Descriptive Statistics of Issue-Related Measures

Health Issue	Attitudes *M* (*SD*, Cronbach's α)	Ever engagement	Current engagement (i.e., performed the behavior on at least one day during the past 30 days)
Smoking	1.97 (1.62, $\alpha = 0.94$)	42.3%	17.3%
Drinking	3.72 (2.64, $\alpha = 0.97$)	88.5%	71.2%
Texting while driving	2.20 (1.52, $\alpha = 0.96$)	73.1%	46.2%
HPV vaccine	9.08 (2.71, $\alpha = 0.99$)	61.5%	--

PSA exposure, involvement, credibility, and clarity. Table 3.2 shows the descriptive statistics of people's perceptions of the 20 health-related PSAs. According to Table 3.2, for smoking, PSA 5, PSA 6 and PSA 7 were first dropped out of further consideration given many people have reported prior exposure to these PSAs. Among PSA1, PSA 2, PSA 3, and PSA 4, PSA 3 was not appropriate because it had the lowest clarity and credibility. PSA 4 was similar to PSA 1 and PSA 2 in clarity and involvement and similar to PSA 2 in credibility. However, PSA 4 received relatively

more prior reviews than PSA 1 and PSA 2. Hence, PSA 4 was dropped. Anti-smoking PSA 1 and PSA 2 were selected. For binge drinking, PSA 4 was first removed given it had more prior views and lowest clarity and low credibility. PSA 1 was also not considered because its level of involvement was relatively too high. Anti-binge drinking PSA 2 and PSA 3 were finally selected. For texting while driving, PSA 3, PSA 4 and PSA 6 were not appropriate because many people used to watch these videos. Among the rest, PSA 5 was not appropriate because it had more views, lower clarity and lower credibility than PSA 1 and PSA 2. Anti-texting while driving PSA 1 and PSA 2 were selected. For HPV vaccine, all of them had received some prior views from the participants. PSA 3 had the lowest credibility and clarity and was not considered appropriate.

Table 3.2

Pilot Study 1: Descriptive Statistics of PSA-Related Measures

Message	Prior exposure	Clarity *M (SD*)	Involvement *M (SD*, Cronbach's α)	Credibility *M (SD*, Cronbach's α)
Smoking				
PSA 1	1.9%	9.40 (2.09)	6.14 (2.46, $\alpha = 0.89$)	8.20 (2.67, $\alpha = 0.99$)
PSA 2	0	9.35 (2.21)	6.56 (2.48, $\alpha = 0.88$)	8.60 (2.13, $\alpha = 0.95$)
PSA 3	3.8%	8.79 (2.21)	6.04 (2.34, $\alpha = 0.87$)	7.75 (2.71, $\alpha = 0.98$)
PSA 4	5.8%	9.42 (2.37)	6.38 (2.43, $\alpha = 0.85$)	8.71 (2.24, $\alpha = 0.96$)
PSA 5	36.5%	9.33 (2.34)	6.44 (2.51, $\alpha = 0.84$)	8.49 (2.48, $\alpha = 0.97$)
PSA 6	32.7%	9.65 (2.10)	6.40 (2.40, $\alpha = 0.82$)	8.93 (2.74, $\alpha = 0.99$)
PSA 7	17.3%	9.60 (1.96)	6.72 (2.66, $\alpha = 0.86$)	8.72 (2.56, $\alpha = 0.94$)
Binge drinking				
PSA 1	0	9.50 (2.12)	8.07	8.89

			(1.94, α = 0.87)	(2.51, α = 0.99)
PSA 2	1.9%	9.33 (2.05)	7.69	8.34
			(1.73, α = 0.71)	(2.18, α = 0.97)
PSA 3	0	9.35 (2.08)	7.47	8.11
			(2.00, α = 0.85)	(2.55, α = 0.98)
PSA 4	1.9%	9.19 (2.10)	7.50	8.19
			(1.99, α = 0.81)	(2.18, α = 0.96)
Texting while driving				
PSA 1	1.9%	9.40 (2.03)	8.11	8.27
			(1.96, α = 0.92)	(2.46, α = 0.98)
PSA 2	0	9.54 (2.29)	8.22	8.66
			(1.88, α = 0.79)	(2.63, α = 0.99)
PSA 3	15.4%	9.25 (2.21)	8.38	8.36
			(1.94, α = 0.83)	(2.48, α = 0.96)
PSA 4	11.5%	9.48 (2.11)	8.22	8.82
			(2.20, α = 0.83)	(2.65, α = 0.98)
PSA 5	3.8%	9.02 (2.34)	8.01	8.23
			(2.16, α = 0.89)	(2.77, α = 0.98)
PSA 6	32.7%	9.83 (1.92)	8.18	9.46
			(2.27, α = 0.87)	(1.99, α = 0.99)
HPV vaccine				
PSA 1	5.8%	8.90 (2.41)	7.08	7.98
			(2.06, α = 0.82)	(2.97, α = 0.99)
PSA 2	3.8%	8.88 (2.05)	7.16	8.29
			(2.15, α = 0.83)	(2.22, α = 0.96)
PSA 3	5.8%	8.77 (2.18)	6.95	8.08
			(2.14, α = 0.84)	(2.48, α = 0.97)

Two YouTube relevant measures. A total of 75% people indicated that they generally read 1-5 comments while watching videos on YouTube, 15% reported 6-10 comments and 10% indicated 10-20. As for videos view count, 1-100 (60%) and 101-500 (65%) were most selected categories for low view count. 5001-10,000 (40%) and 10,001-50,000 (47%) were top categories for medium view count. 71% people reported 500,001-1,000,000 and 65% people reported over 1,000,000 as high view count.

Discussion

Pilot study 1 provided several notable findings. First, the majority of people (61.5%) indicated that they had received at least one dose of HPV vaccine. For these people, it did not make sense to examine the influence of HPV promotion videos on their intentions to get vaccinated. Prior studies (Kim & Nan, 2016; Nan, 2012) testing HPV vaccine message effectiveness usually excluded these people from their studies. This means a very large sample size for the main studies. Hence, HPV vaccine was not deemed an appropriate issue for this study. Second, people's attitudes towards smoking and texting while driving were very skewed and had relatively small variance. Also, not many people were current smokers (i.e., people who had smoked on at least one day during the past 30 days). However, anti-smoking PSAs and anti-texting while driving PSAs, in general, led to a moderate to high level of involvement among people. Also, for smoking, nearly half of the people indicated they had ever smoked. Due to these findings, it is still worthwhile to study the two topics. Finally, smoking, binge drinking, and texting drinking were determined as the study contexts and for each issue, two PSAs were selected.

Pilot Study 2

The purpose of pilot study 2 was to examine the manipulation of the proportion of positive comments and comment focus. In this study, proportion of positive comments was manipulated only at a few levels. It is important to assure that people can differentiate between these different levels in terms of overall comment valence, including negativity and positivity. It is expected that greater proportion of positive comments leads to greater perceived comment positivity and less negativity.

Comment focus refers to whether a comment focuses on the executional feature of a message or a health behavior depicted in a message (i.e., smoking, binge drinking, and texting while driving). An experiment was conducted to examine the effectiveness of manipulating these different factors.

Participants

A total of 111 UM students taking communication classes participated in this research and were rewarded with course credit. Among these people, eight did not complete the majority of the questionnaire and were deleted. Of the rest 103 people, there were 68% females, 32% males, 64.1% White, 10.7% Black or African American, 18.4% Asian or Pacific Islander, and 6.8% other races. The average age of these 103 people was 18.82 (SD = 1.22), and none of the participants indicated that they have participated in pilot study 1.

Procedure

Similar to pilot study 1, pilot study 2 was an online study posted on the Department of Communication's online research web portal. People who were registered for the study were provided with the link to the survey. The survey consisted of several parts. The first part was a consent form informing people of the nature of the study. Those who provided an informed consent were allowed to continue. The second part of the survey included questions assessing participants' age, gender and race. Following answering these questions, participants were randomly assigned to one of 2 (focus: message vs. behavior) × 3 (proportion of positive comments: large, medium, vs. small) experimental conditions. In each

condition, participants watched six health-related PSAs selected from pilot study 1. The six PSAs were shown to the participants on a mock YouTube web page one at a time and in a random order. The mock YouTube web page also displayed a series of comments for that specific PSA. Following the presentation of each PSA, participants were asked to answer the questions assessing their perceived comment focus and valence. The last part of the survey was a debriefing form.

Stimuli Materials

Video presentation. Following Walther, DeAndrea, et al.'s (2010) study, each PSA selected from pilot study 1 was displayed on a mock YouTube web page. The web page had many features similar to actual YouTube web page, such as page layout, color, size, and fonts of text shown on the page. Also, like what they do on an actual YouTube web page, people can start playing the PSA by clicking on the video. A series of comments are shown below the video alike an actual YouTube web page. However, the mock web page did not show the number of views and aggregate ratings of a video to avoid possible confounding effects from these factors (see Appendix A for a stimuli example).

Comments selection. To have greater ecological validity, this study used actual comments on anti-smoking, anti-binge drinking, and anti-texting while driving PSAs on YouTube as experimental stimuli. Although pilot study 1 identified that the majority of people read 1-5 comments while watching YouTube videos, studies similar to this research usually used 5-10 comments (Lee & Jang, 2010; Shi et al., 2014; Walther, DeAndrea, et al., 2010). To make sure three levels of proportion of positive comments were distinctive from each other, this study ended up with eight

comments for each PSA. Final comment set for each PSA was decided through the following procedure. First, for each health topic, relevant PSAs on YouTube were searched. Second, the comments of these PSAs were consulted and comments that were clearly focused on the PSA or the health behavior and were supportive or against the PSA were collected. This step delivered a pool of positive message-focused comments, positive behavior-focused comments, negative message-focused comments, and negative behavior-focused comments. Then, these comments were evaluated and compared for their valence and focus. Finally, 16 most positive message-focused comments, 16 most negative message-focused comments, 16 most positive behavior-focused comments and 16 most negative behavior-focused comments for each health issue were selected. Because each health issue had two PSAs, each of the four comment groups were divided into two sets so that each PSA on the same health issue had eight positive message-focused comments, eight negative message-focused comments, eight positive behavior-focused comments, and eight negative behavior-focused comments. Following this, some minor modifications were made to the comments of each PSA to make sure they were appropriate for that specific video.

Manipulation

Focus. Based on the advertising literature (Batra & Ray, 1986; Coulter & Punj, 1999; Homer, 1990; Mackenzie et al., 1986; Rose et al., 1990), this study defines message-focused comments as those focused on the executional style and quality of the message (i.e., the PSA), such as its audio and visual effects and its impact. For example, message-focused comments on a smoking PSA included: “This

commercial completely captured my attention. I think it got the point across very effectively for anti-smoking." Behavior-focused comments refer to the comments that argue against or for a health behavior. For example, the behavior-focused comments for a smoking PSA included "Smoking is so bad for you. Why would anyone start it? It's just stupid."

Proportion of positive comments. Purely positive or negative comment sets were unrealistic for health promotion messages in current health contexts. To increase the realism of this research, valence was manipulated by changing the proportion of positive comments at three levels, 7/8 4/8, and 1/8. The ratio were developed based on prior research (Lee & Jang, 2010; Shi et al., 2014). To create corresponding comment sets for each PSA, first, eight positive message-focused comments, eight negative message-focused comments, eight positive behavior-focused comments, and eight negative behavior-focused comments of each PSA identified early were numbered from one to eight in their set. Then, for each PSA, to create 7/8 and 1/8 message-focused comment conditions, 1) random number table generated a number; 2) the specific negative comment in the negative message-focused comment group and the specific positive comment in the positive message-focused comment group switched their positions. To create 4/8 comment condition, random number table generated four random numbers. Four negative comments with the specific numbers were selected and replaced four corresponding positive message-focused comments in the positive comment set. The same procedure was performed for the behavior-focused comments. Two PSAs of the same health issue in the same experimental condition did not have the same order of positive and negative comments in order to

avoid the confounding effects of comment order. Table 3.3 shows the order of negative and positive comments in different experimental conditions. Table 3.4 shows one example of the comment stimuli used in pilot study 2.

Table 3.3

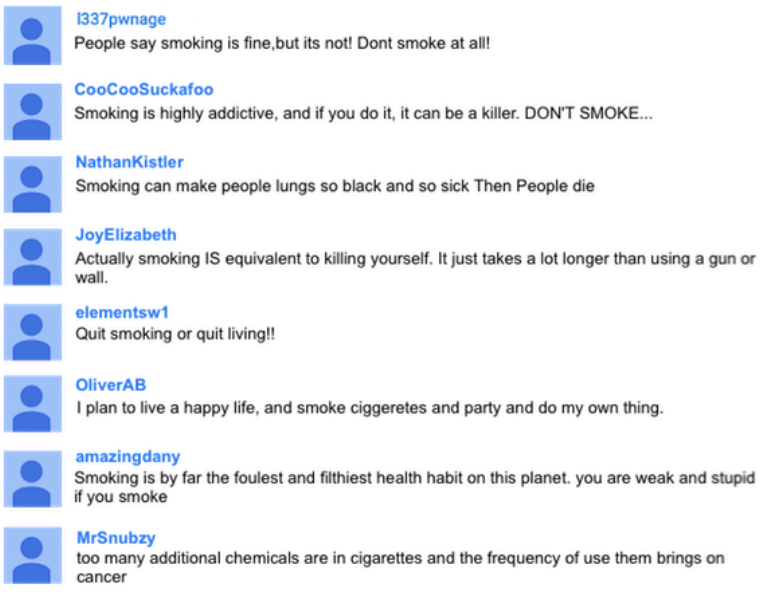
Order of Positive and Negative Comments in Different Conditions

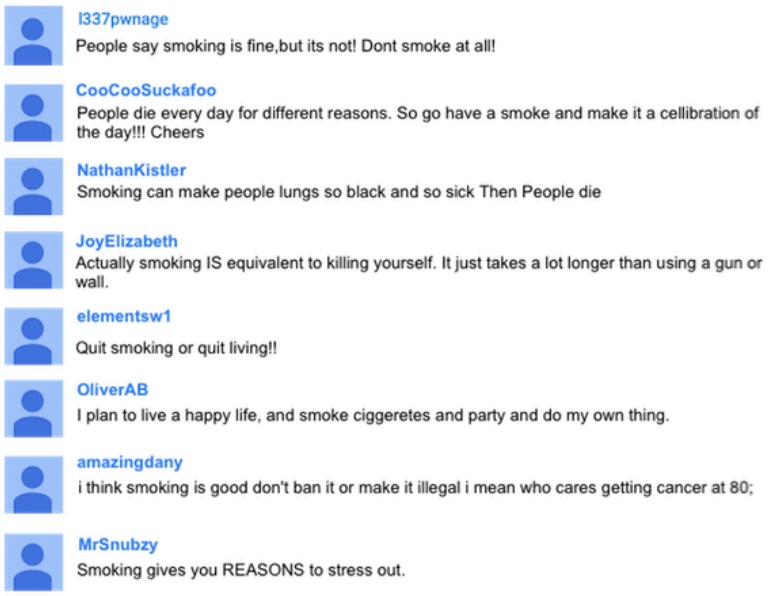
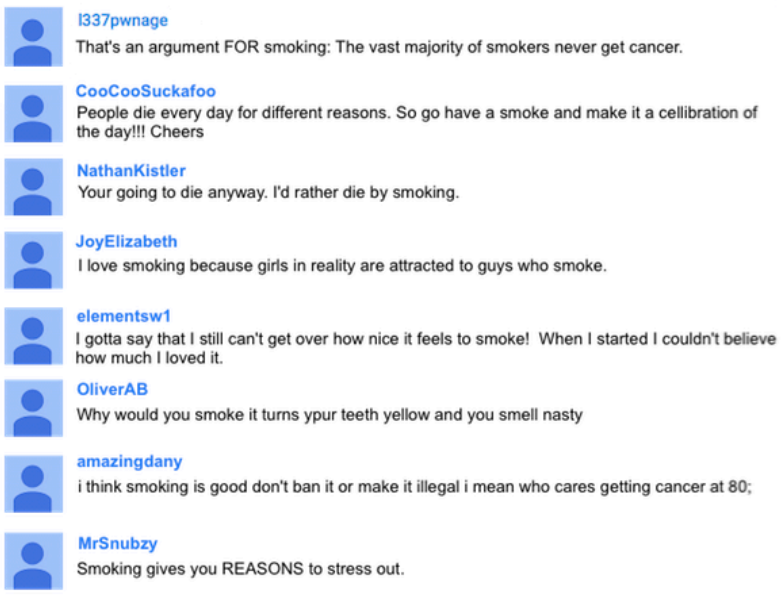
	Proportion of positive comments		
Message	Large	Medium	Small
Anti-smoking PSA 1	+ + + + + − − + +	+ − + + + − − −	− − − − − + − −
Anti-smoking PSA 2	+ + − + + + + +	− − − + + + + −	− − + − − − − −
Anti-binge drinking PSA 1	+ + − + + + + +	+ − − − + + + −	− − + − − − − −
Anti-binge drinking PSA 2	+ + + − + + + +	− − + + − − + +	− − − + − − − −
Anti-texting while driving PSA 1	− + + + + + + +	+ − − + − + + −	+ − − − − − − −
Anti-texting while driving PSA 2	+ + + + + − + +	− − − + + + − +	− − − − − + − −

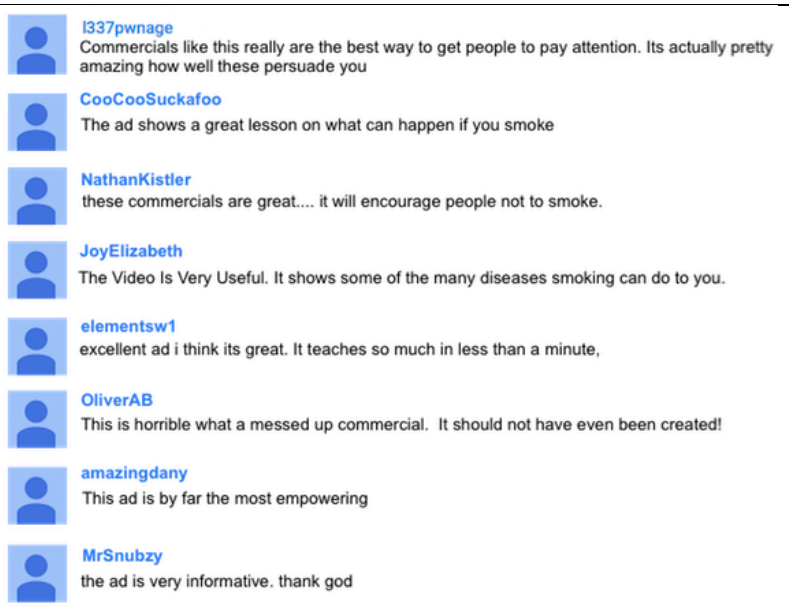
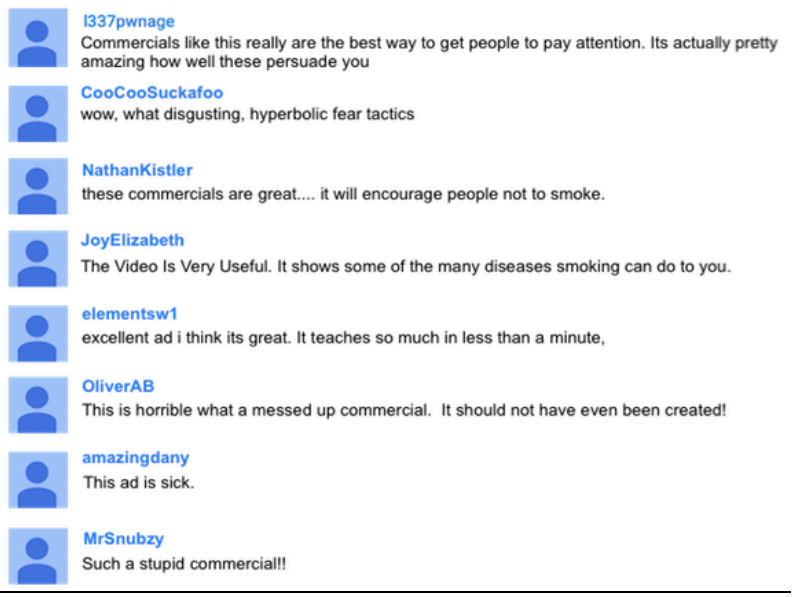
Note. The plus sign (+) represents a positive comment and the minus sign (−) represents a negative comment. The table applies to both message- and behavior-focused comments.

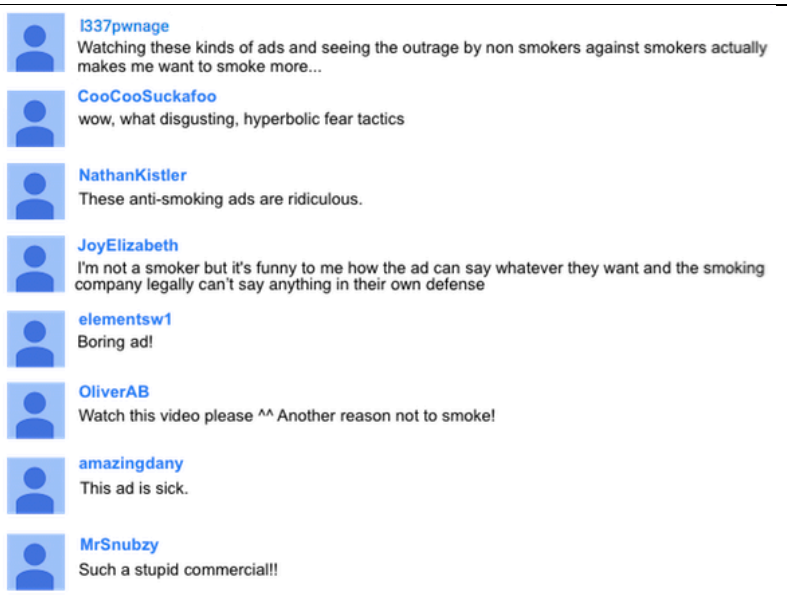
Table 3.4

Pilot Study 2: Comments for Anti-Smoking PSA 1

Focus	Proportion	Comments
Behavior	Large	

Behavior	Medium	
Behavior	Small	

Message	Large	
Message	Medium	

Message	Small	

Key Measures

Comment focus. Two items assessed comment focus. People were asked to indicate their agreement or disagreement on an 11-point Likert-type scale (*1 = strongly disagree, 6 = neutral, 11 = strongly agree*) with two items: "The comments of the PSA focus on people's opinions about the quality or executional style of the PSA," and "The comments of the PSA focus on people's opinions about the unhealthy behavior depicted in the PSA."

Comment valence. Based on prior research (Zhao et al., 2013), two items assessed this variable: "Overall, the comments of the PSA are in favor of the PSA" and "Overall, the comments of the PSA are against the PSA." People were asked to show their agreement or disagreement with each of the items on an 11-point Likert-type scale (*1 = strongly disagree, 6 = neutral, 11 = strongly agree*).

Results

Four analyses of variance (ANOVAs) were performed to check the manipulation of the proportion of positive comments and comment focus with two valence check measure and two focus check measures as dependent variables, respectively. The analyses were performed separately for each PSA.

Comment focus. For anti-smoking PSA 1, comment focus was statistically significant on the two comment focus check measures, $F(1, 97) = 26.23$, $p < .001$, $\eta_p^2 = .21$, and $F(1, 97) = 10.86$, $p = .001$, $\eta_p^2 = .10$. As expected, people exposed to the message-focused comments reported that the comments they read focused more on the quality and executional style of the PSA ($M = 7.30$, $SE = 0.39$) and less on the unhealthy behavior ($M = 7.04$, $SE = 0.33$) than those exposed to the behavior-focused comments (message: $M = 4.42$, $SE = 0.40$; behavior: $M = 8.61$, $SE = 0.34$). Additionally, focus interacted with proportion of positive comments for the measure asking people whether the PSA comments focused on the executional style of the PSA, $F(2, 97) = 6.60$, $p < .01$, $\eta_p^2 = .12$, and proportion of positive comments had a significant main effect on the measure that asked people whether the comments focused on the unhealthy behavior, $F(2, 97) = 4.23$, $p < .05$, $\eta_p^2 = .08$.

For anti-smoking PSA 2, comment focus had a significant main effect on the measure checking whether the comments focused on the PSA, $F(1, 97) = 34.91$, $p < .001$, $\eta_p^2 = .27$, and approached significance for the measure checking whether the comments focused on the unhealthy behavior, $F(1, 97) = 3.52$, $p = .06$, $\eta_p^2 = .04$. As expected, people exposed to the message-focused comments reported that their comments were more focused on the PSA ($M = 7.73$, $SE = 0.40$) and less on the

behavior (M = 7.29, SE = 0.37) than those exposed to the behavior-focused comments (message: M = 3.36, SE = 0.41; behavior: M = 8.28, SE = 0.38). Proportion of positive comments approached significance on the measure asking whether the comments focused on the PSA, $F(1, 97) = 2.99$, $p = .06$, $\eta_p^2 = .06$.

For anti-binge drinking PSA 1, comment focus was statistically significant on the two focus check measures, $F(1, 97) = 82.51$, $p < .001$, $\eta_p^2 = .46$ and $F(1, 97) = 10.42$, $p = .001$, $\eta_p^2 = .10$. As expected, people exposed to the message-focused comments reported that their comments were more focused on the PSA (M = 7.84, SE = 0.34) and less on the behavior (M = 6.78, SE = 0.34) than those exposed to the behavior-focused comments (message: M = 3.47, SE = 0.35; behavior: M = 8.36, SE = 0.35). Additionally, the interaction between focus and proportion of positive comments was significant on the measure checking whether the comments focused on the PSA, $F(2, 97) = 6.77$, $p < .01$, $\eta_p^2 = .12$, and the main effect of proportion of positive comments approached significance for the measure checking whether comments focused on the behavior, $F(2, 97) = 2.90$, $p = .06$, $\eta_p^2 = .06$.

For anti-binge drinking PSA 2, comment focus was statistically significant on the two focus check measures, $F(1, 97) = 28.15$, $p < .001$, $\eta_p^2 = .23$, and $F(1, 97) = 9.16$, $p = .003$, $\eta_p^2 = .09$. As expected, people exposed to the message-focused comments reported that the comments were more focused on the PSA (M = 7.10, SE = 0.39) and less on the behavior (M = 6.85, SE = 0.37) than those exposed to the behavior-focused comments (message: M = 4.12, SE = 0.40; behavior: M = 8.47, SE = 0.38). Additionally, the interaction between focus and proportion of positive

comments was significant for the measure checking whether the focus of the comments was the PSA, $F(2, 97) = 5.24$, $p < .01$, $\eta_p^2 = .10$.

For anti-texting while driving PSA 1, comment focus was statistically significant for the two focus check measures, $F(1, 97) = 88.75$, $p < .001$, $\eta_p^2 = .48$, and $F(1, 97) = 9.16$, $p = .003$, $\eta_p^2 = .09$. As expected, people exposed to the message-focused comments reported that the comments were more focused on the PSA ($M = 8.45$, $SE = 0.34$) and less on the behavior ($M = 5.79$, $SE = 0.37$) than those exposed to the behavior-focused comments (message: $M = 3.88$, $SE = 0.35$; behavior: $M = 8.56$, $SE = 0.37$). Additionally, the interaction between focus and proportion of positive comments was significant for the measure checking whether the focus of the comments was the PSA, $F(2, 97) = 9.46$, $p < .001$, $\eta_p^2 = .16$, and proportion of positive comments was significant on the measure checking whether the focus of the comments was the behavior, $F(2, 97) = 5.28$, $p < .01$, $\eta_p^2 = .10$.

For anti-texting while driving PSA 2, comment focus was statistically significant on the two focus check measures, $F(1, 97) = 46.60$, $p < .001$, $\eta_p^2 = .32$, and $F(1, 97) = 15.89$, $p < .001$, $\eta_p^2 = .14$. As expected, people exposed to the message-focused comments reported that the comments were more focused on the PSA ($M = 8.56$, $SE = 0.37$) and less on the behavior ($M = 6.68$, $SE = 0.34$) than those exposed to the behavior-focused comments (message: $M = 5.79$, $SE = 0.37$; behavior: $M = 8.65$, $SE = 0.35$). Additionally, the interaction between focus and proportion of positive comments was significant on the measure checking whether the focus of the comments was the PSA, $F(2, 97) = 3.97$, $p = .02$, $\eta_p^2 = .08$, and proportion of positive

comments was significant on the measure checking whether the focus of the comments was the behavior, $F(1, 97) = 2.66$, $p = .08$, $\eta_p^2 = .05$.

Comment valence. For anti-smoking PSA 1, positive comment proportion was significant on the two valence check measures, $F(1, 97) = 49.81$, $p < .001$, $\eta_p^2 = .51$, and $F(1, 97) = 35.73$, $p < .001$, $\eta_p^2 = .42$. As expected, increase in the proportion of positive comments led to greater perceived comment positivity (large: $M = 9.21$, $SE = 0.39$; medium: $M = 6.52$, $SE = 0.40$; small: $M = 8.65$, $SE = 0.35$) and less perceive comment negativity (large: $M = 3.56$, $SE = 0.20$; medium: $M = 5.63$, $SE = 0.42$; small: $M = 8.27$, $SE = 0.39$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error. Additionally, proportion of positive comments interacted with focus on the measure that checked whether the PSA comments were overall in favor of the PSA, $F(2, 97) = 3.52$, $p < .05$, $\eta_p^2 = .07$.

For anti-smoking PSA 2, proportion of positive comments was found statistically significant for the two valence check measures, $F(1, 97) = 62.76$, $p < .001$, $\eta_p^2 = .56$, and $F(1, 97) = 31.63$, $p < .001$, $\eta_p^2 = .40$. As expected, greater proportion of comments in favor of the PSA led to greater perceived comments positivity (large: $M = 9.06$, $SE = 0.35$; medium: $M = 6.70$, $SE = 0.35$; small: $M = 3.64$, $SE = 0.34$) and less negativity (large: $M = 3.27$, $SE = 0.41$; medium: $M = 5.67$, $SE = 0.41$; small: $M = 7.77$, $SE = 0.39$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-binge drinking PSA 1, proportion of positive comments was statistically significant for both valence measures, $F(1, 97) = 51.19$, $p < .001$, $\eta_p^2 = .51$, and $F(1, 97) = 44.07$ $p < .001$, $\eta_p^2 = .49$. As expected, increase in the proportion

of positive comments led to greater perceived comment positivity (large: $M = 8.88$, $SE = 0.38$; medium: $M = 5.92$, $SE = 0.38$; small: $M = 3.58$, $SE = 0.37$) and less negativity (large: $M = 3.24$, $SE = 0.38$; medium: $M = 6.31$, $SE = 0.39$; small: $M = 8.18$, $SE = 0.37$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-binge drinking PSA 2, proportion of positive comments had a significant main effect on the two valence check measures, $F(1, 97) = 54.42$, $p < .001$, $\eta_p^2 = .53$, and $F(1, 97) = 45.79$, $p < .001$, $\eta_p^2 = .49$. As expected, increase in the proportion of positive comments led to greater perceived comment positivity (large: $M = 9.15$, $SE = 0.41$; medium: $M = 5.46$, $SE = 0.41$; small: $M = 3.29$, $SE = 0.40$) and less negativity (large: $M = 2.97$, $SE = 0.41$; medium: $M = 6.31$, $SE = 0.42$; small: $M = 8.44$, $SE = 0.40$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-texting while driving PSA 1, proportion of positive comments was statistically significant for the two valence check measures, $F(1, 97) = 38.98$, $p < .001$, $\eta_p^2 = .44$, and $F(1, 97) = 31.69$, $p < .001$, $\eta_p^2 = .39$. As expected, increase in the proportion of positive comments led to greater perceived comment positivity (large: $M = 9.41$, $SE = 0.41$; medium: $M = 6.30$, $SE = 0.41$; small: $M = 4.49$, $SE = 0.39$) and less negativity (large: $M = 2.91$, $SE = 0.42$; medium: $M = 5.25$, $SE = 0.43$; small: $M = 7.53$, $SE = 0.40$). Again, all pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-texting while driving PSA 2, proportion of positive comments was statistically significant on perceived positivity, $F(1, 97) = 59.44$, $p < .001$, $\eta_p^2 = .55$,

and perceived negativity $F(1, 97) = 57.11$, $p < .001$, $\eta_p^2 = .54$. As expected, increase in the proportion of positive comments contributed to greater perceived comment positivity (large: $M = 9.12$, $SE = 0.40$; medium: $M = 6.02$, $SE = 0.40$; small: $M = 3.06$, $SE = 0.39$) and less negativity (large: $M = 2.71$, $SE = 0.39$; medium: $M = 5.98$, $SE = 0.40$; small: $M = 8.57$, $SE = 0.38$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

Discussion

Based on the above results, people could clearly distinguish between three levels of proportion of positive comments in terms of the overall comment valence. Also, comment focus was successfully manipulated. However, proportion of positive comments served as a confounding factor for comment focus. Also, for several PSAs, proportion of positive comments interacted with comment focus, which indicated that comment focus was manipulated differently in the three proportion conditions. However, compared with comment focus, proportion of positive comments and their interaction with comment focus in general had relatively smaller effect size, indicating these factors might not be a big concern. But based on the current results, message-focused comments for some PSAs were slightly modified to make sure that comment focus was manipulated to the same extent across different proportion conditions.

Pilot Study 3

The purpose of pilot study 3 was to examine the manipulation of proportion of thumbs-up and view count. Similar to study 2, the two variables were each

manipulated only at a few levels. It is important to assure that people can distinguish between different levels of each variable. Alike the proportion of positive comments, the proportion of thumbs-up was assessed for its effects on perceived rating positivity and negativity. It was expected that increases in the proportion of thumbs-up is positively associated with the perceived rating positivity and negatively associated with perceived rating negativity. View count was assessed for its influence on people's perception of how many people have watched the video.

Participants

Similar to previous pilot studies, pilot study 3 recruited UM undergraduate students who took communication classes and needed course credit. A total of 104 students participated in pilot study 3. Five people did not complete the majority of the questionnaire and were excluded from the data analysis. For the rest 99 participants, their average age was 19.75 (*SD* = 3.50). There were more females (63.6%) than males (36.4%) and more White (63.6%) than other races, including Black or African American (11.1%), Asian or Pacific Islander (18.2), American Indian, Alaskan Native, or Native Hawaiian (1%), and other (6.1%). None of the participants have participated in pilot study 1 or pilot study 2.

Procedure

The study was conducted online. Participants gained an access to this study via Department of Communication research web portal. During the study, participants were first asked to provide an informed consent. Those who consented to take the study were allowed to proceed. Demographic information, including gender, age and

race, was then collected. Following that, participants were randomly assigned to one of 3 (view count: high, medium, vs. low) × 3 (proportion of thumbs-up: large, medium, vs. small) experimental conditions. Similar to pilot study 2, in each condition, participants watched six PSAs shown one at a time on a mock YouTube web page and in a random order. Following the presentation of each PSA, people reported their perceptions about the number of views the video has received and other people's overall ratings of the PSA. Participants were debriefed before they left the survey.

Stimuli Materials

Video presentation. The six PSA videos were the same ones used in pilot study 2. Similar to pilot study 2, each of the six PSAs was shown on a mock YouTube web page. The mock YouTube web page had the same layout and elements as that in pilot study 2 except that the web page only showed view count and ratings of the PSA video without displaying any textual comments (see Appendix A for a stimuli example,).

Manipulation

View count. View count was manipulated at three levels: high, medium, and low. According to pilot study 1, 1-100 (60%) and 101-500 (65%) were most selected categories for low view count; 5001-10,000 (40%) and 10,001-50,000 (47%) were top categories for medium view count; 71% people reported 500,001-1,000,000 and 65% people reported over 1,000,000 as high view count. In prior research, scholars have found that the view count of anti-smoking videos on YouTube ranged from 18 (low)

to 1,247,540 (high; Backinger et al., 2011). Other study reported that the average view count of YouTube anti-smoking videos was 7,877 (Paek, Kim, & Hove, 2010). This study also recorded the view count of the top several most-viewed PSA videos for each health behavior. It turned out that the view count of the top several most-viewed anti-smoking PSAs ranged from 540,558 to 4,492,317, the view count of the top several most-viewed anti-binge drinking PSAs ranged from 10,766 to 1,864,101 and the view count of top several most-viewed anti-texting while driving PSAs ranged from 147,597 to 5,465,087. The specific number of view count for a video used in each condition was then decided based on the results from pilot study 1, prior research, and examination of view count of anti-smoking, anti-binge drinking and anti-texting while driving PSAs on YouTube.

Proportion of thumbs-up. Based on prior study (Flanagin & Metzger, 2013; Lee & Jang, 2010), proportion of thumb-up was manipulated at three levels: 7/8, 4/8, and 1/8. Proportion of thumbs-up was manipulated similarly as proportion of positive comments. Hence, the results about comments and ratings were comparable. To avoid confounding effects of rating volume, the sum of thumbs-up and thumbs-down for a video was made equal to the view count of the video. Similar practice has been implemented in prior research (Gambino, Kahn, & Edwards, 2015).

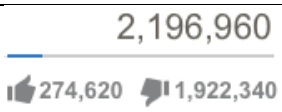
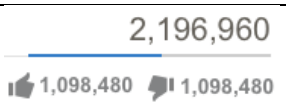
Table 3.5 shows the number of views and the number of thumbs-up vs. thumbs-down for all videos in different experimental conditions.

Table 3.5

View Count and the Number of Thumbs-up Versus Thumbs-Down for All Videos in Different Experimental Conditions

		Proportion of thumbs-up		
Message	View	Large	Medium	Small

	count			
Anti-smoking PSA 1	High	2,632,504 2,303,441 329,062	2,632,504 1,316,252 1,316,252	2,632,504 329,062 2,303,441
	Medium	9,016 7,889 1,127	9,016 4,508 4,508	9,016 1,127 7,889
	Low	88 77 11	88 44 44	88 11 77
Anti-smoking PSA 2	High	2,100,008 1,837,507 262,501	2,100,008 1,050,004 1,050,004	2,100,008 262,501 1,837,507
	Medium	6,008 5,257 751	6,008 3,004 3,004	6,008 751 5,257
	Low	56 49 7	56 28 28	56 7 49
Anti-binge drinking PSA 1	High	2,450,928 2,144,562 306,366	2,450,928 1,225,464 1,225,464	2,450,928 306,366 2,144,562
	Medium	8,000 7,000 1,000	8,000 4,000 4,000	8,000 1,000 7,000
	Low	80 70 10	80 40 40	80 10 70
Anti-binge drinking PSA 2	High	2,238,960 1,959,090 279,870	2,238,960 1,119,480 1,119,480	2,238,960 279,870 1,959,090
	Medium	7,888 6,902 986	7,888 3,944 3,944	7,888 986 6,902
	Low	72 63 9	72 36 36	72 9 63
Anti-texting while driving PSA 1	High	2,765,088 2,419,452 345,636	2,765,088 1,382,544 1,382,544	2,765,088 345,636 2,419,452
	Medium	9,504 8,316 1,188	9,504 4,752 4,752	9,504 1,888 8,316
	Low	96 84 12	96 48 48	96 12 84

Anti-texting while driving PSA 2	High			
	Medium			
	Low			

Key Measures

View count. According to previous research (Khare et al., 2011; Xu, 2013), two items assessed perceived number of views. People were asked to indicate their agreement or disagreement with each of the two statements: "The PSA has been watched by a very large number of people" and "The PSA has been watched by very few people." People rated these two items on an 11-point Likert-type scale (*1 = strongly disagree, 6 = neutral, 11 = strongly agree*).

Rating valence. This variable was assessed via two statements: "Overall people's evaluation of the PSA is positive" and "Overall, people's evaluation of the PSA is negative." People were asked to indicate their agreement or disagreement with each of the statement on an 11-point Likert-type scale (*1 = strongly disagree, 6 = neutral, 11 = strongly agree*).

Results

Four ANOVAs were performed to examine the manipulation of proportion of thumbs-up and view count. For these four ANOVAs, the dependent variables were the two valence check measures and two view count check measures, respectively. These four analyses were performed for each of the six health-related PSAs.

View count. For anti-smoking PSA 1, view count had a significant main effect on two view count check measures, $F(2, 90) = 33.20$, $p < .001$, $\eta_p^2 = .43$, and $F(2, 90) = 34.97$, $p < .001$, $\eta_p^2 = .44$. As expected, as PSA view count increased, people were more likely to report that the PSA had been watched by a large number of people (high: $M = 8.53$, $SE = 0.44$; medium: $M = 6.32$, $SE = 0.41$; low: $M = 3.59$, $SE = 0.42$) and less likely to report that the PSA had been watched by very few people (high: $M = 3.01$, $SE = 0.44$; medium: $M = 5.64$, $SE = 0.41$; low: $M = 8.11$, $SE = 0.42$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-smoking PSA 2, view count was statistically significant on two view count check measures, $F(2, 90) = 18.19$, $p < .001$, $\eta_p^2 = .29$, and $F(2, 90) = 25.46$, $p < .001$, $\eta_p^2 = .36$. As expected, increase in the number of PSA views led to greater perception that the PSA had been watched by a large number of people (high: $M = 8.34$, $SE = 0.51$; medium: $M = 5.98$, $SE = 0.48$; low: $M = 4.09$, $SE = 0.49$) and less perception that the PSA had been viewed by very few people (high: $M = 3.23$, $SE = 0.48$; medium: $M = 5.30$, $SE = 0.45$; low: $M = 7.96$, $SE = 0.46$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

For anti-binge drinking PSA 1, view count had significant main effects on the two view count check measures, $F(2, 90) = 14.56$, $p < .001$, $\eta_p^2 = .24$, and $F(2, 90) = 17.40$, $p < .001$, $\eta_p^2 = .28$. As expected, high view count was associated with greater perception that the PSA had been watched by a large number of people (high: $M = 8.20$, $SE = 0.52$; medium: $M = 5.82$, $SE = 0.49$; low: $M = 4.34$, $SE = 0.50$) and less

perception that the PSA had been watched by very few people (high: $M = 3.43$, $SE = 0.52$; medium: $M = 5.50$, $SE = 0.49$; low: $M = 7.72$, $SE = 0.51$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error except the difference between low and medium view count condition on people's perception that the PSA had been watched by a large number of people, $p = ns$.

For anti-binge drinking PSA 2, view count was statistically significant on the two view count check measures, $F(2, 89) = 20.71$, $p < .001$, $\eta_p^2 = .32$, and $F(2, 89) = 29.99$, $p < .001$, $\eta_p^2 = .40$. As expected, as view count became higher, people were more likely to report that the PSA had been watched by a large number of people (high: $M = 8.15$, $SE = 0.46$; medium: $M = 5.63$, $SE = 0.44$; low: $M = 4.07$, $SE = 0.46$) and less likely to report that the PSA had been watched by very few people (high: $M = 3.12$, $SE = 0.44$; medium: $M = 5.40$, $SE = 0.42$; low: $M = 7.83$, $SE = 0.42$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error. Additionally, proportion of thumbs-up was statistically significant for the perception that the PSA had been watched by a large number of people, $F(2, 89) = 3.38$, $p < .001$, $\eta_p^2 = .07$, and approached significance for the measure that the PSA had been watched by very few people, $F(2, 89) = 2.72$, $p = .07$, $\eta_p^2 = .06$.

For anti-texting while driving PSA 1, view count was statistically significant on the two view count check measures, $F(2, 90) = 28.64$, $p < .001$, $\eta_p^2 = .39$, and $F(2, 89) = 26.28$, $p < .001$, $\eta_p^2 = .36$. Those exposed to high view count reported more perception that the PSA had been watched by a large number of people (high: $M = 8.22$, $SE = 0.43$; medium: $M = 6.54$, $SE = 0.40$; low: $M = 3.79$, $SE = 0.41$) and less

perception that the PSA had been watched by very few people (high: $M = 3.69$, $SE = 0.44$; medium: $M = 5.48$, $SE = 0.42$; low: $M = 8.11$, $SE = 0.43$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error. Additionally, proportion of thumbs-up was statistically significant on the two view count check measures, $F(2, 90) = 5.91$, $p < .01$, $\eta_p^2 = .12$, and $F(2, 90) = 5.53$, $p < .01$, $\eta_p^2 = .11$.

For anti-texting while driving PSA 2, view count was statistically significant on two view count check measures, $F(2, 90) = 20.29$, $p < .001$, $\eta_p^2 = .31$, and $F(2, 90) = 32.08$, $p < .001$, $\eta_p^2 = .42$. As expected, increase in the number of PSA views was associated with greater perception that the PSA had been watched by a large number of people (high: $M = 8.63$, $SE = 0.49$; medium: $M = 5.98$, $SE = 0.46$; low: $M = 4.35$, $SE = 0.47$) and less perception that the PSA had been watched by very few people (high: $M = 3.01$, $SE = 0.45$; medium: $M = 5.64$, $SE = 0.42$; low: $M = 8.03$, $SE = 0.44$). All pairwise comparisons were statistically significant with Bonferroni correction for family-wise error.

Rating valence. For anti-smoking PSA 1, proportion of thumbs-up was not statistically significant for the perceived rating positivity, $F(2, 90) = 2.12$, $p = ns$, $\eta_p^2 = .05$ and approached significance for the perceived rating negativity, $F(2, 90) = 2.88$, $p = .06$, $\eta_p^2 = .06$. None of the pairwise comparisons were statistically significant with Bonferroni correction for family-wise error except that the comparison of small and large proportion condition, which approached significance for perceived rating negativity, $p = .06$. In spite of the weak findings, the direction of cell means was consistent with expectations. Greater proportion of thumbs-up appeared to lead to

more perceived rating positivity (large: $M = 7.05$, $SE = 0.49$; medium: $M = 6.31$, $SE = 0.48$; small: $M = 5.62$, $SE = 0.49$) and less negativity (large: $M = 4.59$, $SE = 0.47$; medium: $M = 5.64$, $SE = 0.47$; small: $M = 6.17$, $SE = 0.48$).

For anti-smoking PSA 2, proportion of thumbs-up was statistically significant for both perceived rating positivity, $F(2, 90) = 7.61$, $p = .001$, $\eta_p^2 = .15$, and negativity, $F(2, 90) = 9.19$, $p < .001$, $\eta_p^2 = .17$. Pairwise comparisons with Bonferroni correction for family-wise error found no difference between medium and small proportion condition: positivity, $p = ns$, and negativity, $p = ns$. Except this, all other pairwise comparisons on the two valence measures were statistically significant. Overall, the means were in the expected direction for both perceived rating positivity (large: $M = 7.75$, $SE = 0.49$; medium: $M = 5.67$, $SE = 0.48$; small: $M = 5.25$, $SE = 0.49$) and negativity (large: $M = 4.20$, $SE = 0.50$; medium: $M = 5.95$, $SE = 0.50$; small: $M = 7.05$, $SE = 0.51$).

For anti-binge drinking PSA 1, proportion of thumbs-up was statistically significant for two valence check measures, $F(2, 90) = 7.20$, $p = .001$, $\eta_p^2 = .14$, and $F(2, 90) = 6.36$, $p < .01$, $\eta_p^2 = .12$. For the perceived positivity, pairwise comparisons of three proportion conditions with Bonferroni correction for family-wise error were statistically significant expect the comparison of medium and small proportion condition, $p = ns$. For the perceived negativity, pairwise comparisons with Bonferroni correction for family-wise error found that only the difference between large and small proportion condition was statistically significant, $p < .01$. In spite of these findings, the cell means of both perceived rating positivity and negativity were in the expected direction. Increase in the proportion of thumbs-up led to greater perceived

rating positivity (large: $M = 7.59$, $SE = 0.49$; medium: $M = 5.46$, $SE = 0.48$; small: $M = 5.21$, $SE = 0.49$) and less perceived rating negativity (large: $M = 4.62$, $SE = 0.47$; medium: $M = 5.60$, $SE = .46$; small: $M = 6.99$, $SE = 0.47$).

For anti-binge drinking PSA 2, proportion of thumbs-up was statistically significant for two rating valence check measures, $F(2, 89) = 10.86$, $p < .001$, $\eta_p^2 = .20$, and $F(2, 89) = 9.32$, $p < .001$, $\eta_p^2 = .17$. Pairwise comparisons with Bonferroni correction for family-wise error were all statistically significant except that the difference between small and medium proportion condition for perceived positivity, $p = ns$, and perceived negativity, $p = ns$. However, the means were in the expected direction. Greater proportion of thumbs-up led to greater perceived rating positivity (large: $M = 7.84$, $SE = 0.47$; medium: $M = 5.86$, $SE = .45$; small: $M = 4.83$, $SE = 0.47$) and less negativity (large: $M = 3.97$, $SE = 0.46$; medium: $M = 5.96$, $SE = .45$; small: $M = 6.69$, $SE = 0.46$).

For anti-texting while driving PSA 1, rating valence was statistically significant on two rating valence check measures, $F(2, 90) = 9.86$, $p < .001$, $\eta_p^2 = .18$, and $F(2, 90) = 5.69$, $p = .005$, $\eta_p^2 = .11$. Pairwise comparisons with Bonferroni correction for family-wise error suggested that only the difference between large and small proportion condition was statistically significant for perceived positivity ($p < .001$) and perceived negativity ($p < .01$). Cell means of both variables were in the expected direction, though. Greater proportion of thumbs-up led to greater perceived rating positivity (large: $M = 7.86$, $SE = 0.44$; medium: $M = 6.41$, $SE = .43$; small: $M = 5.08$, $SE = 0.45$) and less negativity (large: $M = 4.12$, $SE = 0.46$; medium: $M = 5.63$, $SE = .45$; small: $M = 6.26$, $SE = 0.47$). Additionally, view count approached

significance for perceived negativity, $F(2, 90) = 2.49$ $p = .09$, $\eta_p^2 = .05$. The interaction between thumbs-up proportion and view count was statistically significant for perceived negativity, $F(4, 90) = 2.51$, $p < .05$, $\eta_p^2 = .10$.

For anti-texting while driving PSA 2, rating valence was statistically significant on two rating valence check measures, $F(2, 90) = 7.79$, $p = .001$, $\eta_p^2 = .15$, and $F(2, 90) = 7.07$, $p = .001$, $\eta_p^2 = .14$. Pairwise comparisons with Bonferroni correction for family-wise error suggested that only the difference between large and small proportion condition was statistically significant for perceived positivity ($p < .001$) and perceived negativity ($p = .001$). Cell means of both positivity and negativity were in the expected direction, though. Greater proportion of thumbs-up led to greater perceived rating positivity (large: $M = 7.90$, $SE = 0.51$; medium: $M = 6.56$, $SE = .50$; small: $M = 5.06$, $SE = 0.51$) and less negativity (large: $M = 4.19$, $SE = 0.50$; medium: $M = 5.76$, $SE = .49$; small: $M = 6.85$, $SE = 0.51$).

Discussion

Overall, manipulating view count succeeded. However, for some PSAs, manipulating thumbs-up proportion confounded the influence of view count. But compared with view count, thumbs-up proportion had relatively small effect size, indicating that its confounding effect might not be a big concern. As for proportion of thumbs-up, the present results suggested that people had difficulty differentiating between medium and low proportion condition in terms of their overall valence towards a PSA. However, the cell means were in the expected direction. A larger sample size possibly will make the difference between the two experimental conditions more prominent. Proportion of thumbs-up was a message feature

independent of people's perception (O'Keefe, 2003). Though people could not clearly differentiate between medium and small proportion of thumbs-up in terms of their valence, it did not necessarily mean that people did not identify the differences in the number of thumbs-up across the two conditions. Hence, in main study 2, items to check the effectiveness of manipulating proportion of thumbs-up directly assessed people's perception of the proportion of thumbs-up to thumbs-down associated with a health promotion message.

To sum up, through three pilot studies, 1) three health contexts were chosen for the main studies: cigarette smoking, binge drinking, and texting while driving; 2) for each health context, two health promotion messages in the form of PSA would be presented to the participants; 3) to understand the influence of comments, for each PSA, participants would be presented with eight comments. These eight comments either focus on the executional features/quality of the PSA (i.e., message-focused comments) or the unhealthy behavior depicted in the PSA (i.e., behavior-focused comments); 4) the proportion of positive comments associated with each PSA was manipulated at three levels, 7/8, 4/8, and 1/8; 5) view count and proportion of thumbs-up were manipulated at three levels (see Table 3.5).

Chapter 4. Main Studies

The main studies included two experiments. Study 1 examined the influence of comment focus and proportion of positive comments and study 2 examined the influence of view count and proportion of thumbs-up on people's responses to a series of health promotion messages. In each study, people were presented with six health-related PSAs focusing on three health issues (cigarette smoking, binge drinking and texting while driving). Study hypotheses and research questions were separately examined for each health context. In each health context, those who indicated prior exposure to any one of the two issue relevant PSAs were excluded from the data analysis. To determine sample size for each study, several methods were utilized (e.g., Gagné & Hancock, 2006; Hancock & French, 2013; Kline, 2011; Kraemer & Thiemann, 1987). The one that suggested the largest sample size for a medium effect size f = .25, alpha of .05, and power of .80 was G*Power (N = 316 for study 1 and N = 474 for study 2).

Study 1

Participants

A total of 637 undergraduate students taking communication classes at UM took the study in exchange for course credit. Among these people, those who completed only the first several questions of the questionnaire, did not provide an informed consent or indicated they had taken pilot study 1, 2 or 3 were deleted. This procedure led to 586 people. Of these people, 549, 557, and 520 people indicated that they had not encountered any one of the two PSAs arguing against smoking, binge

drinking, and texting while driving, respectively. These people respectively constituted the working sample for each health issue. The 549 people in the smoking context had a mean age of 19.14 (*SD* = 1.78) and were composed of 54.1% females, 64.1% White, 13.8% Black or African American, 14.4%, Asian or Pacific Islander, 0.2% American Indian, Alaskan Native, or Native Hawaiian and 7.5% other races. The demographic backgrounds of this sample was similar to that of binge drinking sample (M_{age} = 19.14, SD_{age} = 1.77, 53.8% females, 64.1% White, 13.8% Black or African American, 14.4%, Asian or Pacific Islander, 0.2% American Indian, Alaskan Native, or Native Hawaiian and 7.5% other races) and texting while driving sample (M_{age} = 19.16, SD_{age} = 1.82, 54.1% female, 63.8% White, 13.7% Black or African American, 14.8%, Asian or Pacific Islander, 0.2% American Indian, Alaskan Native, or Native Hawaiian and 7.5% other races).

Design and Procedure

The study followed a 2 (focus: message vs. health behavior) × 3 (proportion of positive comments: large, medium, vs. small) × 6 (order) factorial design. In each experimental condition, people were presented with six PSAs with two focused on the same health issue. The two PSAs focusing on the same health behavior were presented in a fixed order (e.g., anti-smoking PSA 1 was always shown before anti-smoking PSA 2). But the three health issues were presented in a counterbalanced order, leading to a total of six orders of stimuli presentation (see Table 4.1).

Table 4.1

Message Presentation Order

Order	Message

1	Anti-smoking PSA 1, anti-smoking PSA 2, anti-binge drinking PSA 1, anti-binge drinking PSA 2, anti-texting while driving PSA 1, anti-texting while driving PSA 2
2	Anti-smoking PSA 1, anti-smoking PSA 2, anti-texting while driving PSA 1, anti-texting while driving PSA 2, anti-binge drinking PSA 1, anti-binge drinking PSA 2
3	Anti-binge drinking PSA 1, anti-binge drinking PSA 2, Anti-smoking PSA 1, anti-smoking PSA 2, anti-texting while driving PSA 1, anti-texting while driving PSA 2
4	Anti-binge drinking PSA 1, anti-binge drinking PSA 2, anti-texting while driving PSA 1, anti-texting while driving PSA 2, Anti-smoking PSA 1, anti-smoking PSA 2
5	Anti-texting while driving PSA 1, anti-texting while driving PSA 2, Anti-smoking PSA 1, anti-smoking PSA 2, anti-binge drinking PSA 1, anti-binge drinking PSA 2
6	Anti-texting while driving PSA 1, anti-texting while driving PSA 2, anti-binge drinking PSA 1, anti-binge drinking PSA 2, Anti-smoking PSA 1, anti-smoking PSA 2

The study was conducted via an online survey hosted by a commercial survey website (www.qualtrics.com) and the link to the survey was posted on the communication department's research web portal. People signed up for the study obtained the survey link. Before entering the actual study, participants were first asked to sign a consent form informing them of the benefits, risks, purpose, and procedure of the study. Only participants who clicked "I consent to participate" were allowed to proceed. Once participants entered the actual study, instructions guided them to watch a series of PSA videos shown on a YouTube web page and to examine everything showing together with the video on the web page carefully. Then, an algorithm randomly assigned participants to one of 36 experimental conditions. In each condition, participants were presented with six PSA videos in an order shown in

Table 4.1. After people were presented with two PSAs of the same health behavior, they responded to questions assessing their prior exposure to the two PSAs, their perceived social norms, attitudes, and behavioral intentions about the health behavior depicted in the two PSAs. The norms, attitudes and behavioral intentions questions were presented in a random order. For each question, its response items were also randomized. Following that, participants responded to questions assessing the effectiveness of manipulating proportion of positive comments and comment focus. Also, participants answered questions assessing their prior engagement in each health behavior. When all the PSAs and their corresponding questions were presented, people entered the last part of the survey, which included questions assessing participants' demographic backgrounds. Participants were debriefed before they left the survey.

Stimuli Materials

The video stimuli, comments, and YouTube mock-up were all from pilot study 2. As mentioned previously, following pilot study 2, some minor modifications were performed on the message-focused comments of some PSAs. During the study, participants were presented with only one PSA at a time. The YouTube mock-up was made to be very similar to the actual YouTube web page except that under the PSA video, there were no view count and aggregate ratings (see Appendix A for a stimuli example).

Manipulation

Comment focus. The manipulation of comment focus was the same as pilot study 2. Message-focused comments concentrate on the executional style of the PSA, such as its audio and visual effects and its impact. For example, message-focused comments for an anti-smoking PSA included: "This commercial completely captured my attention. I think it got the point across very effectively for anti-smoking." Behavior-focused comments refer to the comments that argue against or for a health behavior. For example, the behavior-focused comments for an anti-smoking PSA included "Smoking is so bad for you. Why would anyone start it? It's just stupid."

Proportion of positive comments. Being the same as study 2, proportion of positive comments was manipulated at three levels: large (7/8), medium (4/8), and small (1/8).

Key Outcome Measures

Key outcome variables of this research included three types of normative perceptions, attitudes, and behavioral intentions. The three normative measures were adapted from Park and Smith's (2007) study, and health-related attitudes and future behavioral intentions were developed from Ajzen's (2002) study. Different from pilot studies, all the questions were assessed on a 7-point scale to facilitate people's responses to the questions. Additionally, attitude measurement scale was slightly changed from that in pilot study 1 to make sure the scale was unidimensional.

Descriptive norms. Four items measured descriptive norms for each health behavior, including "A majority of people in general xx [health behavior, e.g., smoke cigarettes]," "A majority of people in general are engaged in xx," "xx is commonly

performed by people in general," and "xx is prevalent among people in general." Participants were asked to indicate their agreement or disagreement with each of the four statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Injunctive norms. Four items measured injunctive norms of each health behavior, including "A majority of people in general approve of xx [health behavior, e.g. cigarette smoking]," "A majority of people in general endorse others' xx," "A majority of people in general support xx," and "A majority of people in general believe that it is appropriate to xx." People were asked about their agreement or disagreement with each of the statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Subjective norms. Similar to descriptive norms and injunctive norms, to measure subjective norms, participants were asked to indicate their agreement or disagreement with four items on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).* The four items were: "Most people who are important to me think that I should xx [health behavior, e.g., smoke cigarettes]," "Most people whose opinions I value want me to xx," "Most people whose opinions I value consider that I should xx," and "It is expected of me that I xx."

Attitudes. People's attitudes towards each health behavior were assessed through five 7-point semantic differential scales, which were anchored by bad(1)/good(7), harmful(1)/beneficial(7), unpleasant(1)/pleasant(7), unenjoyable(1)/enjoyable(7), and foolish(1)/wise(7).

Behavioral intentions. Four items assessed people's intentions to perform each health-risk behavior in the future, including "I intend to xx [health behavior; e.g., smoke cigarettes] in the near future," "I plan to xx in the near future," "I am going to xx in the near future," and "I will xx in the near future." Answers to each item were provided on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Manipulation Check Measures

Being the same as pilot study 2, two items assessed comment focus manipulation and two items assessed the effectiveness of manipulating proportion of positive comments as it is related to comment valence. The statements assessing comment focus manipulation included, for example: "The comments of the two anti-smoking PSAs focus on people's opinions about the quality or executional style of the PSAs," and "The comments of the two anti-smoking PSAs focus on people's opinions about smoking." Items assessing the manipulation of proportion of positive comments were: "Overall, the comments of the two PSAs are in favor of the PSAs," and "Overall, the comments of the two PSAs are against the PSAs." People were asked about their agreement or disagreement with each of the statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Analysis Strategy

H1 suggests that a greater proportion of positive comments will be associated with the following responses toward a problem behavior: a) lower perceived prevalence (descriptive norms), b) lower perceived social approval (injunctive

norms), c) lower perceived expectation (subjective norms), d) more negative attitudes, and e) lower behavioral intentions. RQ2 and RQ3 ask whether comment focus influences and/or interacts with proportion of positive comments to influence people's responses to the health promotion messages. ANCOVAs were employed to test H1 and address RQ2 and RQ3 in three health contexts. H3 predicts social norms as mediators of the influence of comment valence on attitudes and behavioral intentions. Structural equation modeling (SEM) was employed to test the mediation effects via M*plus* version 7.4. Specifically, bootstrapping technique was employed to obtain bootstrapped confidence intervals for examining the indirect effects. Indirect effects were regarded as significant if their 95% bias-corrected bootstrapped confidence intervals (BC 95% CI) based on 1000 bootstrap samples do not contain zero. Bootstrapping technique is thought as being statistically superior to other methods testing the statistical significance of mediation models (Hayes, 2009; Warner, 2013). Message order was added as a covariate in a series of ANCOVAs and SEMs.

Prior studies suggested that whether or not people have been engaged in a health behavior would influence their responses to a health promotion message (e.g., Jung, Shim, & Mantaro, 2010; Nan & Zhao, 2012; Zhao, Nan, Iles, & Yang, 2015). For health-risk behaviors, both risk behavior prevention and cessation are important health communication goals. This study then investigates whether people's current engagement in each of the three health-risk behaviors influenced their responses to health promotion messages associated with different users' feedbacks. To do this, behavior (i.e., smoking, binge drinking, and texting while driving) status was

included as an additional independent variable in ANCOVAs testing H1 and examining RQ2 and RQ3. Multi-group modeling was used to test H3. To identify those who are present performers of each health behavior, participants were asked on how many days they had smoked, binge drunk and texted while driving during the past 30 days. According to CDC (2015), those who reported having performed these behaviors on at least one day in the past 30 days were thought as current performers of each health-risk behavior (N_{smk} = 46 [8.4%], N_{dri} = 272 [49.3%], N_{tex} = 212 [40.9%]). Only 46 people were current smokers. The size was too small. But a total of 168 (30.8%) people indicated that they had ever smoked. Hence, the analysis differentiated between ever-smokers and never-smokers to better understand the influence of smoking experience on responses to anti-smoking health promotion messages associated with different users' feedbacks.

While performing multi-group modeling, this study followed the procedure detailed by Bryne (2011). First, the measurement model was run separately for each group. After establishing measurement validity for each group, the measurement model was run for both groups while allowing all parameters to be freely estimated (i.e., configural model). Then, factor loadings were constrained to be equal. The measurement model was re-run for both groups. If the constrained model became worse, modifications indices were read iteratively to examine whether release of any path could improve the model fit. Next, structural models with all paths allowed to be freely estimated across groups were examined. After this, structural models with all paths constrained to be equal across groups were examined. If the constrained

structural model suggested worse fit, modifications indices were consulted and appropriate paths were released iteratively to increase the fit of the model.

To assess the fit of both measurement and structural model, this study utilized several model fit indices (Hu & Bentler, 1999). The χ^2 statistic is a widely used model fit index. As an absolute model fit index, it evaluates the discrepancy between the model-implied and observed covariance matrix. Statistically insignificant χ^2 statistic means the model fits the data. Hence, smaller χ^2 statistic close to zero is desired. However, Kline (2011) suggests that χ^2 statistic is very sensitive to sample size. Other fit indices should be used. SRMR is also an absolute model fit index. A good model fit is suggested by having a SRMR value of .08 or smaller. RMSEA is a parsimonious model fit index, which evaluates the discrepancy between model-implied and observed covariance matrix while considering the model's simplicity. An acceptable model fit is indicated by a RMSEA value of .06 or smaller. CFI is an incremental model fit index. It evaluates a model's absolute and parsimonious fit relative to an independent model. CFI value of .95 or greater indicates better model fit. Before multi-group modeling, CFI, RMSEA and SRMR were used altogether to evaluate the goodness of each measure.

As the first step of data analysis, this study performed data screening.

Data Screening

Missing values and inconsistent responses. Data for each health context was first examined for missing values, implausible and inconsistent responses. Examination revealed three inconsistent responses (e.g., people reported they had never smoked but said they had smoked in the past 30 days) in the smoking context,

six inconsistent responses in the binge drinking context, and two inconsistent responses in the texting while driving context. These cases were treated as missing values in data analyses. For each health context, there were only a few missing cases (< 5%) and these cases did not show a systematic pattern. Listwise deletion was considered appropriate and employed (Tabachnick & Fidell, 2013).

Data transformation. Next, as detailed above, the study used ANCOVA and SEM to examine the study propositions. Additionally, confirmatory factor analysis (CFA) was employed to examine measurement adequacy. ANCOVA requires quantitative outcome variables to approach normal distribution (Kline, 2011). Univariate normality is also a necessary condition of multivariate normality required by Maximum Likelihood (ML) estimation for CFA and SEM. Hence, quantitative outcome variables were first screened for their univariate distribution. Those appeared to very non-normal were transformed using power transformation (Fink, 2009). Through trial and error, it was expected that the best transformation can make both skewness and kuortsis close to zero. The kurtosis and skewness of transformed and untransformed variables are shown in Table 4.2 to 4.4. Kline (2011) indicates that skewness above three and kurtosis over ten indicate a distribution problem. As it is shown in Table 4.2, after transformation, attitude 2 was still highly skewed. This variable was deleted.

Table 4.2

Study 1: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Smoking Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				

DN 1	0.69 (0.10)	-0.03 (0.21)	--	--
DN 2	0.64 (0.10)	-0.38 (0.21)	--	--
DN 3	0.39 (0.10)	-0.82 (0.21)	--	--
DN 4	0.29 (0.10)	-0.91 (0.21)	--	--
Injunctive norms (IN)				
IN 1[a]	1.24 (0.10)	0.83 (0.21)	0.58 (0.10)	-0.80 (0.21)
IN 2[a]	1.46 (0.10)	1.65 (0.21)	0.76 (0.10)	-0.50 (0.21)
IN 3[a]	1.33 (0.10)	1.30 (0.21)	0.65 (0.10)	-0.67 (0.21)
IN 4[a]	1.12 (0.10)	0.66 (0.21)	0.43 (0.10)	-0.90 (0.21)
Subjective norms (SN)				
SN 1[b]	4.42 (0.10)	20.85 (0.21)	3.06 (0.10)	7.37 (0.21)
SN 2[b]	4.46 (0.10)	21.33 (0.21)	2.97 (0.10)	6.85 (0.21)
SN 3[b]	4.63 (0.10)	24.35 (0.21)	2.81 (0.10)	5.93 (0.21)
SN 4[b]	4.80 (0.10)	25.05 (0.21)	3.01 (0.10)	7.10 (0.21)
Attitude				
Attitude 1[c]	5.02 (0.10)	29.91 (0.21)	2.89 (0.10)	6.37 (0.21)
Attitude 2[c]	6.16 (0.10)	43.77 (0.21)	3.93 (0.10)	13.49 (0.21)
Attitude 3[c]	3.02 (0.10)	8.80 (0.21)	1.86 (0.10)	1.45 (0.21)
Attitude 4[c]	2.26 (0.10)	4.10 (0.21)	1.43 (0.10)	0.05 (0.21)
Attitude 5[c]	4.89 (0.10)	27.67 (0.21)	2.85 (0.10)	6.15 (0.21)
Intention				
Intention 1[d]	4.01 (0.10)	16.26 (0.21)	2.74 (0.10)	5.53 (0.21)
Intention 2[d]	4.08 (0.10)	17.08 (0.21)	2.74 (0.10)	5.53 (0.21)
Intention 3[d]	3.70 (0.10)	13.62 (0.21)	2.45 (0.10)	4.03 (0.21)
Intention 4[d]	3.74 (0.10)	14.16 (0.21)	2.37 (0.10)	3.63 (0.21)

Note. [a]$Y^* = (Y)^{0.25}$; [bcd]$Y^* = (Y - 0.99)^{-1} \times (-0.1)$. Y* refers to transformed variable. Y refers to the original variable.

Table 4.3

Study 1: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Binge Drinking Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				
DN 1	-0.06 (0.10)	-0.80 (0.21)	--	--
DN 2	-0.08 (0.10)	-0.78 (0.21)	--	--
DN 3	-0.24 (0.10)	-0.72 (0.21)	--	--
DN 4	-0.27 (0.10)	-0.68 (0.21)	--	--
Injunctive norms (IN)				
IN 1	-0.13 (0.10)	-0.92 (0.21)	--	--
IN 2	-0.06 (0.10)	-0.94 (0.21)	--	--
IN 3	0.02 (0.10)	-0.93 (0.21)	--	--
IN 4	-0.07 (0.10)	-0.90 (0.21)	--	--

Subjective norms (SN)				
SN 1[a]	1.07 (0.10)	0.12 (0.21)	0.83 (0.10)	-0.58 (0.21)
SN 2[a]	0.99 (0.10)	-0.15(0.21)	0.75 (0.10)	-0.74 (0.21)
SN 3[a]	0.91 (0.10)	-0.32 (0.21)	0.69 (0.10)	-0.88 (0.21)
SN 4[a]	0.90 (0.10)	-0.43 (0.21)	0.68 (0.10)	-0.93 (0.21)
Attitude				
Attitude 1[b]	1.19 (0.10)	0.97 (0.21)	0.75 (0.10)	-0.53 (0.21)
Attitude 2[b]	1.47 (0.10)	1.93 (0.21)	0.99 (0.10)	0.05 (0.21)
Attitude 3[b]	0.95 (0.10)	-0.15 (0.21)	0.61 (0.10)	-0.97 (0.21)
Attitude 4[b]	0.64 (0.10)	-0.88 (0.21)	0.36 (0.10)	-1.37 (0.21)
Attitude 5[b]	1.29 (0.10)	1.40 (0.21)	0.84 (0.10)	-0.32 (0.21)
Intention				
Intention 1[c]	0.60 (0.10)	-1.16 (0.21)	0.83 (0.10)	-0.72 (0.21)
Intention 2[c]	0.62 (0.10)	-1.14 (0.21)	0.85 (0.10)	-0.68 (0.21)
Intention 3[c]	0.55 (0.10)	-1.24 (0.21)	0.77 (0.10)	-0.85 (0.21)
Intention 4[c]	0.54 (0.10)	-1.23 (0.21)	0.77 (0.10)	-0.83 (0.21)

Note. [a]$Y^* = (Y + 1)^{0.5}$; [b]$Y^* = (Y)^{0.5}$; [c]$Y^* = (Y)^{1.5}$. Y* refers to transformed variable. Y refers to the original variable.

Table 4.4

Study 1: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Texting While Driving Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				
DN 1	-0.46 (0.11)	-0.48 (0.21)	--	--
DN 2	-0.40 (0.11)	-0.67 (0.21)	--	--
DN 3	-0.70 (0.11)	-0.13 (0.21)	--	--
DN 4	-0.74 (0.11)	-0.15 (0.21)	--	--
Injunctive norms (IN)				
IN 1[a]	1.04 (0.11)	0.28 (0.21)	0.67 (0.11)	-0.64 (0.21)
IN 2[a]	1.30 (0.11)	1.19 (0.21)	0.88 (0.11)	-0.18 (0.21)
IN 3[a]	1.20 (0.11)	0.91 (0.21)	0.78 (0.11)	-0.34 (0.21)
IN 4[a]	0.82 (0.11)	-0.38 (0.21)	0.49 (0.11)	-0.98 (0.21)
Subjective norms (SN)				
SN 1[b]	3.36 (0.11)	13.01 (0.21)	1.68 (0.11)	0.83 (0.21)
SN 2[b]	3.07 (0.11)	9.97 (0.21)	1.54 (0.11)	0.36 (0.21)
SN 3[b]	3.13 (0.11)	10.77 (0.21)	1.42 (0.11)	0.01 (0.21)
SN 4[b]	2.67 (0.11)	7.43 (0.21)	1.23 (0.11)	-0.49 (0.21)
Attitude				
Attitude 1[c]	4.27 (0.11)	23.03 (0.21)	2.01 (0.11)	2.05 (0.21)
Attitude 2[c]	4.37 (0.11)	22.85 (0.21)	2.27 (0.11)	3.19 (0.21)
Attitude 3[c]	1.94 (0.11)	3.29 (0.21)	0.93 (0.11)	-1.15 (0.21)
Attitude 4[c]	1.63 (0.11)	1.82 (0.21)	0.70 (0.11)	-1.51 (0.21)
Attitude 5[c]	4.28 (0.11)	21.19 (0.21)	2.25 (0.11)	3.07 (0.21)

Intention				
Intention 1[d]	1.91 (0.11)	3.00 (0.21)	0.94 (0.11)	-0.92 (0.21)
Intention 2[d]	1.95 (0.11)	3.14 (0.21)	0.96 (0.11)	-0.87 (0.21)
Intention 3[d]	1.44 (0.11)	0.98 (0.21)	0.59 (0.11)	-1.47 (0.21)
Intention 4[d]	1.39 (0.11)	0.74 (0.21)	0.60 (0.11)	-1.47 (0.21)

Note. [a]$Y^* = (Y + 0.25)^{0.5}$; [bc]$Y^* = (Y - 0.99)^{-1} \times (-0.1)$; [d]$Y^* = (Y)^{-1} \times (-1)$. Y* refers to transformed variable. Y refers to the original variable.

Measurement adequacy. To examine measurement quality, the items measuring three normative perceptions, attitudes, and intentions were subjected to one CFA. In the CFA model, five factors were allowed to covary and the errors of the indicators were not allowed to covary. Metric assumption rendered the loading of first indicator of each factor to be one. CFA with ML estimation requires variables included in the model to approach multivariate normality. Multivariate normality tests using DeCarlo's SPSS macro (DeCarlo, 1997) found that variables included in the measurement model in all three health contexts did not achieve multivariate normality, $p < .001$ (Small's test). Maximum likelihood estimation with robust standard errors (MLR in M*plus*) was used (Muthen & Muthen, 2015). The fit indices and factor loadings of the CFA model for each health issue are shown in Table 4.5. Also, for each multi-item measurement scale, the scale's reliability information is shown in Table 4.6. Both CFA and scale reliability results were considered to evaluate each measure. According to Table 4.5, the measurement model in the smoking context demonstrated appropriate fit, χ^2 (160) = 500.44, $p < .001$, RMSEA = .06, 90% CI = [.06, .07], CFI = .92, SRMR = .04. All factor loadings were above .70. However, the reliability of each scale in the smoking context suggested that by removing subjective norms 4, reliability of subjective norms scale increased slightly. Hence, subjective norms 4 was removed. After removing this item, the measurement

model improved slightly in CFI = .93. The measurement model in the binge drinking context obtained satisfactory fit, χ^2 (179) = 438.31, $p < .001$, RMSEA = .05, 90% CI = [.05, .06], CFI = .97, SRMR = .03. All items had factor loadings above .80. However, removing subjective norms 4 could increase the reliability of the subjective norms scale from .956 to .964. So subjective norms 4 was deleted, leading to a smaller SRMR = .02 for the revised measurement model. Measurement model in the texting while driving context produced, χ^2 (179) = 814.05, $p < .001$, RMSEA = .08, 90% CI = [.08, .09], CFI = .91, SRMR = .04. Compared with other indicators, attitude item 3 and attitude item 4 had relatively small factor loadings (attitude 3: $\lambda = .69$ and attitude 4: $\lambda = .64$). Reliability analysis further showed that removing these two items could improve the reliability of the attitude scale from .89 to .92. Also, similar to smoking and binge drinking context, removing subjective norms 4 could improve the reliability of subjective norms scale from .94 to .95. Attitude 3, attitude 4, and subjective norms 4 were deleted. After deleting these variables, texting while driving measurement model achieved better fit, χ^2 (125) = 465.65, $p < .001$, RMSEA = .07, 90% CI = [.06, .08], CFI = .94, SRMR = .03. Once the measurement scale for each outcome variable was finalized, a composite score was created for each variable by averaging the items of each scale in order to facilitate the implementation of ANCOVA.

Table 4.5

Study 1: Item Loadings and Fit Indices for Confirmatory Factor Analysis of Measurement Scales

	Smoking	Binge Drinking	Texting while driving
Descriptive norms (DN)			
DN 1	.95	.93	.94

DN 2	.95	.93	.91
DN 3	.86	.93	.94
DN 4	.83	.92	.91
Injunctive norms (IN)			
IN 1	.93	.95	.93
IN 2	.91	.90	.87
IN 3	.94	.95	.88
IN 4	.88	.92	.85
Subjective norms (SN)			
SN 1	.95	.93	.93
SN 2	.94	.95	.95
SN 3	.95	.96	.91
SN 4	.88	.84	.77
Attitude			
Attitude 1	.72	.92	.91
Attitude 2	--	.87	.87
Attitude 3	.89	.87	.69
Attitude 4	.83	.87	.64
Attitude 5	.72	.88	.88
Intention			
Intention 1	.95	.98	.96
Intention 2	.95	.96	.97
Intention 3	.95	.97	.91
Intention 4	.94	.97	.91
Model fit indices	χ^2 (160) = 500.44, p < .001, RMSEA = .06, 90% CI [.06, .07], CFI = .92, SRMR = .04	χ^2 (179) = 438.31, p < .001, RMSEA = .05, 90% CI [.05, .06], CFI = .97, SRMR = .03	χ^2 (179) = 814.05, p < .001, RMSEA = .08, 90% CI [.08, .09], CFI = .91, SRMR = .04
	After deleting SN 4: .69	After deleting SN 4: χ^2 (160) = 416.68, p < .001, RMSEA = .05, 90% CI [.05, .06], CFI = .97, SRMR = .02	After deleting SN 4, attitude 3 and 4: χ^2 (125) = 465.65, p < .001, RMSEA = .07, 90% CI [.06, .08], CFI = .94, SRMR = .03

Table 4.6

Study 1: Means, Standard Deviations, and Reliabilities of Measurement Scales

	Initial Cronbach's α	Final Cronbach's α	Final *M* (*SD,* item *N*)
Smoking			

Descriptive norms	.95	--	3.08 (1.53, item *N* = 4)
Injunctive norms	.95	--	1.18 (0.17, item *N* = 4)
Subjective norms	.9611	.9614	-9.14 (7.22, item *N* = 3)
Attitude	.86	--	-8.46 (2.80, item *N* = 4)
Intention	.97	--	-8.94 (2.92, item *N* = 4)
Binge drinking			
Descriptive norms	.96	--	4.11 (1.60, item *N* = 4)
Injunctive norms	.96	--	3.78 (1.63, item *N* = 4)
Subjective norms	.956	.964	1.77 (0.39, item *N* = 3)
Attitude	.94	--	1.42 (0.43, item *N* = 5)
Intention	.99	--	6.06 (5.82, item *N* = 4)
Texting while driving			
Descriptive norms	.96	--	4.64 (1.56, item *N* = 4)
Injunctive norms	.93	--	1.54 (0.40, item *N* = 4)
Subjective norms	.94	.95	-8.06 (3.75, item *N* = 3)
Attitude	.89	.92	-8.68 (3.13, item *N* = 3)
Intention	.97	--	-0.76 (0.31, item *N* = 4)

Statistical assumption check. ANCOVA is in general robust to non-normality when the sample size is large (e.g., error *df* = 20; Tabachnick & Fidell, 2013). In addition to normality, ANCOVA analysis also assumes independence of observations and homogeneity of variance across groups (Lomax & Hahs-Vaughn, 2012; Tabachnick & Fidell, 2013). Given the way how the data were collected, independence of observations is expected for the data in each health context. For homogeneity of variance, when the cell size is relatively equal (smallest: largest = 1:4) and the ratio of largest cell variance to the smallest cell variance is within 10, this will not be a concern (Tabachnick & Fidell, 2013). In addition to these assumptions, ANCOVA requires the relationship between outcome variable and covariate to have equal slope across different experimental groups. This could be tested by examining the interaction between independent variables and covariate for the outcome variable. As aforementioned, the most important assumption for SEM with ML estimation is

multivariate normality. Before applying multi-group modeling, variables involved in the model for each health context were screened for multivariate normality.

All the above statistical assumptions were conducted before each individual test detailed below. Any violations of assumptions were reported in the results section.

Results

Manipulation check. Similar to pilot study 2, a series of ANOVAs examined the effectiveness of manipulating proportion of positive comments and comment focus in each health context.

Smoking. In the smoking context, proportion of positive comments had a significant main effect on two valence check measures, $F(2, 543) = 102.54$, $p < .001$, $\eta_p^2 = .27$, and $F(2, 543) = 79.56$, $p < .001$, $\eta_p^2 = .23$. As expected, increase in the proportion of positive comments was associated with greater perceived comment positivity (large: $M = 5.39$, $SE = 0.13$; medium: $M = 4.36$, $SE = 0.13$; small: $M = 2.81$, $SE = 0.13$) and less negativity (large: $M = 2.40$, $SE = 0.13$; medium: $M = 3.51$, $SE = 0.13$; small: $M = 4.72$, $SE = 0.13$). All pairwise comparisons were significant with Bonferroni correction for family-wise error. Focus interacted with valence on perceived positivity, $F(2, 543) = 5.95$ $p < .01$, $\eta_p^2 = .02$. As for the effectiveness of manipulating comment focus, focus had a main effect on two focus check measures, $F(1, 543) = 189.30$, $p < .001$, $\eta_p^2 = .26$, and $F(1, 543) = 134.59$, $p < .001$, $\eta_p^2 = .20$. As expected, those exposed to the message-focused comments reported greater focus of the comments on the PSA (message-focused: $M = 4.98$, $SE = 0.10$; behavior-focused: $M = 2.96$, $SE = 0.10$) and less focus on the behavior than those exposed to

the behavior-focused comments (message-focused: $M = 3.83$, $SE = 0.10$; behavior-focused: $M = 5.48$, $SE = 0.10$). Focus interacted with valence to influence people's perception that the comments focused on the behavior, $F(2, 543) = 3.35$, $p < .05$, $\eta_p^2 = .01$. Given the above two significant interactions had relatively small effect size and only significant for one of the two measures of each manipulated variables, they should not create severe problems.

Binge drinking. In the binge drinking context, proportion of positive comments had a significant main effect on two valence check measures, $F(1, 551) = 104.42$, $p < .001$, $\eta_p^2 = .28$, and $F(2, 551) = 83.56$, $p < .001$, $\eta_p^2 = .23$. As expected, increase in the proportion of positive comments was associated with greater perceived comment positivity (large: $M = 5.31$, $SE = 0.12$; medium: $M = 3.79$, $SE = 0.11$; small: $M = 3.00$, $SE = 0.12$) and less negativity (large: $M = 2.82$, $SE = 0.12$; medium: $M = 3.98$, $SE = 0.12$; small: $M = 4.97$, $SE = 0.12$). All pairwise comparisons were significant with Bonferroni correction for family-wise error. Focus also influenced perceived positivity, $F(1, 543) = 9.58$ $p < .01$, $\eta_p^2 = .02$. As for the effectiveness of manipulating comment focus, focus had a main effect on two focus check measures $F(1, 551) = 126.60$, $p < .001$, $\eta_p^2 = .19$, and $F(1, 551) = 86.39$, $p < .001$, $\eta_p^2 = .14$. As expected, those exposed to the message-focused comments reported greater focus of the comments on the PSA (message-focused: $M = 4.90$, $SE = 0.10$; behavior-focused: $M = 3.30$, $SE = 0.10$) and less focus on the behavior than those exposed to the behavior-focused comments (message-focused: $M = 4.30$, $SE = 0.09$; behavior-focused: $M = 5.49$, $SE = 0.09$). Focus interacted with proportion of positive comments to influence people's perception that the comments focused on the behavior, $F(2,$

551) =3.13, $p < .05$, $\eta_p^2 = .01$. Proportion of positive comments influenced people's perception that the comments focused on the PSA, $F(2, 551) = 3.85$, $p < .05$, $\eta_p^2 = .01$. Given that the above three unexpected findings were relatively small in size and only occurred for one of the two measures checking each variable, they were not considered as severe problems.

Texting while driving. In the texting while driving context, proportion of positive comments had a significant main effect on two valence check measures, $F(2, 514) = 86.06$, $p < .001$, $\eta_p^2 = .25$, and $F(2, 514) = 50.16$, $p < .001$, $\eta_p^2 = .16$. As expected, increase in the proportion of positive comments was associated with greater perceived comment positivity (large: $M = 5.50$, $SE = 0.12$; medium: $M = 4.25$, $SE = 0.13$; small: $M = 3.20$, $SE = 0.12$) and less perceived comment negativity (large: $M = 2.68$, $SE = 0.13$; medium: $M = 3.62$, $SE = 0.13$; small: $M = 4.51$, $SE = 0.13$). All pairwise comparisons were significant with Bonferroni correction for family-wise error. Focus also influenced perceived positivity, $F(1, 543) = 9.58$ $p < .01$, $\eta_p^2 = .02$. As for the effectiveness of manipulating comment focus, focus had a main effect on two focus check measures, $F(1, 514) = 177.23$, $p < .001$, $\eta_p^2 = .26$, and $F(1, 514) = 88.60$, $p < .001$, $\eta_p^2 = .15$. As expected, those exposed to the message-focused comments reported greater focus of the comments on the PSA (message-focused: $M = 4.99$, $SE = 0.10$; behavior-focused: $M = 3.04$, $SE = 0.10$) and less focus on the behavior than those exposed to the behavior-focused comments (message-focused: $M = 4.02$, $SE = 0.10$; behavior-focused: $M = 5.38$, $SE = 0.10$). Proportion of positive comments approached significance for the perception that the comments focused on the PSA, $F(2, 514) = 2.72$, $p = .07$, $\eta_p^2 = .01$. Focus interacted with comment focus on

perception that the comments focused on the behavior, $F(2, 514) = 2.75$, $p = .07$, $\eta_p^2 = .01$. Again, the unexpected findings were relatively small in size and only significant for one of the two measures checking each variable. Consequently, they were not considered severe problems.

Hypotheses testing. H1 predicts that a greater proportion of positive comments will be associated with the following responses toward a problem behavior: a) lower perceived prevalence (descriptive norms), b) lower perceived social approval (injunctive norms), c) lower perceived expectation (subjective norms), d) more negative attitudes, and e) lower behavioral intentions. RQ2 and RQ3 ask whether comment focus alone or together with proportion of positive comments will influences people's responses to a health promotion message[2]. These were explored separately in each health context using ANCOVA. In all ANCOVAs, the independent variables were health behavior status, proportion of positive comments, and comment focus. The covariate was message order.

[2] A series of mixed ANCOVAs were performed first to examine hypotheses and RQs. In these analyses, the within-subject factor was health context, the between-subject factors were comment focus and proportion of positive comments, and the covariate was message order. The dependent variables were three perceived norms, attitudes, and intentions. The results revealed a main effect of valence on injunctive norms, $F(2, 488) = 3.56$, $p < .05$, $\eta_p^2 = .01$. Trend analysis suggested a negative linear relationship between proportion of positive comments and injunctive norms, $t = -2.17$, $p < .05$. Furthermore, the interaction between health context and comment focus was marginally significant on descriptive norms, $F(1.98, 966.28) = 2.54$, $p = .08$, $\eta_p^2 = .01$[Greenhouse-Geisser corrected], and the interaction between health context, focus, and proportion of positive comments was marginally significant on attitudes, $F(2.64, 966.28) = 2.43$, $p = .07$, $\eta_p^2 = .01$ [Greenhouse-Geisser corrected]. These results suggested that comment focus and proportion of positive comments could have different persuasive effects across three health contexts. Hypotheses and RQs were explored separately in each health context.

Smoking[3]**.** ANCOVAs did not find that comment focus, proportion of positive comments, or their interaction influenced norms, attitudes, or intentions. H1 was not supported.

Ever-smokers indicated more favorable smoking attitudes, $F(1, 474) = 53.33$, $p < .001$, $\eta_p^2 = .10$, and stronger smoking intentions, $F(1, 474) = 63.57$, $p < .001$, $\eta_p^2 = .12$, than never-smokers.

Binge drinking[4]**.** ANCOVAs revealed that proportion of positive comments had a main effect on injunctive norms, $F(2, 535) = 4.02$, $p < .05$, $\eta_p^2 = .02$. As it is shown in Figure 4.1, there was a significant quadratic effect of proportion of positive comments on injunctive norms, $t = -2.02$, $p < .05$. Although the linear effect was also significant, $t = -1.98$, $p < .05$, which suggested a general decreasing trend in the data, proportion of positive comments had a concave downward relationship with injunctive norms. H1 was not supported. Focus had a main effect on intentions, $F(1, 535) = 4.37$, $p < .05$, $\eta_p^2 = .01$. Behavior-focused comments led to fewer binge

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[3] Examination of homogeneity of regression indicated that order interacted with proportion of positive comments, $F(10, 474) = 1.90$, $p < .05$, $\eta_p^2 = .04$, and focus to influence attitudes, $F(5, 474) = 2.67$, $p < .05$, $\eta_p^2 = .03$. Order also interacted with the three-way interaction among proportion of positive comments, comment focus, and smoking status for attitudes, $F(10, 474) = 1.98$, $p < .05$, $\eta_p^2 = .04$. These interaction terms were kept in the ANCOVA model examining group differences in smoking attitudes. Besides, order interacted with focus, $F(5, 474) = 2.88$, $p < .05$, $\eta_p^2 = .03$, proportion of positive comments, $F(10, 474) = 3.44$, $p < .05$, $\eta_p^2 = .07$, the interaction between comment focus and proportion of positive comments, $F(10, 474) = 2.76$, $p < .01$, $\eta_p^2 = .06$, the three-way interaction among proportion of positive comments, comment focus, and smoking status to influence intentions, $F(10, 474) = 3.35$, $p < .001$, $\eta_p^2 = .07$. These interaction terms were kept in the ANCOVA model examining group differences in smoking intentions.

[4] Homogeneity of regression analysis found that message order interacted with comment focus to influence attitudes, $F(5, 480) = 2.44$, $p = .03$, $\eta_p^2 = .03$. This interaction term was kept in the model testing group differences in binge drinking attitudes.

drinking intentions than message-focused comments (M = 5.72, SE = 0.27 vs. vs. M = 6.51, SE = 0.27).

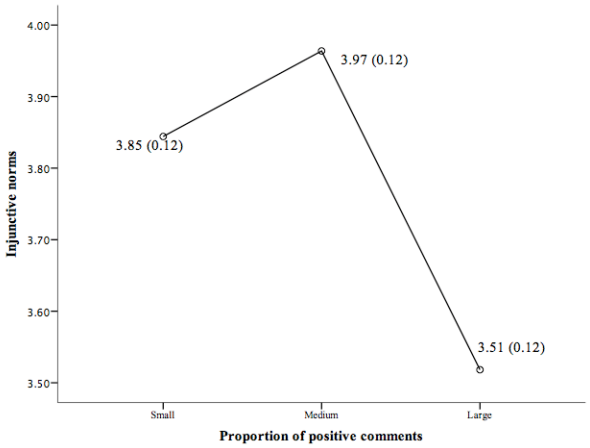


Figure 4.1. Study 1: Influence of proportion of positive comments on injunctive norms in the binge drinking context.

Compared with non-current binge drinkers, current binge drinkers reported greater perceived descriptive norms, $F(1, 535) = 41.81$, $p < .001$, $\eta_p^2 = .07$, injunctive norms, $F(1, 535) = 17.71$, $p < .001$, $\eta_p^2 = .03$, subjective norms, $F(1, 535) = 151.60$, $p < .001$, $\eta_p^2 = .22$, more favorable smoking attitudes, $F(1, 530) = 210.92$, $p < .001$, $\eta_p^2 = .29$, and greater smoking intentions $F(1, 535) = 377.89$, $p < .001$, $\eta_p^2 = .41$.

***Texting while driving*[5].** ANCOVAs revealed that the proportion of positive comments had a main effect on injunctive norms, $F(2, 501) = 6.00$, $p < .01$, $\eta_p^2 = .02$. As it is shown in Figure 4.2, proportion of positive comments had a negative linear effect on injunctive norms, $t = -3.44$, $p < .001$. The quadratic effect was not significant, $t = -0.33$, $p = ns.$ H1 was partially supported. Additionally, focus had a

[5] Assumption check found that homogeneity of regression was violated: Order interacted with proportion of positive comments on intentions, $F(10, 446) = 1.86$, $p < .05$, $\eta_p^2 = .04$. This interaction term was retained in the model examining group differences in texting while driving intentions.

significant main effect on descriptive norms, $F(1, 501) = 5.96$, $p < .05$, $\eta_p^2 = .01$. Behavior-focused comments led to fewer prevalence perceptions than the message-focused comments ($M = 4.53$, $SE = 0.10$ vs. $M = 4.86$, $SE = 0.10$).

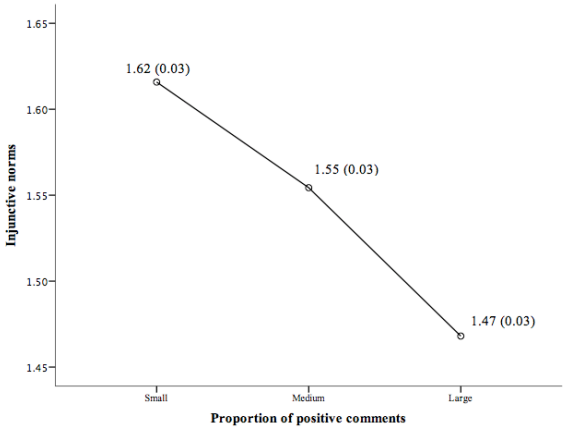


Figure 4.2. Study 1: Influence of proportion of positive comments on injunctive norms in the texting while driving context.

Proportion of positive comments further interacted with comment focus to influence injunctive norms, $F(2, 501) = 5.41$, $p < .01$, $\eta_p^2 = .02$. As it is shown in Figure 4.3, when comments focused on the PSAs, proportion of positive comments had a concave downward ($t = -2.04$, $p < .05$) instead of linear relationship ($t = -0.97$, $p = ns$) with injunctive norms. On the other hand, when comments focused on texting while driving behavior, proportion of positive comments was negatively related to injunctive norms, $t = -3.87$, $p < .001$. Its quadratic effect on injunctive norms was not significant, $t = 1.60$, $p = ns$. The interaction between proportion of positive comments and comment focus approached significance for attitudes, $F(1, 501) = 2.52$, $p = .08$, $\eta_p^2 = .01$. As it is shown in Figure 4.3, when comments focused on the ad, similar to injunctive norms, the relationship between proportion of positive comments and attitudes was concave downward, $t = -2.08$, $p < .05$ (linear: $t = -1.46$, $p = ns$). On the

other hand, when comments focused on texting while driving behavior, the relationship between proportion of positive comments and attitudes was an upward curve. In spite of this noticeable pattern, the concave upward effect was not significant, $t = 0.89$ $p = ns$. The linear effect was not significant, either, $t = -0.42$, $p = ns$.

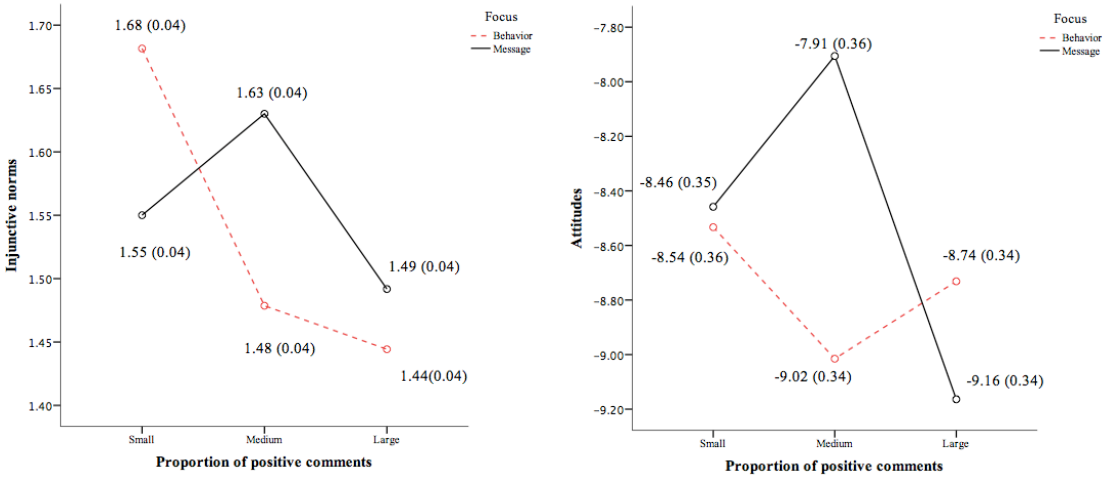


Figure 4.3. Study 1: Interaction between comment focus and proportion of positive comments on injunctive norms and attitudes in the texting while driving context.

Current distracted drivers reported greater perceived descriptive norms, $F(1, 501) = 24.93$, $p < .001$, $\eta_p^2 < .05$, subjective norms, $F(1, 501) = 18.46$, $p < .001$, $\eta_p^2 = .04$, and intentions, $F(1, 491) = 79.54$, $p < .001$, $\eta_p^2 = .14$, than non-current distracted drivers.

Summary. Through the above analyses, it appears that comments associated with anti-smoking PSAs did not influence smoking norms perceptions, smoking attitudes, or intentions. For the other two health issues, proportion of positive comments could influence people's perceived injunctive norms and the effect could be curvilinear. Also, in the texting while driving context, proportion of positive comments could interact with comment focus to influence people's normative

perceptions and attitudes. Proportion of positive comments was curvilinearly related to injunctive norms and texting while driving attitudes when the comments focused on the message. This suggests a curvilinear by linear interaction between comment focus and comment valence. Given the findings from ANCOVAs, following SEMs included a quadratic term of proportion of positive comments and the interaction between comment focus and the quadratic term of proportion of positive comments to better understand how comment valence and focus might be related to people's evaluations of a health behavior. Although proportion of positive comment was not found to be an important variable in the smoking context, SEM could take out measurement error and may identify some insignificant relationship in ANCOVA. A quadratic term of proportion of positive comments and its interaction with comment focus were also added into the structural model in the smoking context.

ANCOVAs did not identify health behavior status influenced people's responses to the PSAs accompanied by different comments. However, because prior studies have found people's health behavior status influenced health message persuasiveness (Jung et al., 2010; Zhao et al., 2015), multi-group modeling was executed to better understand whether health behavior status is an important factor in the influence of online comments on health promotion message effects.

Mediation testing. SEM was separately run for each health context. Exogenous variables in all models included five order dummy variables, proportion of positive comments, comment focus, the square of proportion of positive comments, the interaction between proportion of positive comments and comment focus, and the interaction between comment focus and square of proportion of positive comments.

For all the nonlinear terms, variables were first centered before forming products. All the exogenous variables were specified as latent variables with a single indicator and the indicator's error variance being fixed to zero. Exogenous variables were allowed to covary and to influence all the endogenous variables in the model. Endogenous variables included three normative perceptions, attitudes and behavioral intentions. These variables were all measured by multiple items as detailed in the data screening section. Three normative perceptions were allowed to covary and influenced attitudes and behavioral intentions. According to TRA and TPB, a path from attitudes to intentions was also added. For the endogenous variables, one indicator loading was fixed to one. As mentioned previously, multi-group modeling was employed to examine the mediation effects across two groups classified on people's engagement in each health behavior. Multivariate normality tests found that variables involved in the model in each health context failed to achieve multivariate normality, $p < .001$ (Small's test). MLR was employed for all SEMs.

Measurement model. According to Bryne (2011), multi-group modeling starts with the examination of the measurement model for each group.

Smoking. Preliminary analysis showed that intention 3 and intention 4 was linearly dependent and intention 1 resulted in a negative residual variance for the never-smoker group. A decision was to remove the three variables from the model for both groups so that the measurement model of each group had the same variables. After removing these variables, measurement model for ever-smokers resulted in a good fit, χ^2 (229) = 330.33, $p < .001$, RMSEA = .05, 90% CI [.04, .06], CFI = .96, SRMR = .04. So did the measurement model for never-smokers, χ^2 (229) = 512.78, p

< .001, RMSEA = .06, 90% CI [.05, .06], CFI = .94, SRMR = .03. For both models, modification indices suggested a large improvement of model fit by allowing the errors of attitude 3 and attitude 4 to covary. Given the wordings of the two items were similar, their errors were allowed to covary. The revised model generated a better fit for both groups, χ^2 (228) = 267.01, p < .001, RMSEA = .03, 90% CI [.01, .05], CFI = .98, SRMR = .03 for ever-smokers, and χ^2 (228) = 374.45, p < .001, RMSEA = .04, 90% CI [.03, .05], CFI = .97, SRMR = .02 for never-smokers. Then, a configural model with all parameters allowed to differ across groups was estimated and the model produced, χ^2 (458) = 666.56, p < .001, RMSEA = .04, 90% CI = [.03, .05], CFI = .97, SRMR = .03. After this, factor loadings were constrained to be equal across ever-smokers and never-smokers. The constrained model generated, χ^2 (470) = 686.66, p < .001, RMSEA = .04, 90% CI = [.03, .05], CFI = .97, SRMR = .03. The model was not different from the configural model, p = *ns*.

Binge drinking. Separate examination of measurement model produced, χ^2 (310) = 526.39, p < .001, RMSEA = .05, 90% CI = [.04, .06], CFI = .96, SRMR = .03 for current binge drinkers and χ^2 (310) = 512.23, p < .001, RMSEA = .05, 90% CI = [.04, .06], CFI = .96, SRMR = .02 for non-current binge drinkers. Then, a configural model with all parameters allowed to differ across groups was estimated. The model produced, χ^2 (621) = 1038.70, p < .001, RMSEA = .05, 90% CI = [.04, .05], CFI = .96, SRMR = .03. Then, factor loadings were constrained to be equal across current binge drinkers and non-current binge drinkers. The constrained model generated, χ^2 (636) = 1061.37, p < .001, RMSEA = .05, 90% CI = [.04, .05], CFI = .96, SRMR = .03. This model was not different from the configural model, p = *ns*.

Texting while driving. Separate examination of measurement model found χ^2 (255) = 457.25, $p < .001$, RMSEA = .06, 90% CI = [.05, .07], CFI = .94, SRMR = .03 for current distracted drivers and χ^2 (255) = 423.58, $p < .001$, RMSEA = .05, 90% CI = [.04, .05], CFI = .97, SRMR = .02 for non-current distracted drivers. Modification indices suggested that a large χ^2 decrease by allowing errors of intention 3 and intention 4 to covary. Given the wordings of the two items were similar, errors of the two items were allowed to covary. After such practice, the revised model generated better fit, χ^2 (254) = 294.12, $p < .001$, RMSEA = .03, 90% CI = [.03, .05], CFI = .99, SRMR = .03 for current distracted drivers and χ^2 (254) = 360.30, $p < .001$, RMSEA = .04, 90% CI = [.03, .05], CFI = .98, SRMR = .02 for non-current distracted drivers. Then, a configural model with all parameters allowed to differ across groups was estimated. The model generated, χ^2 (509) = 655.79, $p < .001$, RMSEA = .03, 90% CI = [.03, .04], CFI = .98, SRMR = .03. Then, factor loadings were constrained to be equal across the two groups. The constrained model produced, χ^2 (522) = 675.91, $p < .001$, RMSEA = .03, 90% CI = [.03, .04], CFI = .98, SRMR = .03 This model did not differ from the configural model $p = ns$.

Structural model. After examining the measurement models across groups for each health issue, structural models were examined.

Smoking. Unconstrained multi-group model produced, χ^2 (480) = 706.96, $p < .001$, RMSEA = .04, 90% CI = [.04, .05], CFI = .97, SRMR = .03. Constrained model produced, χ^2 (527) = 762.997, $p < .001$, RMSEA = .04, 90% CI = [.03, .05], CFI = .97, SRMR = .05. The constrained model was not different from the unconstrained one, $p = ns$.

As it is shown in Figure 4.4 and Table 4.7, greater proportion of positive comments led to less perceived social approval of smoking, b = -0.05, p < .05. H1 was partially supported. Injunctive norms (b = 2.21, p < .01) and subjective norms (b = 0.28, p < .001) were significant predictors of smoking attitudes. Descriptive norms were marginally related to smoking attitudes (b = -.15, p = .07). Of the three social norms, only subjective norms influenced smoking intentions (b = .41, p < .001).

Mediation analysis found that for both ever-smokers and never-smokers, proportion of positive comments indirectly influenced smoking attitudes via injunctive norms, b = -0.12, BC 95% CI = [-0.32, -0.02]. H3 was partially supported.

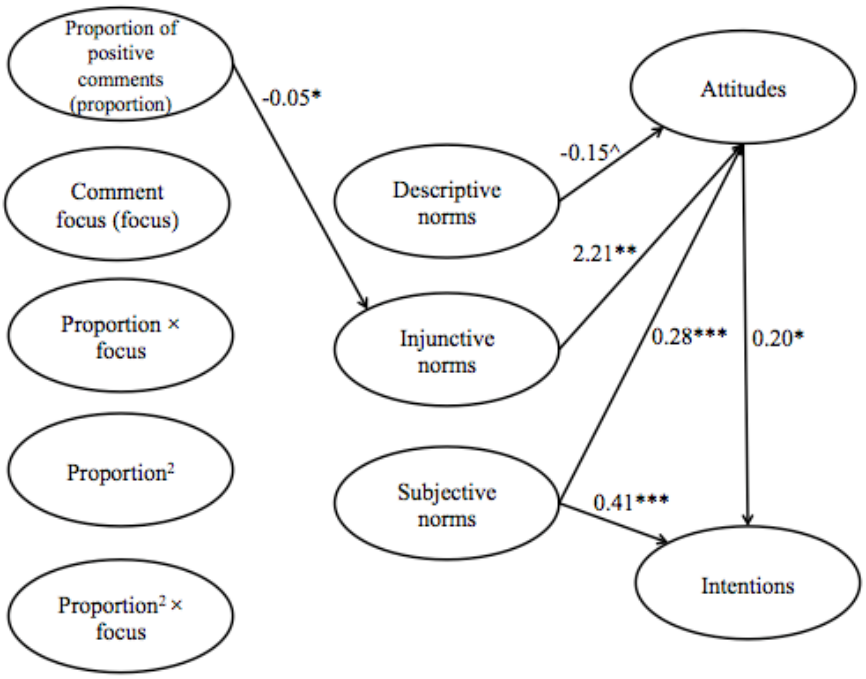


Figure 4.4. Study 1: Structural model in the smoking context.
Note. Only significant paths related to the hypotheses and research questions are shown.
^p < .10. *p < .05. **p < .01. ***p < .001.

Table 4.7

Study 1: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediated Model in the Smoking Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error (*SE*)
Descriptive norms ON		
Proportion	-0.24	0.22
Focus	-0.29	0.22
Proportion × focus	0.38	0.44
Proportion^2	-0.75	0.98
Proportion^2 × focus	0.69	1.96
Order 1	0.02	0.23
Order 2	0.04	0.23
Order 3	-0.22	0.23
Order 4	0.01	0.24
Order 5	0.62*	0.25
(R^2 = .04*/R^2 = .04*)		
Injunctive norms ON		
Proportion	-0.05*	0.02
Focus	0.01	0.03
Proportion × focus	0.01	0.05
Proportion^2	0.03	0.11
Proportion^2 × focus	-0.22	0.22
Order 1	0.04	0.03
Order 2	0.04	0.02
Order 3	0.01	0.02
Order 4	0.06*	0.03
Order 5	0.11***	0.03
(R^2 = .05*/R^2 = .06*)		
Subjective norms ON		
Proportion	-0.13	0.35
Focus	0.53	0.42
Proportion × focus	0.72	0.70
Proportion^2	-1.67	1.77
Proportion^2 × focus	-4.22	3.52
Order 1	0.15	0.37
Order 2	0.05	0.37
Order 3	-0.05	0.36
Order 4	0.26	0.40
Order 5	0.28	0.40
(R^2 = .01/R^2 = .01)		
Attitudes ON		
Proportion	0.11	0.32
Focus	-0.05	0.29

Proportion × focus	0.23	0.66
Proportion^2	1.70	1.36
Proportion^2 × focus	1.86	2.67
Descriptive norms	-0.15^	0.08
Injunctive norms	2.21**	0.80
Subjective norms	0.28***	0.08
Order 1	0.53^	0.32
Order 2	0.80*	0.40
Order 3	0.30	0.32
Order 4	-0.22	0.27
Order 5	-0.51	0.25
(R^2 = .11*/R^2 = .19**)		
Intentions ON		
Proportion	-0.38	0.25
Focus	0.32	0.26
Proportion × focus	0.20	0.48
Proportion^2	-1.01	1.10
Proportion^2 × focus	-2.25	2.13
Attitudes	0.20*	0.09
Descriptive norms	-0.03	0.06
Injunctive norms	0.43	0.61
Subjective norms	0.41***	0.09
Order 1	-0.04	0.22
Order 2	-0.23	0.22
Order 3	-0.10	0.27
Order 4	0.04	0.28
Order 5	-0.34	0.24
(R^2 = .15*/R^2 = .45***)		

Note. Numbers shown on the left of the slash are for ever-smokers and on the right of the slash are for never-smokers. Proportion refers to the proportion of positive comments. Focus stands for comment focus.
^p < .10. *p < .05. **p < .01. ***p < .001.

Binge drinking. Unconstrained multi-group model produced, $\chi 2$ (635) = 932.49, p < .001, RMSEA = .04, 90% CI = [.04, .05], CFI = .97, SRMR = .03. Constrained model produced, χ^2 (694) = 1064.76, p < .001, RMSEA = .04, 90% CI = [.04, .05], CFI = .97, SRMR = .06. The two models were statistically different, p < .001. Modification indices suggest to release the path from attitudes to intentions and to release the path from subjective norms to intentions. The final revised model

produced, χ^2 (690) = 998.21, $p < .001$, RMSEA = .04, 90% CI = [.04, .05], CFI = .97, SRMR = .04, which was not different from the unconstrained model, $p = ns$.

As it is shown in Figure 4.5 and Table 4.8, the square of proportion of positive comments had a marginally significant effect on injunctive norms (b = -1.86, p = .05). H1 was not supported. The square of proportion of positive comments interacted with focus to influence intentions (b = 8.26, $p < .05$). Subjective norms predicted attitudes (b = 0.49, $p < .001$) and intentions (current binge drinkers: b = 4.45, $p < .001$; non-current binge drinkers: b = 3.28, $p < .01$). Attitudes predicted intentions for both current binge drinkers, b = 4.69, $p < .001$ and non-current binge drinkers, b = 3.49, $p < .001$. None of the hypothesized mediation effects were significant. H3 was not supported.

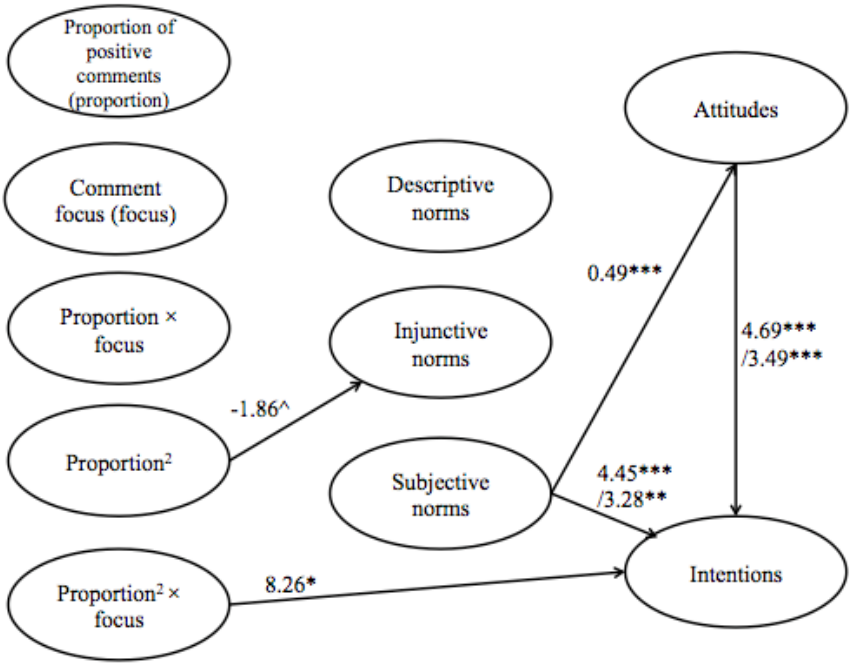


Figure 4.5. Study 1: Structural model in the binge drinking context.

Note. Only significant paths related to the hypotheses and research questions are shown. Numbers shown on the left of the slash are for current binge drinkers and on the right of the slash are for non-current binge drinkers.
^$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4.8

Study 1: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediate Model in the Binge Drinking Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error (*SE*)
Descriptive norms ON		
Proportion	-0.21	0.22
Focus	0.20	0.22
Proportion × focus	0.05	0.44
Proportion^2	-0.99	0.97
Proportion^2 × focus	-2.00	1.94
Order 1	0.13	0.23
Order 2	-0.02	0.23
Order 3	-0.06	0.22
Order 4	-0.30	0.23
Order 5	0.13	0.22
($R^2 = .02$/$R^2 = .01$)		
Injunctive norms ON		
Proportion	-0.37	0.22
Focus	0.31	0.22
Proportion × focus	-0.09	0.45
Proportion^2	-1.86^	0.96
Proportion^2 × focus	-2.31	0.94
Order 1	0.39^	0.23
Order 2	0.17	0.21
Order 3	0.33	0.21
Order 4	0.06	0.22
Order 5	0.60**	0.22
($R^2 = .03$*/$R^2 = .03$*)		
Subjective norms ON		
Proportion	0.04	0.04
Focus	0.05	0.05
Proportion × focus	-0.06	0.09
Proportion^2	-0.27	0.20
Proportion^2 × focus	-0.55	0.40
Order 1	0.12*	0.05
Order 2	0.03	0.04
Order 3	0.01	0.04

Order 4	-0.04	0.04
Order 5	0.07	0.05
(R^2 = .03*/R^2 = .04*)		
Attitudes ON		
Proportion	0.02	0.05
Focus	0.04	0.04
Proportion × focus	0.02	0.09
Proportion^2	0.16	0.20
Proportion^2 × focus	-0.21	0.40
Descriptive norms	0.00	0.01
Injunctive norms	0.01	0.01
Subjective norms	0.49***	0.07
Order 1	0.10*	0.05
Order 2	0.05	0.04
Order 3	0.03	0.04
Order 4	0.09*	0.05
Order 5	0.03	0.04
(R^2 = .22***/R^2 = .25**)		
Intentions ON		
Proportion	-0.08	0.40
Focus	-0.14	0.40
Proportion × focus	-0.50	0.84
Proportion^2	0.23	1.95
Proportion^2 × focus	8.26*	3.69
Attitudes	4.69***/3.49***	0.89/0.91
Descriptive norms	0.18	0.15
Injunctive norms	0.06	0.15
Subjective norms	4.45***/3.28**	0.91/1.07
Order 1	0.17	0.38
Order 2	0.01	0.01
Order 3	-0.01	0.32
Order 4	0.97*	0.42
Order 5	-0.41	0.35
(R^2 = .35***/R^2 = .41***)		

Note. Numbers shown on the left of the slash are for current binge drinkers and on the right of the slash are for non-current binge drinkers. Proportion refers to the proportion of positive comments. Focus stands for comment focus.
^p < .10. *p < .05. **p < .01. ***p < .001.

Texting while driving. Unconstrained multi-group model produced, χ^2 (522) = 675.91, p < .001, RMSEA = .03, 90% CI = [.03, .04], CFI = .98, SRMR = .03. Constrained model produced, χ^2 (579) = 719.82, p < .001, RMSEA = .03, 90% CI = [.02, .04], CFI = .98, SRMR = .04. The two models were not different, p = *ns*.

As it is shown in Figure 4.6 and Table 4.9, proportion of positive comments (b = -0.20, $p < .001$) negatively predicted injunctive norms, which partially supported H1. Comment focus approached significance for descriptive norms (b = 0.38, p = .07), injunctive norms (b = 0.13, p = .06), and attitudes (b = 0.81, p = .08). Message-focused comments led to greater perception of texting while driving prevalence and social approval as well as more favorable texting while driving attitudes than behavior-focused comments. Also, the interaction between comment focus and proportion of positive comments approached significance for injunctive norms (b = 0.22, p = .05), and the interaction between comment focus and the square of proportion of positive comments was a significant predictor of injunctive norms (b = -1.26, $p < .05$). Simple slope analysis revealed that when the focus of the comments was texting while driving behavior, proportion of positive comments had a negative linear relationship with injunctive norms, b = -0.31, $p < .001$. When the focus of the comments was the PSA message, proportion of positive comments had a concave downward relationship with injunctive norms, b = -0.15, $p < .05$. Subjective norms were a significant predictor of attitudes (b = 0.46, $p < .001$) and intentions (b = 0.02, $p < .001$). Intentions were also predicted by attitudes (b = 0.03, $p < .001$) and descriptive norms (b = 0.03, $p < .01$).

Mediation analysis found that descriptive norms mediated the influence of focus on intentions, b = 0.01, BC 95% CI = [0.001, 0.03]. The total indirect effect of comment focus on intentions was significant, b = 0.06, BC 95% CI = [0.003, 0.11]. H3 was not supported.

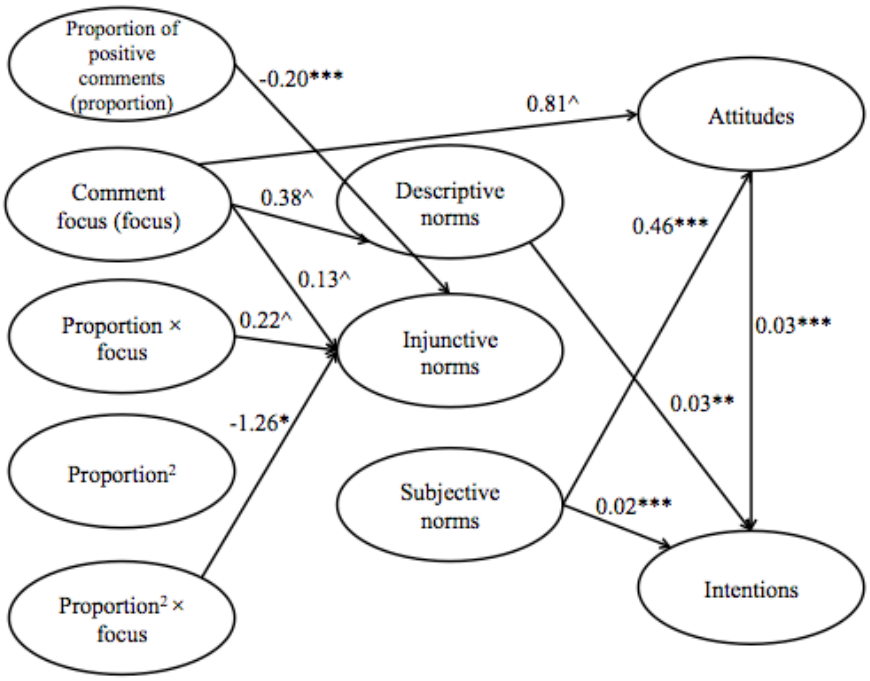


Figure 4.6. Study 1: Structural model in the texting while driving context.
Note. Only significant paths related to the hypotheses and research questions are shown.
^$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4.9

Study 1: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediated Model in the Texting While Driving Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error (*SE*)
Descriptive norms ON		
Proportion	-0.25	0.22
Focus	0.38^	0.21
Proportion × focus	0.63	0.45
Proportion^2	-0.95	0.96
Proportion^2 × focus	-0.48	1.93
Order 1	-0.22	0.23
Order 2	0.17	0.21
Order 3	-0.18	0.22
Order 4	-0.08	0.23
Order 5	0.29	0.21
($R^2 = .04$*/$R^2 = .03$*)		
Injunctive norms ON		

Proportion	-0.20***	0.06
Focus	0.13^	0.07
Proportion × focus	0.22^	0.11
Proportion^2	-0.15	0.28
Proportion^2 × focus	-1.26*	0.56
Order 1	0.00	0.06
Order 2	0.06	0.07
Order 3	-0.01	0.06
Order 4	-0.04	0.06
Order 5	0.13*	0.06
(R^2 = .06**/R^2 = .06*)		
Subjective norms ON		
Proportion	0.12	0.47
Focus	0.49	0.58
Proportion × focus	0.13	0.95
Proportion^2	-2.45	2.35
Proportion^2 × focus	-7.28	4.85
Order 1	-0.50	0.51
Order 2	0.34	0.58
Order 3	-0.55	0.50
Order 4	-0.77	0.48
Order 5	0.26	0.54
(R^2 = .02^/R^2 = .03^)		
Attitudes ON		
Proportion	-0.67	0.41
Focus	0.81^	0.46
Proportion × focus	-1.06	0.82
Proportion^2	-1.02	1.95
Proportion^2 × focus	-4.56	4.02
Descriptive norms	-0.04	0.09
Injunctive norms	0.18	0.39
Subjective norms	0.46***	0.06
Order 1	-0.16	0.47
Order 2	-0.03	0.48
Order 3	0.08	0.46
Order 4	0.08	0.43
Order 5	0.18	0.47
(R^2 = .33***/R^2 = .23**)		
Intentions ON		
Proportion	0.02	0.03
Focus	-0.02	0.04
Proportion × focus	0.07	0.07
Proportion^2	-0.17	0.16
Proportion^2 × focus	0.31	0.32
Attitudes	0.03***	0.01
Descriptive norms	0.03**	0.01

Injunctive norms	0.02	0.03
Subjective norms	0.02***	0.01
Order 1	0.02	0.03
Order 2	0.04	0.04
Order 3	0.03	0.03
Order 4	0.02	0.03
Order 5	0.04	0.04
(R^2 = .28***/R^2 = .39***)		

Note. Numbers shown on the left of the slash are for current distracted drivers and on the right of the slash are for non-current distracted drivers. Proportion refers to the proportion of positive comments. Focus stands for comment focus.
^p < .10. *p < .05. **p < .01. ***p < .001.

Discussion

Main study 1 examined H1, H3, RQ2, and RQ3. H1 predicts a negative linear relationship between people's favorable evaluation of a health risk behavior and the proportion of positive comments. RQ2 and RQ3 aim to explore the influence of comment focus on people's responses to health promotion messages. Findings from a series of ANCOVAs and SEMs partially supported H1 in the smoking and texting while driving context: Proportion of positive comments was negatively related to people's perceived social approval of health-risk behaviors. However, proportion of positive comments had a concave downward relationship with injunctive norms when the health issue was binge drinking. From pilot study 1, it appeared that compared with texting while driving and smoking, people held relatively more varied opinions about binge drinking. Also, binge drinking seemed to be a more prevalent behavior in this population (There were more current binge drinkers than current smokers and distracted drivers in this sample). In this case, it might be difficult for people to infer public opinion climate about binge drinking. According to the heuristic-systematic model (HSM), when people are less confident in reaching a conclusion, they might

devote more cognitive efforts to evaluate relevant information (Chaiken et al., 1989). Because medium proportion of positive comments had equal number of positive and negative comments, people engaged in systematic message processing might find the comment set unhelpful (Forman et al., 2008). When people lack resources for systematic information processing, they would search for other information in the social context to help them make a decision (Chaiken et al., 1989). As mentioned early, prior studies found that message highlighting problem behaviors could cue people the prevalence and social approval of the behaviors (Cialdini, 2003; Jacobson, 2007; Nan & Zhao, 2015; Wang & Jiang, 2016). If this is the case, potentially in the medium proportion of positive comments condition, the drinker image depicted in the ad increased people' accessibility to instances of college binge drinkers in their minds. As a result, people developed high estimates of injunctive norms. The estimate could be even higher than the estimate given by people in the small proportion of positive comments condition because the negative comment set included one positive comment. The one positive comment had the capacity to remind people of some anti-binge drinking messages they had seen in the past.

Though injunctive norms were mostly influenced by comment valence, injunctive norms had limited influence on people's actual health attitudes and behavioral intentions. Only in the smoking context, perceived social approval of smoking positively predicted smoking attitudes. Of the three normative constructs, subjective norms were the most influential predictor of attitudes and behavioral intentions. These findings were consistent with previous social norms research that norms of close, important referent groups were more influential than norms of

proximal, general groups (for a review, see Chung & Rimal, 2016). However, proportion of positive comments was unable to influence subjective norms. This occurred possibly because people did not identify commenters as important referents. Due to the limited influence of norms on attitudes or behavioral intentions and limited influence of proportion of positive comments on norms, H3, which predicts that three social norms perceptions mediate the influence of proportion of positive comments on attitudes and intentions, received weak support.

The influence of proportion of positive comments on norms and attitudes might not be fully understood without taking comment focus into consideration. In the texting while driving context, when the focus of the comments was health promotion message, proportion of positive comments had a concave downward relationship with injunctive norms and attitudes. When the focus of the comments was texting while driving behavior, however, proportion of positive comments negatively predicted people's perceived social approval of the behavior. Compared with behavior-focused comments, message-focused comments provided relatively less information about the social norms surrounding a health behavior. As indicated early, confronted with ambiguous information, people might spend more cognitive efforts on deciphering the information. In this case, it is easy for those exposed to medium proportion of message-focused positive comments to find the comments unhelpful. As a result, these people might use health promotion messages highlighting the problem behavior as an indicator of high social permissiveness toward the behavior.

Comment focus not only influenced the effects of proportion of positive comments but also had independent effects on social norms, attitudes, and intentions in binge drinking and texting while driving context. Specifically, compared with behavior-focused comments, message-focused comments resulted in greater perceived texting while driving prevalence, social approval, and more favorable texting while driving attitudes. Also, message-focused comments led to stronger intentions to binge drink and text while driving. This occurred possibly because public discussion about a problem behavior itself indicates great public concern about the behavior ("Many people have discussed this health-risk behavior. The behavior is a great public concern."). However, many effects of comment focus in the texting while driving context only approached significance. In spite of the weak effects, findings about comment focus on persuasive outcomes of health promotion messages were similar to prior findings that interpersonal discussion about health issues depicted in a health message contributed to more health-enhancing beliefs than discussion about the actual health message (Hendriks & de Bruijn, 2015; van den Putte et al., 2011).

It is important to note, however, SEMs generated some findings that were not found when performing ANCOVAs (for a summary of differences, see Appendix B). Also, some findings from ANCOVAs were not replicated in SEMs. This might be because 1) SEM analyzed the effects of exogenous variables on different outcome variables simultaneously; 2) SEM took measurement error into consideration whereas ANCOVA tested group differences using a composite score; 3) SEM did not control for health behavior status as ANCOVA did. In spite of the differences between SEM

and ANCOVA results, the findings produced by both analysis procedures were consistent. Neither ANCOVAs nor SEMs found that people's health behavior status influenced the persuasive impacts of online comments on people's responses to health promotion messages.

Study 2

Participants

Participants were 868 UM students enrolled in communication classes. Excluding those who only completed the first several questions of the questionnaire or had participated in any of the previous studies related to this research resulted in a total of 812 people. Among these people, 759 people reported they had not been exposed to any one of the two anti-smoking PSAs and comprised the working sample for the smoking context. The average age of this sample was 19.18 (*SD* = 1.84). There were more females (57.8%) than males (42.2%). White accounted for 63.6% of the sample, Black or African American for 12.5%, Asian or Pacific Islander for 15.3%, American Indian, Alaskan Native, or Native Hawaiian for 0.3% and other races for 8.3%. A total of 761 people reported no prior exposure to the two anti-binge drinking PSAs and constituted the working sample for the binge drinking context. These people were on average 19.70 years old (*SD* = 1.99). 58% of the people were females, 64% were White, 12.4 were Black or African American, 15.2% were Asian or Pacific Islander, 0.3% were American Indian, Alaskan Native, or Native Hawaiian and 8.1% other races. Finally, 721 people who never viewed any of the two anti-texting while driving PSAs were included as the working sample for the texting while

driving context. These people had an average age of 19.22 (*SD* = 2.03) and self-identified their race as White (62.7%), Black or African American (13.2%), Asian or Pacific Islander (15.8%), American Indian, Alaskan Native, or Native Hawaiian (0.3%), and other races (8%). Females accounted for 57.6%.

Design and Procedure

The study followed a 3 (view count: high, medium, vs. low) × 3 (proportion of thumbs-up: large, medium, small) × 6 (order) factorial design. Similar to main study 1, in each experimental condition, people were presented with six PSAs. Two of the six PSAs focused on the same health issue. The two PSAs of same health issue were presented in a fixed order and the three health issues were presented in a counterbalanced order. The order of the six PSAs was the same as it was in study 1, which is shown in Table 4.1.

The procedure of this study is the same as study 1. Participants were invited to participate in a 30-minute online survey. The link to the survey was posted on the Department of Communication research web portal. The first part of the survey was a consent form informing people of the benefits, risks, purpose, and procedure of the study. Once participants clicked "I consent to participate," they were directed to the actual questionnaire. The questionnaire first instructed people to pay a close attention to several health-related PSAs posted on YouTube. Then, an algorithm randomly assigned people to one of the 54 experimental conditions. In each condition, people were presented with six health-related PSAs. Following the presentation of two PSAs focusing on the same health behavior, people were asked about their prior exposure to the two PSAs, their normative perceptions, their attitudes, and intentions toward the

health behavior. Questions assessing norms, attitudes and intentions were randomized and the response items under each question were also shown in a random order. Then, manipulation check questions were presented. Finally, people's prior experience with each health issue was assessed. When all the PSAs were presented, people were asked to report their demographics. The last part of the survey was a debriefing form.

Stimuli Materials

The materials used in study 2 were the same as those used in pilot study 3. Six PSA videos were shown to the participants one at a time on a mock YouTube web page. The page looked similar to actual YouTube web page except that the page did not contain textual comments but showed the view count and the number of thumbs-up and thumbs-down a video has received (see Appendix A for a stimuli example).

Manipulation

Proportion of thumbs-up. Being the same as pilot study 3, proportion of positive comments was manipulated at three levels: large (7/8), medium (4/8) and small (1/8) of the total views of the PSA. The number of thumbs-up vs. the number of thumbs-down in each condition for different PSAs is shown in Table 3.5.

View count. View count was manipulated at three levels for each video. View count of each video in different conditions is shown in Table 3.5.

Key Outcome Measures

The key outcome measures in study 2 were the same as those in study 1 (for details, see study 1 key outcome measures).

Descriptive norms. Four items measured descriptive norms of each health behavior, such as "A majority of people in general xx [health behavior; e.g., smoke cigarettes]" and "A majority of people in general are engaged in xx." Participants were asked to indicate their agreement or disagreement with each of the four statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Injunctive norms. Four items measured injunctive norms of each health behavior, such as "A majority of people in general approve of xx [health behavior; e.g., cigarette smoking]," and "A majority of people in general endorse others' xx." People were asked about their agreement or disagreement with each of the statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Subjective norms. Similar to descriptive norms and injunctive norms, participants were asked to indicate their agreement or disagreement with four statements on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).* Example items included: "Most people who are important to me think that I should xx [health behavior; e.g., smoke cigarettes]," and "Most people whose opinions I value want me to xx."

Attitudes. People's attitudes towards each health behavior were assessed through five 7-point semantic differential scales, which were anchored by bad(1)/good(7), harmful(1)/beneficial(7), unpleasant(1)/pleasant(7), unenjoyable(1)/enjoyable(7), and foolish(1)/wise(7).

Behavioral intentions. Four items assessed people's intentions to perform each health-risk behavior in the future, such as "I intend to xx [health behavior; e.g.,

smoke cigarettes] in the near future," and "I plan to xx in the near future." Answers to each item were provided on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).*

Manipulation Check Measures

Being similar to pilot study 3, two items assessed the proportion of thumbs-up and two items assessed view count. Participants were asked to indicate their agreement or disagreement with each statement on a 7-point Likert-type scale (*1 = strongly disagree, 4 = neutral, 7 = strongly agree).* The two view count check statements were "According to the view count of the two PSA videos, the two videos have been watched by a very large number of people," and "According to the view count of the two PSA videos, the two videos have been watched by very few people." The two proportion check items included "The two PSAs have more thumbs-up than thumbs-down," and "The two PSAs have more thumbs-down than thumbs-up."

Analysis Strategy

Study 2 examined H2, H4, H5, RQ1, and RQ4. H2 argues for a negative relationship between proportion of thumbs-up and people's favorable evaluation of a health problem behavior. RQ1 investigates the relationship between view count and people's responses to health promotion messages. H4 and H5 propose social norms as mediators of the influence of proportion of thumbs-up and view count on attitudes and intentions. RQ4 explores the joint effects of view count and proportion of thumbs-up on people's responses to health promotion messages. Similar to study 1, ANCOVAs were used to test H2, RQ1 and RQ4. SEM was utilized to test H4 and H5.

Being the same as study 1, people's current engagement in each health-risk behavior was added as an additional independent variable to the ANCOVAs. Multi-group modeling was employed to examine the study propositions across people with different experiences with each health behavior. Alike study 1, to identify those who are current executors of each health behavior, participants were asked on how many days they had smoked, binge drunk or texted while driving during the past 30 days. Those who reported having performed these behaviors on at least one day in the past 30 days were thought as current performers of the health-risk behavior (N_{smk} = 64 [8.4%], N_{dri} = 350 [46.1%], N_{tex} = 299 [41.6%]). Only 64 people were current smokers. Hence, the analysis distinguished between ever-smokers (208 [27.4%]) and never-smokers to better understand the influence of smoking experience on responses to the anti-smoking messages. The multi-group modeling procedure was the same as study 1. For all ANCOVAs, the independent variables were proportion of thumbs-up, view count, health behavior status. Message order was a covariate. Indirect effects were examined through bootstrapping technique.

Before data analyses, alike study 1, this study performed data screening.

Data Screening

Missing values and inconsistent responses. First, data for each health context was examined for missing values, implausible and inconsistent responses. This procedure identified that in each dataset, two cases provided implausible age values (> 90) and one person did not provide age. These three cases were replaced with the mean age of the sample in the dataset. Then, in the binge drinking dataset, it was found that two cases provided inconsistent responses to the questions assessing

their prior engagement in binge drinking (e.g., people reported no to ever binge drinking but said they had binge drunk in the past 30 days). Such inconsistent responses were treated as missing values. Similarly, in the texting while driving dataset, two cases provided inconsistent responses to the questions assessing their prior behavior engagement. The inconsistent responses of the two cases were treated as missing values. Altogether, each dataset only contained a small amount of missing cases (< 5%), which did not demonstrate a systematic pattern. Listwise deletion was used in subsequent data analysis.

Data transformation. For the same reason mentioned in study 1, quantitative outcome variables were screened for their distribution. Those appeared to very non-normal were transformed using power transformation (Fink, 2009). Through trial and error, it was expected that the best transformation made both skewness and kurtosis of variables close to zero. The kurtosis and skewness of the transformed and untransformed variables are shown in Table 4.10 to 4.12. Kline (2011) indicates that skewness above three and kurtosis over ten indicate a distribution problem. As it is shown in Table 4.10, after transformation, attitude 1 and attitude 2 were still highly skewed and the two variables were deleted.

Table 4.10

Study 2: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Smoking Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				
DN 1	0.62 (0.09)	-0.41 (0.18)	--	--
DN 2	0.55 (0.09)	-0.53 (0.18)	--	--
DN 3	0.26 (0.09)	-0.93 (0.18)	--	--
DN 4	0.21 (0.09)	-0.99 (0.18)	--	--
Injunctive norms (IN)				

IN 1[a]	0.19 (0.09)	0.86 (0.18)	0.53 (0.09)	-0.85 (0.18)
IN 2[a]	1.43 (0.09)	1.73 (0.18)	0.73 (0.09)	-0.53 (0.18)
IN 3[a]	1.41 (0.09)	1.71 (0.18)	0.68 (0.09)	-0.57 (0.18)
IN 4[a]	1.05 (0.09)	0.38 (0.18)	0.44 (0.09)	-0.98 (0.18)
Subjective norms (SN)				
SN 1[b]	5.06 (0.09)	28.58 (0.18)	3.20 (0.09)	8.23 (0.18)
SN 2[b]	4.68 (0.09)	23.42 (0.18)	3.06 (0.09)	7.39 (0.18)
SN 3[b]	4.67 (0.09)	22.81 (0.18)	3.09 (0.09)	7.59 (0.18)
SN 4[b]	4.92 (0.09)	26.19 (0.18)	3.13 (0.09)	7.80 (0.18)
Attitude				
Attitude 1[c]	5.26 (0.09)	31.52 (0.18)	3.51 (0.09)	10.33 (0.18)
Attitude 2[c]	6.33 (0.09)	43.59 (0.18)	4.49 (0.09)	18.17 (0.18)
Attitude 3[c]	3.04 (0.09)	8.57 (0.18)	1.81 (0.09)	1.29 (0.18)
Attitude 4[c]	2.29 (0.09)	4.19 (0.18)	1.46 (0.09)	0.13 (0.18)
Attitude 5[c]	4.69 (0.09)	23.38 (0.18)	3.27 (0.09)	8.70 (0.18)
Intention				
Intention 1[d]	4.24 (0.09)	18.86 (0.18)	2.60 (0.09)	4.76 (0.18)
Intention 2[d]	4.13 (0.09)	17.70 (0.18)	2.69 (0.09)	5.27 (0.18)
Intention 3[d]	3.78 (0.09)	14.65 (0.18)	2.49 (0.09)	4.20 (0.18)
Intention 4[d]	3.61 (0.09)	12.95 (0.18)	2.46 (0.09)	4.08 (0.18)

Note. [a]$Y^* = (Y)^{0.25}$; [bcd]$Y^* = (Y - 0.99)^{-1} \times (-0.1)$. Y* refers to transformed variable. Y refers to the original variable.

Table 4.11

Study 2: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Binge Drinking Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				
DN 1	-0.11 (0.09)	-0.97 (0.18)	--	--
DN 2	-0.15 (0.09)	-0.98 (0.18)	--	--
DN 3	-0.26 (0.09)	-0.90 (0.18)	--	--
DN 4	-0.31 (0.09)	-0.83 (0.18)	--	--
Injunctive norms (IN)				
IN 1[a]	-0.06 (0.09)	-1.01 (0.18)	-0.65 (0.09)	-0.66 (0.18)
IN 2[a]	-0.02 (0.09)	-1.11 (0.18)	-0.57 (0.09)	-0.85 (0.18)
IN 3[a]	0.00 (0.09)	-1.08 (0.18)	-0.56 (0.09)	-0.83 (0.18)
IN 4[a]	-0.05 (0.09)	-1.08 (0.18)	-0.62 (0.09)	-0.74 (0.18)
Subjective norms (SN)				
SN 1[b]	1.26 (0.09)	0.65 (0.18)	0.85 (0.09)	-0.66 (0.18)
SN 2[b]	1.27 (0.09)	0.68 (0.18)	0.85 (0.09)	-0.64 (0.18)
SN 3[b]	1.28 (0.09)	0.75 (0.18)	0.82 (0.09)	-0.63 (0.18)
SN 4[b]	1.09 (0.09)	0.07 (0.18)	0.70 (0.09)	-0.94 (0.18)
Attitude				
Attitude 1[c]	1.60 (0.09)	2.07 (0.18)	0.74 (0.09)	-1.04 (0.18)

Attitude 2[c]	1.90 (0.09)	3.83 (0.18)	0.89 (0.09)	-0.75 (0.18)
Attitude 3[c]	1.20 (0.09)	0.31 (0.18)	0.50 (0.09)	-1.40 (0.18)
Attitude 4[c]	1.00 (0.09)	-0.28 (0.18)	0.35 (0.09)	-1.55 (0.18)
Attitude 5[c]	1.66 (0.09)	2.75 (0.18)	0.79 (0.09)	-0.99 (0.18)
Intention				
Intention 1	0.85 (0.09)	-0.68 (0.18)	--	--
Intention 2	0.84 (0.09)	-0.68 (0.18)	--	--
Intention 3	0.76 (0.09)	-0.86 (0.18)	--	--
Intention 4	0.80 (0.09)	-0.78 (0.18)	--	--

Note. [a]$Y^* = (Y)^{0.25}$; [b]$Y^* = (Y - 0.5)^{0.5}$; [c]$Y^* = LN(Y - 0.5)$. Y* refers to transformed variable. Y refers to the original variable.

Table 4.12

Study 2: Skewness and Kurtosis of Outcome Measures Before and After Transformation in the Texting While Driving Context

	Untransformed		Transformed	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (*SE*)	Kurtosis (*SE*)
Descriptive norms (DN)				
DN 1	-0.52 (0.09)	-0.49 (0.18)	--	--
DN 2	-0.48 (0.09)	-0.64 (0.18)	--	--
DN 3	-0.80 (0.09)	0.00 (0.18)	--	--
DN 4	-0.82 (0.09)	-0.00 (0.18)	--	--
Injunctive norms (IN)				
IN 1[a]	1.19 (0.09)	0.77 (0.18)	0.79 (0.09)	-0.34 (0.18)
IN 2[a]	1.30 (0.09)	1.09 (0.18)	0.90 (0.09)	-0.17 (0.18)
IN 3[a]	1.18 (0.09)	0.73 (0.18)	0.79 (0.09)	-0.38 (0.18)
IN 4[a]	0.96 (0.09)	-0.11 (0.18)	0.62 (0.09)	-0.80 (0.18)
Subjective norms (SN)				
SN 1[b]	3.43 (0.09)	13.77 (0.18)	1.84 (0.09)	1.37 (0.18)
SN 2[b]	3.39 (0.09)	12.68 (0.18)	1.77 (0.09)	1.13 (0.18)
SN 3[b]	3.48 (0.09)	13.33 (0.18)	1.72 (0.09)	0.95 (0.18)
SN 4[b]	2.89 (0.09)	8.95 (0.18)	1.36 (0.09)	-0.15(0.18)
Attitude				
Attitude 1[c]	4.62 (0.09)	24.72 (0.18)	2.87 (0.09)	6.24 (0.18)
Attitude 2 [c]	5.42 (0.09)	37.92 (0.18)	2.93 (0.09)	6.60 (0.18)
Attitude 3[c]	1.97 (0.09)	3.05 (0.18)	1.09 (0.09)	-0.81 (0.18)
Attitude 4[c]	1.86 (0.09)	2.59 (0.18)	0.94 (0.09)	-1.13 (0.18)
Attitude 5[c]	4.83 (0.09)	26.64 (0.18)	2.96 (0.09)	6.78 (0.18)
Intention				
Intention 1[d]	2.48 (0.09)	6.27 (0.18)	0.99 (0.09)	-1.00 (0.18)
Intention 2[d]	2.40 (0.09)	5.76 (0.18)	1.02 (0.09)	-0.94 (0.18)
Intention 3[d]	1.72 (0.09)	1.96 (0.18)	0.55 (0.09)	-1.68 (0.18)
Intention 4[d]	1.66 (0.09)	1.72 (0.18)	0.54 (0.09)	-1.69 (0.18)

Note. $^{a}Y^{*} = (Y + 0.25)^{0.5}$; $^{bc}Y^{*} = (Y - 0.99)^{-1} \times (-0.1)$; $^{d}Y^{*} = (Y - 0.99)^{-0.25} \times (-1)$. Y* refers to transformed variable. Y refers to the original variable.

Measurement adequacy. To examine the measurement quality, items measuring three normative perceptions, attitudes, and intentions were subject to one CFA for each health topic. In the CFA model, five factors were allowed to covary and the error terms of the indicators were not allowed to covary. The loading of first indicator of each factor was fixed at one. CFA with ML estimation requires variables included in the model to approach multivariate normality. Multivariate normality tests using DeCarlo's SPSS macro (DeCarlo, 1997) found that variables included in the measurement model of each health contexts did not achieve multivariate normality, $p < .001$ (Small's test). MLR was used (Muthen & Muthen, 2015). The fit indices and factor loadings of the CFA model for each health issue are shown in Table 4.13. Also, for each multi-item measurement scale, its reliability information is shown in Table 4.14. Both information was consulted to assess the quality of measurement.

The measurement model in the smoking context demonstrated appropriate fit, χ^2 (142) = 375.35, $p < .001$, RMSEA = .05, 90% CI = [.04, .05], CFI = .95, SRMR = .03. All factor loadings were above .80 except attitude 4, which had a very low loading. The item was deleted. Revised model produced, χ^2 (125) = 346.99, $p < .001$, RMSEA = .05, 90% CI = [.04, .06], CFI = .95, SRMR = .02. The measurement model in the binge drinking context showed a good fit χ^2 (179) = 639.73, $p < .001$, RMSEA = .06, 90% CI = [.05, .06], CFI = .96, SRMR = .03. However, removing subjective norms 4 improved the scale reliability from .95 to .96. Hence, subjective norms 4 was removed. After removing this item, the measurement model in the binge drinking context produced, χ^2 (160) = 612.92, $p < .001$, RMSEA = .06, 90% CI = [.06, .07],

CFI = .96, SRMR = .03. The measurement model in the texting while driving context obtained, χ^2 (179) = 1041.34, $p < .001$, RMSEA = .08, 90% CI = [.08, .09], CFI = .89, SRMR = .06. All items had factor loadings above .80. However, removing subjective norms 4 could increase the reliability of the subjective norms scale from .93 to .94. Subjective norms 4 was deleted. Also, the loadings of attitude 3 and attitude 4 were very low compared with other indicators. The two items were deleted. By removing these two items, texting while driving attitude scale's reliability improved from .86 to .91. The revised model showed a better fit, χ^2 (125) = 465.65, $p < .001$, RMSEA = .07, 90% CI = [.06, .08], CFI = .93, SRMR = .04. The final indicators of each scale were averaged into a summary measure to represent each scale.

Table 4.13

Study 2: Item Loadings and Fit Indices for Confirmatory Factor Analysis of Measurement Scales

	Smoking	Binge Drinking	Texting while driving
Descriptive norms (DN)			
DN 1	.95	.93	.94
DN 2	.96	.94	.91
DN 3	.86	.90	.92
DN 4	.86	.89	.89
Injunctive norms (IN)			
IN 1	.93	.95	.91
IN 2	.87	.91	.85
IN 3	.90	.96	.91
IN 4	.89	.93	.81
Subjective norms (SN)			
SN 1	.92	.93	.93
SN 2	.89	.95	.91
SN 3	.91	.95	.91
SN 4	.85	.83	.75
Attitude			
Attitude 1	--	.90	.88
Attitude 2	--	.85	.85
Attitude 3	.89	.89	.57
Attitude 4	.85	.87	.56

Attitude 5	.55	.88	.88
Intention			
Intention 1	.98	.98	.83
Intention 2	.97	.98	.82
Intention 3	.96	.97	.96
Intention 4	.94	.97	.96
Model fit indices	χ^2 (142) = 375.35, p < .001, RMSEA = .05, 90% CI = [.04, .05], CFI = .95, SRMR = .03	χ^2 (179) = 639.73, p < .001, RMSEA = .06, 90% CI = [.05, .06], CFI = .96, SRMR = .03	χ^2 (179) = 1041.34, p < .001, RMSEA = .08, 90% CI = [.08, .09], CFI = .89, SRMR = .06
	After deleting attitude 5: χ^2 (125) = 346.99, p < .001, RMSEA = .05, 90% CI = [.04, .06], CFI = .95, SRMR = .02.	After deleting SN 4: χ^2 (160) = 612.92, p < .001, RMSEA = .06, 90% CI = [.06, .07], CFI = .96, SRMR = .03	After deleting SN 4, attitude 3 and 4: χ^2 (125) = 465.65, p < .001, RMSEA = .07, 90% CI = [.06, .08], CFI = .93, SRMR = .04

Table 4.14

Study 2: Means, Standard Deviations, and Reliabilities of Measurement Scales

	Initial Cronbach's α	Final Cronbach's α	Final M (*SD,* item N)
Smoking			
Descriptive norms	.95	--	3.12 (1.55, item N = 4)
Injunctive norms	.94	--	1.17 (0.16, item N = 4)
Subjective norms	.94	--	-9.21 (2.48, item N = 4)
Attitude	.80	.86[a]	-8.16 (3.62, item N = 2)
Intention	.98	--	-8.94 (2.98, item N = 4)
Binge drinking			
Descriptive norms	.95	--	4.06 (1.62, item N = 4)
Injunctive norms	.97	--	1.35 (1.98, item N = 4)
Subjective norms	.95	.96	1.14 (0.52, item N = 3)
Attitude	.94	--	0.00 (0.77, item N = 5)
Intention	.99	--	2.71 (1.98, item N = 4)
Texting while driving			
Descriptive norms	.95	--	4.63 (1.56, item N = 4)
Injunctive norms	.93	--	1.51 (0.38, item N = 4)
Subjective norms	.93	.94	-8.33 (3.51, item N = 3)
Attitude	.86	.91	-9.12 (2.59, item N = 3)

Intention	.95	--	-2.42 (0.99, item $N = 4$)

Note. [a]Equal to Spearman-Brown coefficient, which is suggested for checking reliability of two-item measure (Eisinga, te Grotenhuis, & Pelzer, 2012).

Statistical assumption check. Being the same as study 1, assumptions associated with each statistical procedure were examined, such as homogeneity of variance and homogeneity of regression for ANCOVA and multivariate normality for SEM. Assumptions that were violated were noted in the results section.

Results

Manipulation check. Before hypotheses testing, this study first examined the effectiveness of manipulating proportion of thumbs-up and view count.

Smoking. A series of ANOVAs were performed to examine whether the proportion of thumbs-up and view count were successfully manipulated. In the smoking context, view had a significant main effect on two view check measures, $F(2, 750) = 303.06$, $p < .001$, $\eta_p^2 = .45$ and $F(2, 750) = 251.53$, $p < .001$, $\eta_p^2 = .40$. As expected, high view count was associated with greater perception that the PSAs had been watched by a large number of people (high: $M = 5.67$, $SE = 0.11$; medium: $M = 3.14$, $SE = 0.10$; small: $M = 2.16$, $SE = 0.10$) and less perception that the PSAs had been watched by very few people (high: $M = 2.20$, $SE = 0.11$; medium: $M = 4.49$, $SE = 0.11$; small: $M = 5.63$, $SE = 0.11$). All pairwise comparisons were significant with Bonferroni correction for family-wise error. Proportion of thumbs-up had a statistically significant effect on two measures checking proportion of thumbs-up, $F(2, 750) = 187.28$, $p < .001$, $\eta_p^2 = .33$ and $F(2, 750) = 198.75$, $p < .001$, $\eta_p^2 = .35$. As expected, increase in the proportion of thumbs-up is associated with greater perception that a video had received more thumbs-up (large: $M = 5.61$, $SE = 0.12$;

medium: $M = 3.54$, $SE = 0.12$; small: $M = 2.48$, $SE = 0.12$) and less thumbs-down (large: $M = 2.44$, $SE = 0.11$; medium: $M = 3.01$, $SE = 0.11$; small: $M = 5.45$, $SE = 0.11$). Pairwise comparisons on each proportion check measure were statistically significant with Bonferroni correction for family-wise error.

Binge drinking. For binge drinking, view count had a significant main effect on two view count check measures, $F(2, 752) = 287.01$, $p < .001$, $\eta_p^2 = .43$ and $F(2, 752) = 215.42$, $p < .001$, $\eta_p^2 = .36$. As expected, higher view count led to greater perception that the PSAs had been watched by a large number of people (high: $M = 5.54$, $SE = 0.10$; medium: $M = 3.19$, $SE = 0.10$; small: $M = 2.16$, $SE = 0.10$) and less perception that the PSAs had been watched by very few people (high: $M = 2.48$, $SE = 0.11$; medium: $M = 4.48$, $SE = 0.11$; small: $M = 5.68$, $SE = 0.11$). Pairwise comparisons on each view count check measure were statistically significant with Bonferroni correction for family-wise error. Proportion of thumbs-up had a significant main effect on two measures checking proportion of thumbs-up, $F(2, 752) = 178.56$, $p < .001$, $\eta_p^2 = .32$ and $F(2, 752) = 202.37$, $p < .001$, $\eta_p^2 = .35$. People exposed to larger proportion of thumbs-up reported greater perception that the PSAs had received more thumbs-up (large: $M = 5.45$, $SE = 0.11$; medium: $M = 3.51$ $SE = 0.11$; small: $M = 2.52$, $SE = 0.11$) and less thumbs-down (large: $M = 2.62$, $SE = 0.11$; medium: $M = 3.10$, $SE = 0.11$; small: $M = 5.54$, $SE = 0.11$). Pairwise comparisons on each check measure were statistically significant with Bonferroni correction for family-wise error.

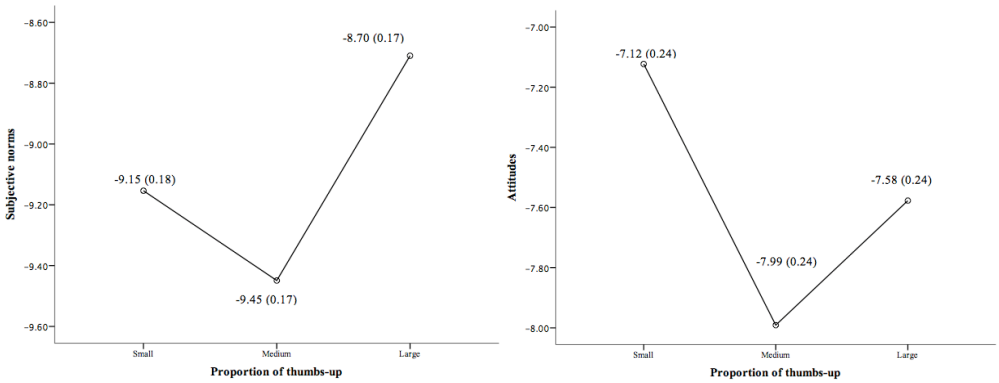
Texting while driving. For texting while driving, view count had a main effect on two view count check measures, $F(2, 711) = 227.08$, $p < .001$, $\eta_p^2 = .39$, and $F(2,$

711) = 250.94, $p < .001$, $\eta_p^2 = .41$. As expected, greater number of views led to greater perception that the PSAs had been watched by a large number of people (high: $M = 5.52$, $SE = 0.11$; medium: $M = 3.33$, $SE = 0.11$; small: $M = 2.16$, $SE = 0.11$) and less perception that the PSAs had been watched by very few people (high: $M = 2.37$, $SE = 0.11$; medium: $M = 4.40$, $SE = 0.11$; small: $M = 5.71$, $SE = 0.11$). Pairwise comparisons on each check measure were statistically significant with Bonferroni correction for family-wise error. For proportion of thumbs-up, it had a main effect on two proportion of thumbs-up check measures, $F(2, 711) = 518.04$, $p < .001$, $\eta_p^2 = .28$, and $F(2, 711) = 151.47$, $p < .001$, $\eta_p^2 = .30$. People exposed to larger proportion of thumbs-up reported greater perception that the PSAs had more thumbs-up (large: $M = 5.47$, $SE = 0.12$; medium: $M = 3.56$, $SE = 0.12$; small: $M = 2.58$, $SE = 0.13$) and less thumbs-down (large: $M = 2.55$, $SE = 0.12$; medium: $M = 2.87$, $SE = 0.12$; small: $M = 5.30$, $SE = 0.12$). Pairwise comparisons on each check measure were statistically significant with Bonferroni correction for family-wise error except that the difference between large and medium condition, $p = ns$, on people's perception that the videos had received more thumbs-down than thumbs-up.

Hypotheses testing. ACOVAs tested the direct effects of view count, proportion of thumbs-up, and health behavior status on three normative measures, attitudes and behavioral intentions separately for each of the three health contexts[6]. Message order was added as a covariate in all analyses.

[6] Prior to testing RQs and hypotheses in each health context, a series of mixed ANCOVAs were performed. In these analyses, the within-subject factor was health context, the between-subject factors were proportion of thumbs-up and view count, and the covariate was message order. The dependent variables were three perceived norms, attitudes, and intentions. The results revealed a marginally significant main

Smoking[7]**.** Proportion of thumbs-up had a main effect on subjective norms, $F(2, 736) = 4.68$, $p = .01$, $\eta_p^2 = .01$, attitudes, $F(2, 736) = 3.24$, $p < .05$, $\eta_p^2 = .01$, and intentions, $F(2, 651) = 8.25$, $p < .001$, $\eta_p^2 = .03$. Consistent with Figure 4.7, trend analysis supported a significant concave upward effect of proportion of thumbs-up on subjective norms, $t = 2.45$, $p < .05$ (linear: $t = 1.81$, $p = .07$), smoking attitudes, $t = 2.18$, $p < .05$ (linear: $t = -1.33$, $p = ns$), and intentions, $t = 3.97$, $p < .001$ ($t = 0.74$, $p = ns$). These results rejected H2.



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effect of proportion of thumbs-up, $F(2, 668) = 2.82$, $p = .06$, $\eta_p^2 = .01$, and a significant effect of view count on intentions, $F(2, 668) = 4.46$, $p < .05$, $\eta_p^2 = .01$. Trend analysis suggested a concave upward relationship between proportion of thumbs-up and intentions, $t = 2.32$, $p < .05$, and a concave downward relationship between view count and intentions, $t = -2.40$, $p < .05$. The linear relationship between view count and intentions approached significance, $t = 1.76$, $p = .08$. Furthermore, health context interacted with proportion of thumbs-up on intentions, $F(3.32, 1108.67) = 3.11$, $p < .05$, $\eta_p^2 = .01$[Greenhouse-Geisser corrected]. The results suggested that proportion of thumbs-up had different effects on intentions across three health contexts. To better understand the influence of message views and proportion of thumbs-up, hypotheses and research questions were explored separately in each health context.

[7] Homogeneity of regression analysis indicated that order interacted with smoking status, $F(5, 651) = 3.07$, $p < .05$, $\eta_p^2 = .02$, the interaction between view count and proportion of thumbs-up, $F(20, 651) = 2.14$, $p < .01$, $\eta_p^2 = .06$, and the three-way interaction among smoking status, proportion of thumbs-up, and view count, $F(20, 651) = 2.32$, $p = .001$, $\eta_p^2 = .07$, for intentions. These interaction terms were kept in the model examining group differences in smoking intentions.

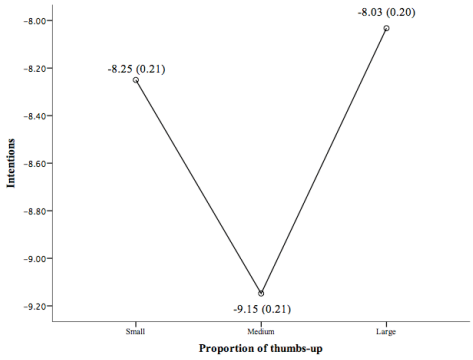


Figure 4.7. Study 2: Influence of proportion of thumbs-up on subjective norms, attitudes, and intentions in the smoking context.

View count had a main effect on intentions, $F(2, 651) = 3.48$, $p < .05$, $\eta_p^2 = .01$. Figure 4.8 showed a clear curvilinear pattern of the influence of view count on intentions. In spite of this, trend analysis found a significant linear effect of view count on intentions, $t = 1.98$, $p < .05$. The quadratic effect only approached significance, $t = -1.72$, $p = .09$.

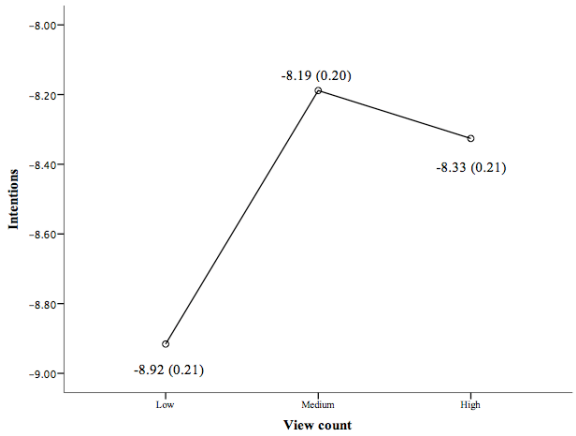


Figure 4.8. Study 2: Influence of view count on intentions in the smoking context.

View count marginally interacted with proportion of thumbs-up to influence intentions, $F(4, 651) = 2.34$, $p = .05$, $\eta_p^2 = .01$. The interaction is displayed in Figure 4.9. Trend analysis suggested that when the proportion of thumbs-up was small, view count had a positive linear relationship with intentions, $t = 3.21$, $p < .01$ (quadratic: t

= -0.87, p = *ns*). When the proportion of thumbs-up was large, view count had a concave downward relationship with intentions, t = -2.10, $p < .05$ (linear: t = 0.47, p = *ns*).

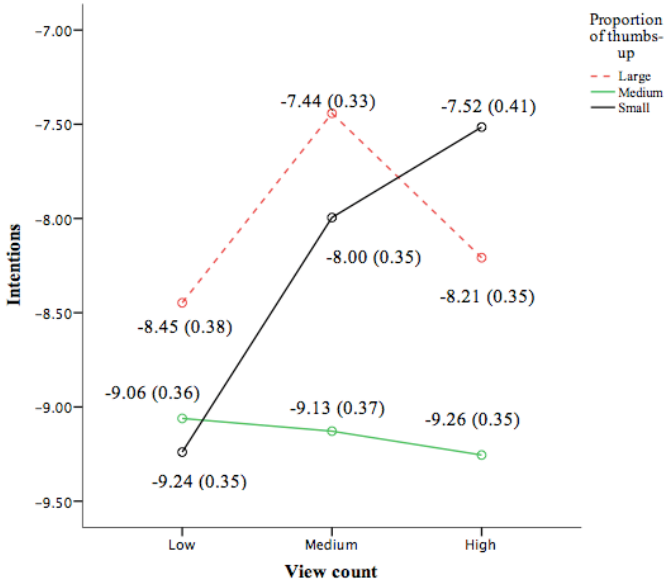


Figure 4.9. Study 2: Interaction between view count and proportion of thumbs-up on intentions in the smoking context.

Ever-smokers reported greater perceived subjective norms, $F(1, 736) = 5.97$, $p < .05$, $\eta_p^2 = .01$, more favorable smoking attitudes, $F(1, 736) = 87.42$, $p < .001$, $\eta_p^2 = .11$, and greater intentions, $F(1, 651) = 88.81$, $p < .001$, $\eta_p^2 = .12$, than never-smokers. Furthermore, proportion of thumbs-up interacted with smoking status on injunctive norms, $F(2, 736) = 3.36$, $p < .05$, $\eta_p^2 = .01$, attitudes, $F(2, 736) = 3.08$, $p < .05$, $\eta_p^2 = .01$, and intentions, $F(2, 651) = 3.34$, $p < .05$, $\eta_p^2 = .01$ (see Figure 4.10). For never-smokers, proportion of thumbs-up had a marginally significant linear effect on injunctive norms, t = -1.68, p = .09, but did not have effects on attitudes or intentions. For ever-smokers, neither linear nor quadratic effect of proportion of thumbs-up on injunctive norms was significant. But the quadratic effect of proportion of thumbs-up

on attitudes was significant, $t = 2.30$, $p < .05$. The linear effect approached significance, $t = -1.82$, $p = .07$. Similar to attitudes, for ever-smokers, proportion of thumbs-up had a concave upward relationship with intentions, $t = 3.68$, $p < .001$.

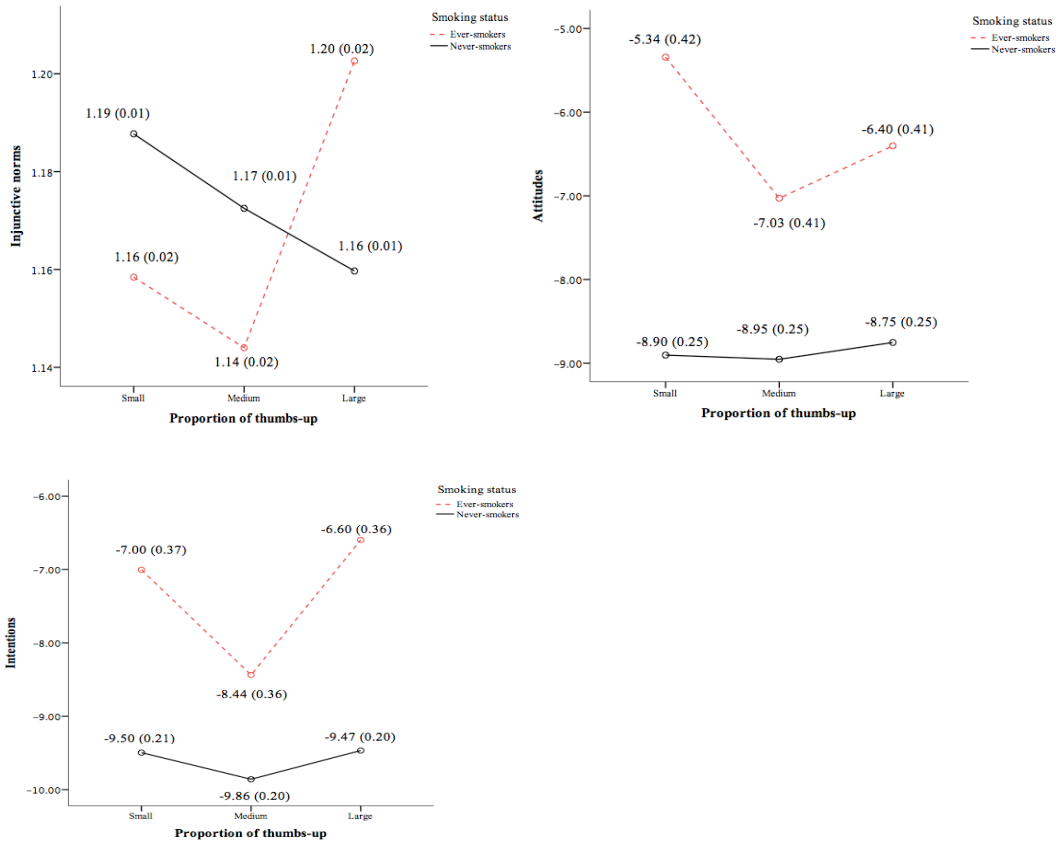


Figure 4.10. Interaction between health behavior status and proportion of thumbs-up on injunctive norms, attitudes, and intentions in the smoking context.

View count significantly interacted with smoking status on intentions, $F(2, 651) = 3.98$, $p < .05$, $\eta_p^2 = .01$. Trend analysis suggested that among ever-smokers, view count had a significant positive linear relationship with intentions, $t = 2.67$, $p < .01$. For never-smokers, neither linear nor quadratic effect of view count on intentions was significant (Figure 4.11).

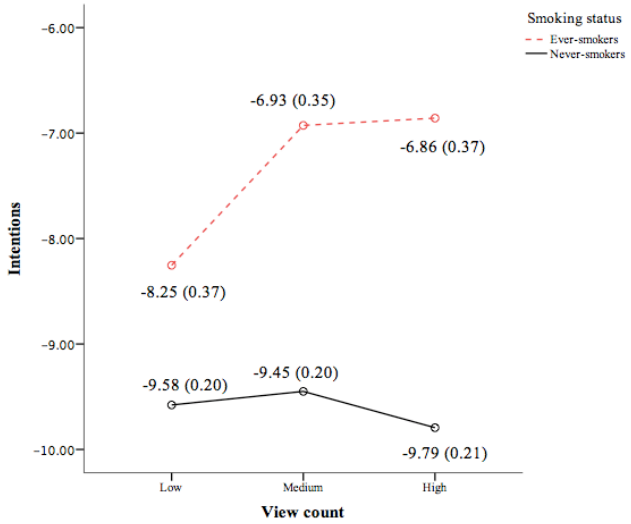


Figure 4.11. Study 2: Interaction between health behavior status and view count on intentions in the smoking context.

Binge drinking. ANCOVAs found that proportion of thumbs-up had a main effect on subjective norms, $F(2, 737) = 3.31$, $p < .05$, $\eta_p^2 = .01$. As it is shown in Figure 4.12, proportion of thumbs-up had a concave upward instead of a linear ($t = -0.60$, $p = ns$) relationship with subjective norms, $t = 2.51$, $p < .05$. H2 was not supported.

View count had a significant main effect on attitudes, $F(2, 737) = 7.59$, $p = .001$, $\eta_p^2 = .02$ (Figure 4.13). Trend analysis supported a significant quadratic effect of view count on attitudes, $t = -2.67$, $p < .01$. The linear effect was also significant, $t = 2.82$, $p < 0.01$, which suggests an increasing trend in the data. Also, view count had a significant main effect on intentions, $F(2, 737) = 3.90$, $p < .05$, $\eta_p^2 = .01$. Trend analysis supported a significant linear ($t = 2.35$, $p < .05$) instead of a curvilinear ($t = -1.49$, $p = ns$) relationship between view count and intentions.

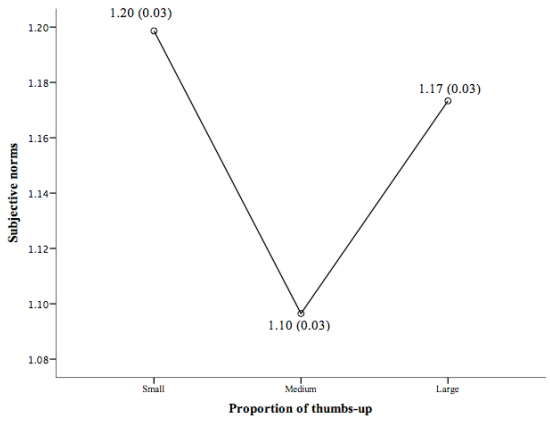


Figure 4.12. Study 2: Influence of proportion of thumbs-up on subjective norms in the binge drinking context.

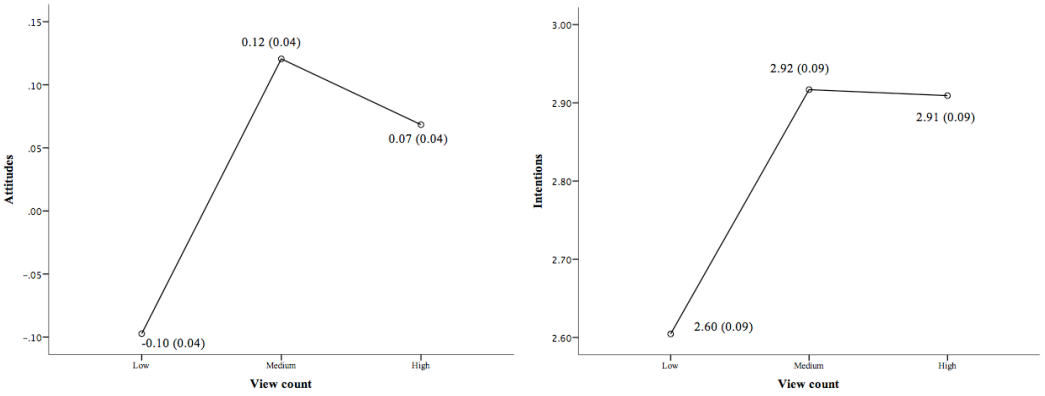


Figure 4.13. Study 2: Influence of view count on attitudes and intentions in the binge drinking context.

In addition to main effects, proportion of thumbs-up significantly interacted with view count on attitudes, $F(4, 737) = 2.82$, $p < .05$, $\eta_p^2 = .01$ and approached significance for intentions, $F(4, 737) = 2.06$, $p = .08$, $\eta_p^2 = .01$. As it is shown in Figure 4.14, the relationship between view count and attitudes approached linearity for messages having a small proportion of thumbs-up, $t = 2.45$, $p < .05$. By contrast, when PSAs had medium proportion of thumbs-up, the quadratic effect of view count was significant, $t = -3.74$, $p < .01$ as well as the linear effect $t = 2.26$, $p < .05$. When

PSAs had a large proportion of thumbs-up, view count did not have effects. Similar pattern of interaction between view count and proportion of thumbs-up was found for intentions. When PSAs had a small proportion of thumbs-up, view count was positively related with intentions, $t = 2.14$, $p < .05$. When proportion of thumbs-up was medium, view count had a significant concave downward relationship with intentions, $t = -2.49$, $p < .05$ (linear: $t = 1.87$, $p = .06$). When proportion of thumbs-up was high, neither quadratic nor linear effect of view count on intentions was significant.

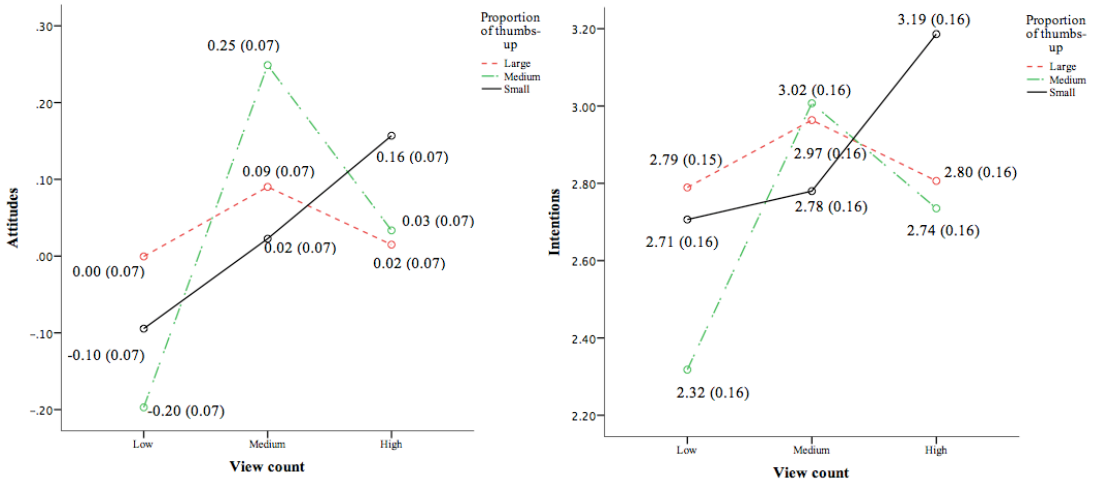


Figure 4.14. Study 2: Interaction between view count and proportion of thumbs-up on attitudes and intentions in the binge drinking context.

Current binge drinkers reported greater descriptive norms, $F(1, 737) = 32.98$, $p < .001$, $\eta_p^2 = .04$, greater injunctive norms, $F(1, 737) = 39.59$, $p < .001$, $\eta_p^2 = .05$, as well as subjective norms, $F(1, 737) = 200.11$, $p < .001$, $\eta_p^2 = .21$, more favorable binge drinking attitudes, $F(1, 737) = 230.00$, $p < .001$, $\eta_p^2 = .24$, and greater intentions, $F(1, 737) = 621.83$, $p < .001$, $\eta_p^2 = .46$. View count interacted with binge drinking status on attitudes, $F(2, 737) = 3.47$, $p < .05$, $\eta_p^2 = .01$, and on intentions $F(2, 737) = 3.17$, $p < .05$, $\eta_p^2 = .01$. As it is shown in Figure 4.15, for current binge

drinkers, view count had a significant linear effect on attitudes, $t = 3.65$, $p < .001$, and intentions, $t = 3.28$, $p < .01$. However, for non-current binge drinkers, view count had a quadratic ($t = -2.18$, $p < .05$) effect on attitudes and was not related with intentions.

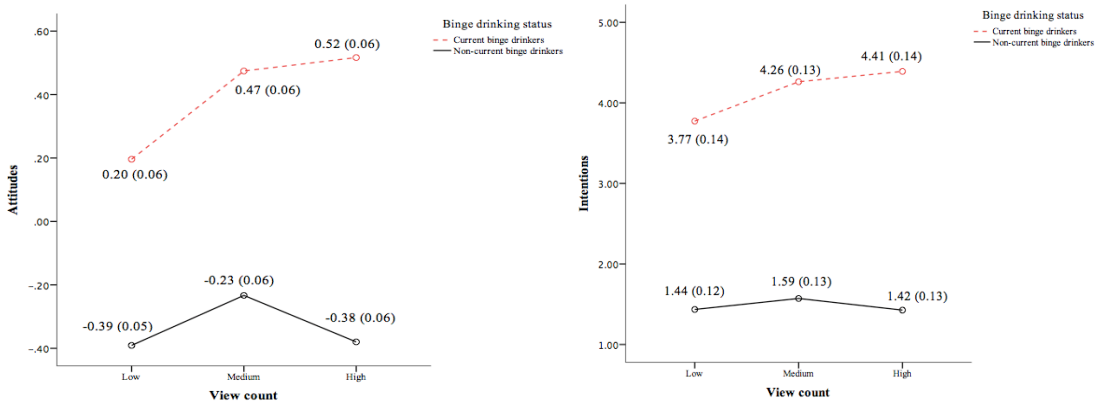


Figure 4.15. Study 2: Interaction between health behavior status and view count on attitudes and intentions in the binge drinking context.

***Texting while driving*[8].** Proportion of thumbs-up approached significance for intentions, $F(2, 694) = 2.55$, $p = .08$, $\eta_p^2 = .01$. As it is shown in Figure 4.16, proportion of thumbs-up was negatively related with texting while driving intentions, $t = -2.23$, $p < .05$. H2 was partially supported.

Proportion of thumbs-up interacted with view count on subjective norms, $F(4, 690) = 2.98$, $p < .05$, $\eta_p^2 = .02$. When the proportion of thumbs-up was small, view count did not have either a linear ($t = 0.93$, $p = ns$) or quadratic ($t = 1.23$, $p = ns$) effect on subjective norms. When the proportion of thumbs-up was medium, view

[8] Examination of homogeneity of regression found that order interacted with view count for descriptive norms, $F(10, 610) = 1.93$, $p < .05$, $\eta_p^2 = .03$. Order interacted with the three-way interaction among texting while driving status, view count, and proportion of thumbs-up for injunctive norms, $F(20, 610) = 1.63$, $p < .05$, $\eta_p^2 = .05$. Order interacted with texting while driving status for subjective norms, $F(5, 610) = 2.41$, $p < .05$, $\eta_p^2 = .02$. Order interacted with proportion of thumbs-up for attitudes, $F(10, 610) = 1.89$, $p < .05$, $\eta_p^2 = .03$. These interaction terms were kept in the ANCOVA models.

count had a positive linear relationship with subjective norms, $t = 2.53$, $p < .05$. When the proportion of thumbs-up was large, view count had a concave downward effect on subjective norms, $t = -2.11$, $p < .05$. Such interaction is displayed in Figure 4.17.

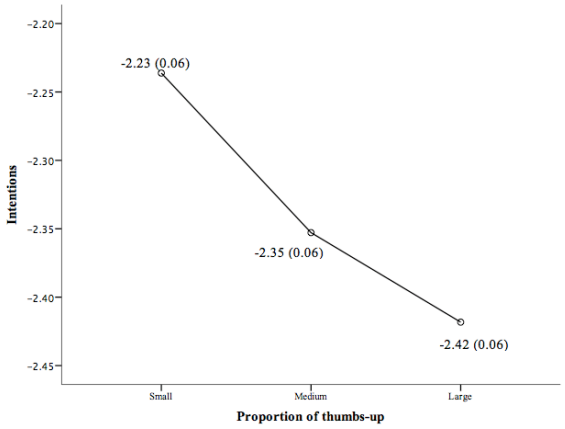


Figure 4.16. Study 2: Influence of proportion of thumbs-up on intentions in the texting while driving context.

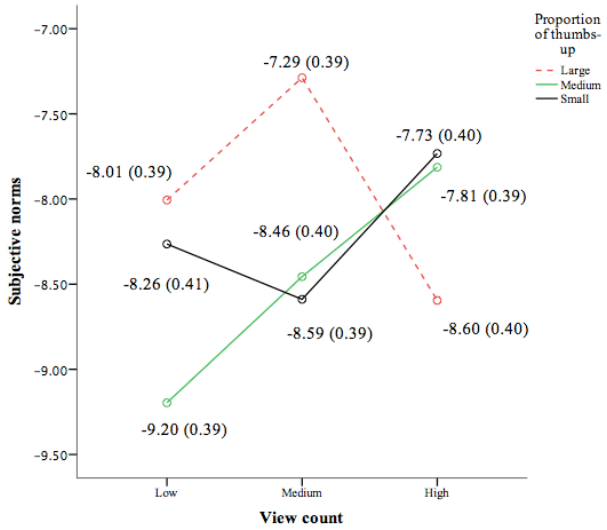
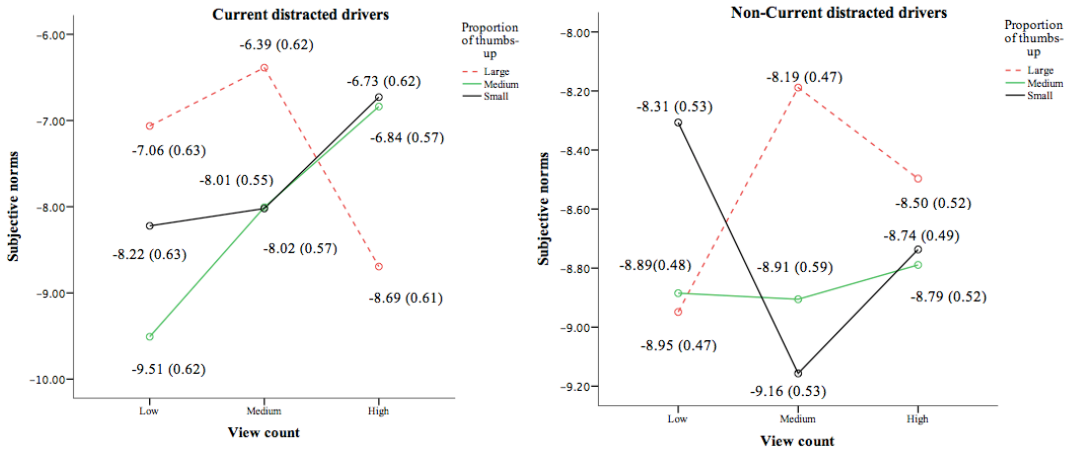


Figure 4.17. Study 2: Interaction between view count and proportion of thumbs-up on subjective norms in the texting while driving context.

Current distracted drivers reported higher descriptive norms, $F(1, 685) = 44.63$, $p < .001$, $\eta_p^2 = .06$, injunctive norms, $F(1, 610) = 7.75$, $p < .01$, $\eta_p^2 = .01$,

subjective norms, $F(1, 690) = 14.10$, $p < .001$, $\eta_p^2 = .02$, more favorable attitudes, $F(1, 685) = 14.34$, $p < .001$, $\eta_p^2 = .02$, and greater intentions, $F(1, 694) = 197.37$, $p < .001$, $\eta_p^2 = .22$. The interaction among texting while driving status, proportion of thumbs-up, and view count was significant on subjective norms, $F(4, 690) = 2.67$, $p < .05$, $\eta_p^2 = .02$ and attitudes, $F(4, 685) = 2.64$, $p < .05$, $\eta_p^2 = .02$. Although Figure 4.18 indicates that view count has different relationships with subjective norms and attitudes at different levels of proportion of thumbs-up for both current and non-current distracted drivers, view count by proportion of thumbs-up interaction was significant only among current distracted drivers, $F(4, 690) = 4.33$, $p < .01$, $\eta_p^2 = .02$ (subjective norms) and $F(4, 685) = 3.40$, $p < .01$, $\eta_p^2 = .02$ (attitudes). When the proportion of thumbs-up was small, view count had a concave upward relationship with attitudes, $t = 2.25$, $p < .05$. When the proportion of thumbs-up was medium, view count was positively related with subjective norms, $t = 3.18$, $p < .01$, and attitudes, $t = 2.01$, $p < .05$. When the proportion of thumbs-up was large, the quadratic and linear effect of view count on subjective norms approached significance (quadratic: $t = -1.96$, $p = .05$; linear: $t = -1.86$, $p = .06$).



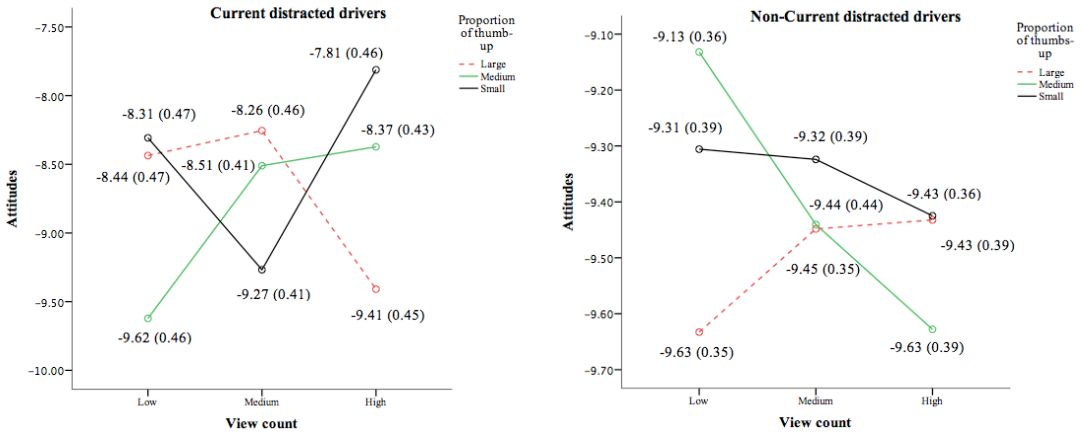


Figure 4.18. Study 2: Interaction between health behavior status, view count, and proportion of thumbs-up on subjective norms and attitudes in the texting while driving context.

Summary. Through the above analyses, it appears that proportion of thumbs-up and view count could independently and jointly influence subjective norms, attitudes, and intentions and their effects could be curvilinear. Furthermore, people's health behavior status also influenced the effects of view count and proportion of thumbs-up on people's responses to health promotion messages. Being the same as study 1, to further understand how aggregate ratings, view count, and health behavior status might be related to each outcome variables and also examine whether norms were mediating mechanisms in the influence process, multi-group SEM was executed in each health context. Given the findings from ANCOVAs, the structural models included quadratic term of view count and proportion of thumbs-up and the linear by curvilinear interaction between view count and proportion of thumbs-up.

Mediation testing. SEM was separately run for each health issue. Exogenous variables in all models included five order dummy variables, proportion of thumbs-up, view count, the interaction between proportion of thumbs-up and view count, the

square of proportion of thumbs-up, the square of view count, the interaction between view count and the square of proportion of thumbs-up and the interaction between proportion of thumbs-up and square of view count. For all the nonlinear terms, variables were first centered before forming products. All the exogenous variables were specified as latent variables with a single indicator and the indicator's error variance was fixed to zero. Exogenous variables were allowed to covary and were allowed to influence all the endogenous variables in the model. Endogenous variables included three normative perceptions, attitudes, and behavioral intentions. The three normative perceptions were allowed to covary and to influence attitudes and behavioral intentions. These endogenous variables were all measured by multiple items as detailed early. According to TRA and TPB, a path from attitudes to intentions was added to each model. For the endogenous variables, one indicator loading was fixed to one. As mentioned previously, multi-group modeling was employed to examine the mediation effects across people who are or are not engaged in each health behavior. Multivariate normality tests found that variables in the model for each health context failed to achieve multivariate normality, $p < .001$ (Small's test). MLR was employed for all analyses. View count was logarithm transformed to increase variable normality and facilitate model convergence in M*plus*.

Measurement model. Similar to study 1, measurement model was first examined separately for people engaged or not engaged in a health-risk behavior in each health context.

Smoking. In the smoking context, measurement model for ever-smokers resulted in a good fit, χ^2 (281) = 482.32, $p < .001$, RMSEA = .06, 90% CI = [.05, .07],

CFI = .95, SRMR = .03. So did the model for never-smokers, χ^2 (281) = 617.98, p < .001, RMSEA = .05, 90% CI = [.04, .05], CFI = .94, SRMR = .02. For both models, however, modification indices suggested a large improvement of model fit by allowing the error of intention 3 and intention 4 to covary and the error of descriptive norms 3 and descriptive norms 4 to covary. Given the wordings of intention 3 and intention 4 were similar and the wordings of descriptive norms 3 and descriptive norms 4 were similar, the error of intention 3 and intention 4 and the error of descriptive norms 3 and 4 was allowed to covary, respectively. The revised model generated a better fit for both groups, χ^2 (279) = 403.72, p < .001, RMSEA = .05, 90% CI = [.04, .06], CFI = .97, SRMR = .03 for ever-smokers, and χ^2 (279) = 460.71, p < .001, RMSEA = .03, 90% CI = [.03, .04], CFI = .97, SRMR = .02 for never-smokers. Then, a configural model with all parameters allowed to differ across groups was estimated and produced, χ^2 (558) = 865.60, p < .001, RMSEA = .04, 90% CI = [.03, .04], CFI = .97, SRMR = .02. Then, factor loadings were constrained to be equal across the two groups. The constrained model produced, χ^2 (571) = 867.99, p < .001, RMSEA = .04, 90% CI = [.03, .04], CFI = .97, SRMR = .02. This model did not differ from the configural model, p = *ns*.

Binge drinking. In the binge drinking context, separate examination of measurement model in each group produced, χ^2 (340) = 785.59, p < .001, RMSEA = .06, 90% CI = [.06, .07], CFI = .94, SRMR = .03 for current binge drinkers and χ^2 (340) = 555.19, p < .001, RMSEA = .04, 90% CI = [.03, .05], CFI = .98, SRMR = .02 for non-current binge drinkers. Modification indices suggested to add a covariance between the error term of attitude 3 and attitude 4. The revised model produced, χ^2

(339) = 593.56, $p < .001$, RMSEA = .05, 90% CI = [.04, .05], CFI = .97, SRMR = .03 for current binge drinkers and χ^2 (339) = 403.31, $p < .001$, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .02 for non-current binge drinkers. Then, a configural model with all parameters allowed to differ across groups was estimated and produced, χ^2 (678) = 1001.447, $p < .001$, RMSEA = .04, 90% CI = [.03, .04], CFI = .98, SRMR = .03. Then, factor loadings were constrained to be equal across the two groups. The constrained model generated, χ^2 (693) = 1020.4618, $p < .001$, RMSEA = .04, 90% CI = [.03, .04], CFI = .98, SRMR = .03. The model did not differ from the configural model, $p = ns$.

Texting while driving. In the texting while driving context, separate examination of measurement model in each group produced, χ^2 (281) = 564.88, $p < .001$, RMSEA = .06, 90% CI = [.05, .07], CFI = .94, SRMR = .04 for current distracted drivers and χ^2 (281) = 552.58, $p < .001$, RMSEA = .05, 90% CI = [.04, .05], CFI = .96, SRMR = .02 for non-current distracted drivers. Modification indices suggested a large model improvement by allowing error of intention 3 and intention 4 to covary and error of intention 3 and intention 4 to covary. Such advices made sense given the wordings of these items and were implemented. The revised models generated, χ^2 (279) = 303.88, $p < .001$, RMSEA = .02, 90% CI = [.00, .03], CFI = 1.00, SRMR = .03 for current distracted drivers and χ^2 (279) = 333.58, $p < .05$, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .02 for non-current distracted drivers. Then, a configural model with all parameters allowed to differ across groups was estimated and produced, χ^2 (558) = 638.40, $p < .05$, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .02. Then, factor loadings were constrained

to be equal across the two groups. The constrained model resulted, χ^2 (571) = 658.04, $p < .001$, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .03. This model did not differ from the configural model, $p = ns$.

Structural model. After examining the measurement model, structural model was examined separately for each health behavior.

Smoking. Unconstrained multi-group model produced, χ^2 (571) = 867.99, $p <$ .001, RMSEA = .04, 90% CI = [.03, .04], CFI = .97, SRMR = .02. Constrained model produced χ^2 (638) = 980.97, $p < .001$, RMSEA = .04, 90% CI = [.03, .04], CFI = .97, SRMR = .05. The two models were different, $p < .01$. Modification indices suggested to release the path from attitudes to intentions. Revised model produced χ^2 (637) = 940.00, $p < .001$, RMSEA = .04, 90% CI = [.03, .04], CFI = .97, SRMR = .04, which was not different from the unconstrained model.

According to Figure 4.19 and Table 4.15, greater proportion of thumbs-up led to more perception of smoking prevalence in the society, $b = 0.81$, $p < .01$. The square of proportion of thumbs-up approached significance for subjective norms, $b =$ 2.38, $p = .06$, indicating a concave upward relationship between proportion of thumbs-up of and subjective norms. Also, intentions were predicted by the square of proportion of thumbs-up ($b = 1.97$, $p < .05$). The positive sign of the path coefficient indicated that the relationship between proportion of thumbs-up and intentions was concave upward. These results were inconsistent with H2.

The interaction between proportion of thumbs-up and the square of view count significantly predicted descriptive norms, $b = -0.21$, $p < .01$. Simple slopes analysis revealed view count had a concave upward relationship with descriptive

norms at low level of proportion of thumbs-up, $b = 0.11$ $p < .01$. The interaction between view count and the square of proportion of thumbs-up approached significance for attitudes, $b = 1.38$, $p = .09$. Simple slope analyses revealed that the square of proportion of thumb-up was marginally related to attitudes at high level of view count, $b = 4.05$, $p = .08$. Higher levels of descriptive norms ($b = -0.14$, $p = .07$) and lower levels of subjective norms ($b = 0.27$, $p < .001$) predicted less favorable drinking attitudes. Greater subjective norms ($b = 0.51$, $p < .001$) predicted greater intentions. Attitudes predicted intentions among ever-smokers, $b = 0.52$, $p < .001$ but not among never-smokers, $b = 0.04$, $p = ns$.

As for the mediation effects, the indirect effects of the square of proportion of thumbs-up on attitudes via subjective norms was significant, $b = 0.65$, BC 95% CI = [0.02, 1.64]. Total indirect effects of the square of proportion of thumbs-up on attitudes was significant, $b = 0.73$, BC 95 CI = [0.05, 1.75]. Descriptive norms mediated the influence of proportion of thumbs-up on attitudes, $b = -0.11$, BC 95% CI = [-0.32, -0.01]. Descriptive norms mediated the influence of the interaction between proportion of thumbs-up and view count squared on attitudes, $b = 0.03$, BC 95% CI = [0.003, 0.09]. For ever-smokers, the square of proportion of thumbs-up indirectly influence intentions via subjective norms and attitudes, $b = 0.33$, BC 95% CI = [0.02, 0.85]. However, this indirect path was not significant for never-smokers, $b = 0.03$, BC 95% CI = [-0.04, 0.15]. For ever-smokers, the influence of the interaction between the square of view count and proportion of thumbs-up on intentions was mediated by descriptive norms and attitudes, $b = 0.02$, BC 95% CI = [0.002, 0.05].

This indirect path was not significant for never-smokers, $b = 0.001$, BC 95% CI = [-0.003, 0.01]. These findings provided partial support for H4.

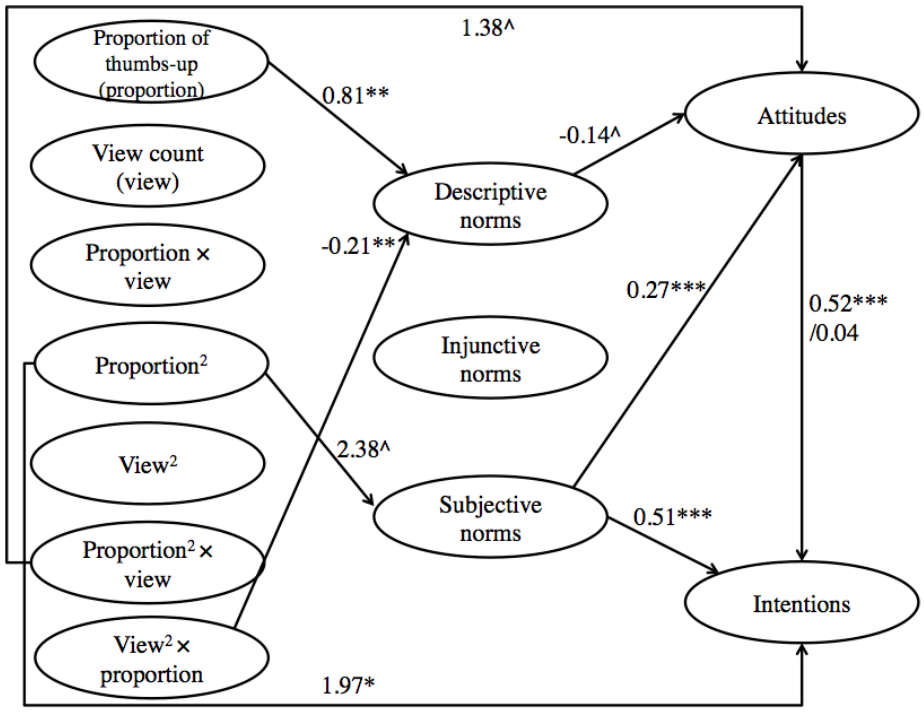


Figure 4.19. Study 2: Structural model in the smoking context.
Note. Only significant paths related to the hypotheses and research questions are shown. Numbers shown on the left of the slash are for ever-smokers and on the right of the slash are for never-smokers.
^$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4.15

Study 2: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediated Model in the Smoking Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error (*SE*)
Descriptive norms ON		
Proportion	0.81**	0.30
View	-0.01	0.05
Proportion^2	0.07	0.85
View^2	0.03	0.02

Proportion × view	0.12	0.11
View^2 × proportion	-0.21**	0.08
Proportion^2 × view	0.16	0.45
Order 1	-0.04	0.20
Order 2	-0.08	0.20
Order 3	-0.23	0.21
Order 4	0.15	0.21
Order 5	0.19	0.20
(R^2 = .02*/R^2 = .02*)		
Injunctive norms ON		
Proportion	0.03	0.03
View	-0.00	0.01
Proportion^2	0.08	0.09
View^2	0.00	0.00
Proportion × view	-0.01	0.01
View^2 × proportion	-0.01	0.01
Proportion^2 × view	0.02	0.05
Order 1	0.02	0.02
Order 2	0.02	0.02
Order 3	0.00	0.02
Order 4	0.01	0.02
Order 5	0.01	0.02
(R^2 = .01/R^2 = .01)		
Subjective norms ON		
Proportion	0.16	0.61
View	-0.01	0.07
Proportion^2	2.38^	1.24
View^2	-0.05	0.04
Proportion × view	-0.13	0.16
View^2 × proportion	0.06	0.14
Proportion^2 × view	-0.08	0.61
Order 1	0.14	0.27
Order 2	0.32	0.30
Order 3	-0.06	0.27
Order 4	0.44	0.32
Order 5	0.20	0.30
(R^2 = .01/R^2 = .02)		
Attitudes ON		
Proportion	0.50	0.57
View	-0.10	0.10
Proportion^2	0.83	1.52
View^2	0.02	0.04
Proportion × view	0.07	0.19
View^2 × proportion	-0.16	0.14
Proportion^2 × view	1.38^	0.82
Descriptive norms	-0.14^	0.08

Injunctive norms	1.24	0.81
Subjective norms	0.27***	0.07
Order 1	1.18**	0.35
Order 2	1.12**	0.35
Order 3	0.59^	0.30
Order 4	0.16	0.31
Order 5	-0.02	0.26
(R^2 = .06**/R^2 = .13***)		
Intentions ON		
Proportion	-0.02	0.52
View	-0.06	0.06
Proportion^2	1.97*	0.95
View^2	-0.03	0.03
Proportion × view	-0.06	0.10
View^2 × proportion	0.00	0.11
Proportion^2 × view	0.55	0.47
Attitudes	0.52***/0.04	0.08/0.06
Descriptive norms	0.04	0.05
Injunctive norms	-0.05	0.56
Subjective norms	0.51***	0.09
Order 1	-0.07	0.21
Order 2	0.33	0.22
Order 3	0.22	0.21
Order 4	0.31	0.20
Order 5	0.14	0.17
(R^2 = .41***/R^2 = .38***)		

Note. Numbers shown on the left of the slash are for ever-smokers and on the right of the slash are for never-smokers. Proportion refers to the proportion of thumbs-up. View refers to view count.
^p < .10. *p < .05. **p < .01. ***p < .001.

Binge drinking. Unconstrained multi-group model produced: χ^2 (693) = 1020.46, p < .001, RMSEA = .04, 90% CI = [.03, .04], CFI = .98, SRMR = .03. Constrained model produced χ^2 (760) = 1087.09, p < .001, RMSEA = .03, 90% CI = [.03, .04], CFI = .98, SRMR = .05. The two models did not differ from each other, p = *ns*.

According to Figure 4.20 and Table 4.16, the square of proportion of thumbs-up predicted subjective norms, b = 0.64, p < .01. The finding rejected H2. The square

of view count predicted drinking attitudes, b = -0.03, p < .01, and the relationship was concave downward. The interaction between proportion of thumbs-up and view count achieved significance for injunctive norms, b = 0.02, p = .07. When PSAs had a small proportion of thumbs-up, increase in view count was associated with lower perceived injunctive norms, b = -0.01, p = .05. View count marginally interacted with proportion of thumbs-up to influence attitudes, b = -0.07, p = .097. Only at low levels of proportion of thumbs-up, increase in view count was associated with more favorable binge drinking attitudes, b = 0.05, p < .05. Injunctive norms (b = 0.59, p < .001) and subjective norms (b = 0.41, p < .001) significantly predicted attitudes. Descriptive norms marginally predicted attitudes (b = -0.03, p = .08). Descriptive norms (b = 0.06, p < .05) and subjective norms (b = 0.67, p < .001) significantly predicted intentions. Attitudes were a positive predictor of intentions, b = 0.81, p < .001.

As for the mediation effects, subjective norms mediated the influence of the square of proportion of thumbs-up on attitudes, b = 0.26, BC 95% CI = [0.09, 0.48]. Total indirect effects of square of proportion of thumbs-up on attitudes were also significant, b = 0.28, BC 95% CI = [0.08, 0.53]. Subjective norms mediated the influence of the square of proportion of thumbs-up on intentions, b = 0.43, BC 95% CI = [0.15, 0.85]. The square of proportion of thumbs-up also indirectly influenced intentions via subjective norms and attitudes, b = 0.21, BC 95% CI = [0.08, 0.42]. These findings provided partial support for H4. Furthermore, the interaction between proportion of thumbs-up and view count on intentions was mediated by injunctive norms and attitudes, b = 0.01, BC 95% CI = [0.001, 0.03].

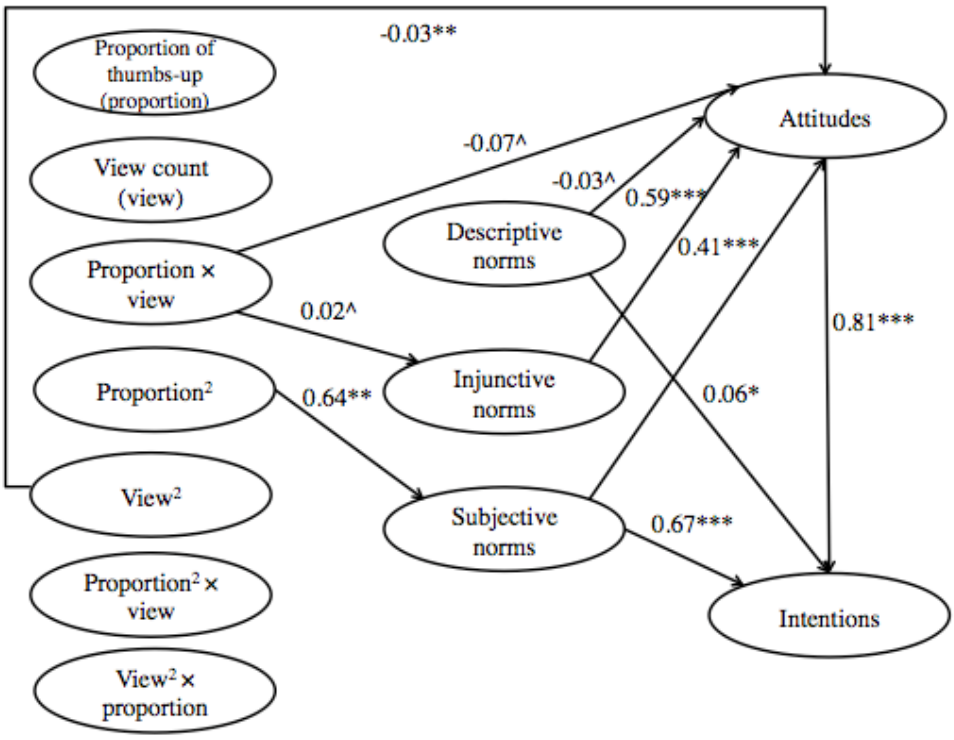


Figure 4.20. Study 2: Structural model in the binge drinking context.
Note. Only significant paths related to the hypotheses and research questions are shown.
^$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4.16

Study 2: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediated Model in the Binge Drinking Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error (*SE*)
Descriptive norms ON		
Proportion	0.00	0.34
View	0.01	0.06
Proportion^2	0.92	0.88
View^2	-0.01	0.03
Proportion × view	0.05	0.11
View^2 × proportion	-0.07	0.08
Proportion^2 × view	-0.02	0.48
Order 1	-0.08	0.20

Order 2	0.02	0.21
Order 3	-0.16	0.20
Order 4	-0.05	0.20
Order 5	-0.18	0.21
(R^2 = .01/R^2 = .01)		
Injunctive norms ON		
Proportion	0.02	0.04
View	-0.01	0.01
Proportion^2	0.09	0.09
View^2	0.00	0.00
Proportion × view	0.02^	0.01
View^2 × proportion	-0.01	0.01
Proportion^2 × view	0.03	0.05
Order 1	0.02	0.02
Order 2	-0.01	0.02
Order 3	0.20	0.02
Order 4	0.00	0.02
Order 5	-0.04	0.02
(R^2 = .03*/R^2 = .02*)		
Subjective norms ON		
Proportion	-0.14	0.09
View	0.00	0.01
Proportion^2	0.64**	0.22
View^2	-0.00	0.01
Proportion × view	0.03	0.03
View^2 × proportion	0.03	0.02
Proportion^2 × view	-0.11	0.12
Order 1	0.03	0.06
Order 2	0.00	0.05
Order 3	-0.00	0.05
Order 4	0.06	0.05
Order 5	-0.02	0.06
(R^2 = .02^/R^2 = .03*)		
Attitudes ON		
Proportion	0.12	0.14
View	0.03	0.02
Proportion^2	-0.35	0.33
View^2	-0.03**	0.01
Proportion × view	-0.07^	0.04
View^2 × proportion	-0.03	0.03
Proportion^2 × view	0.03	0.18
Descriptive norms	-0.03^	0.17
Injunctive norms	0.59***	0.02
Subjective norms	0.41***	0.07
Order 1	0.28***	0.08
Order 2	0.04	0.07

Order 3	0.37***	0.08
Order 4	0.21**	0.07
Order 5	0.18*	0.07
(R^2 = .14***/R^2 = .18***)		
Intentions ON		
Proportion	0.19	0.25
View	0.01	0.03
Proportion^2	0.35	0.56
View^2	-0.01	0.02
Proportion × view	-0.08	0.06
View^2 × proportion	-0.04	0.06
Proportion^2 × view	0.10	0.29
Attitudes	0.81***	0.25
Descriptive norms	0.06*	0.03
Injunctive norms	0.30	0.15
Subjective norms	0.67***	0.11
Order 1	-0.11	0.13
Order 2	0.03	0.11
Order 3	0.00	0.12
Order 4	0.08	0.13
Order 5	0.09	0.13
(R^2 = .23***/R^2 = .41***)		

Note. Numbers shown on the left of the slash are for current binge drinkers and on the right of the slash are for non-current binge drinkers. Proportion refers to the proportion of thumbs-up. View refers to view count.
^p < .10. *p < .05. **p < .01. ***p < .001.

Texing while driving. Unconstrained multi-group model produced: χ^2 (571) = 658.04, p < .01, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .03. Constrained model produced χ^2 (638) = 748.21, p < .001, RMSEA = .02, 90% CI = [.01, .03], CFI = .99, SRMR = .05. The two models were not different, p = *ns.*

According to Figure 4.21 and Table 4.17, the proportion of thumbs-up marginally predicted subjective norms, b = 1.43, p = .05. Proportion of thumbs-up predicted intentions b = -0.40, p < .05 such that increase in the proportion of thumbs-up led to weaker texting while driving intentions, which provided partial support for H2. View count marginally predicted subjective norms, b = 0.18, p = .08. The

interaction between proportion of thumbs-up and the square of view count significantly predicted descriptive norms, b = -0.17, p < .05. Simple slope analyses suggested that only when PSAs had a small proportion of thumbs-up, view count had a concave upward relationship with descriptive norms although the relationship only approached significance, b = .07, p = .09. The interaction between proportion of thumbs-up and the square of view count marginally predicted subjective norms, b = -0.34, p = .05. However, simple effect analysis did not find a curvilinear relationship between view count and subjective norms at any level of proportion of thumbs-up. The interaction between view count and the square of proportion of thumbs-up predicted intentions b = 0.50, p < .05. When PSAs had high view count, the association between proportion of thumbs-up and intentions was concave upward, b = 1.45, p < .05. Subjective norms positively predicted attitudes, b = 0.30, p < .001. Descriptive norms predicted intentions, b = 0.06, p < .001. So did subjective norms, b = 0.10, p < .001, and attitudes, b = 0.10, p < .001.

As for the mediation effects, subjective norms mediated the influence of proportion of thumbs-up on attitudes, b = 0.43, BC 95% CI = [0.04, 0.95] and the influence of proportion of thumbs-up on intentions, b = 0.14, BC 95% CI = [0.01, 0.30]. The influence of proportion of thumbs-up on intentions via subjective norms and attitudes was significant, b = 0.04, BC 95% CI = [0.01, 0.10]. These findings provided partial support for H4. The influence of the interaction between proportion of thumbs-up and square of view count on attitudes via subjective norms was significant for attitudes, b = -0.10, BC 95% CI = [-0.23, -0.01], and for intentions, b = -0.03, BC 95% CI = [-0.07, -0.001]. The influence of the interaction between

proportion of thumbs-up and square of view count on intentions via descriptive norms was significant, *b* = -0.01, BC 95% CI = [-0.03, -0.001]. The influence of the interaction between proportion of thumbs-up and square of view count on intentions via subjective norms and attitudes was significant, *b* = -0.01, BC 95% CI = [-0.03, -0.002]. The total indirect effects of the interaction between proportion of thumbs-up and square of view count were significant for intentions, *b* = -0.06, BC 95% CI = [-0.11, -0.01].

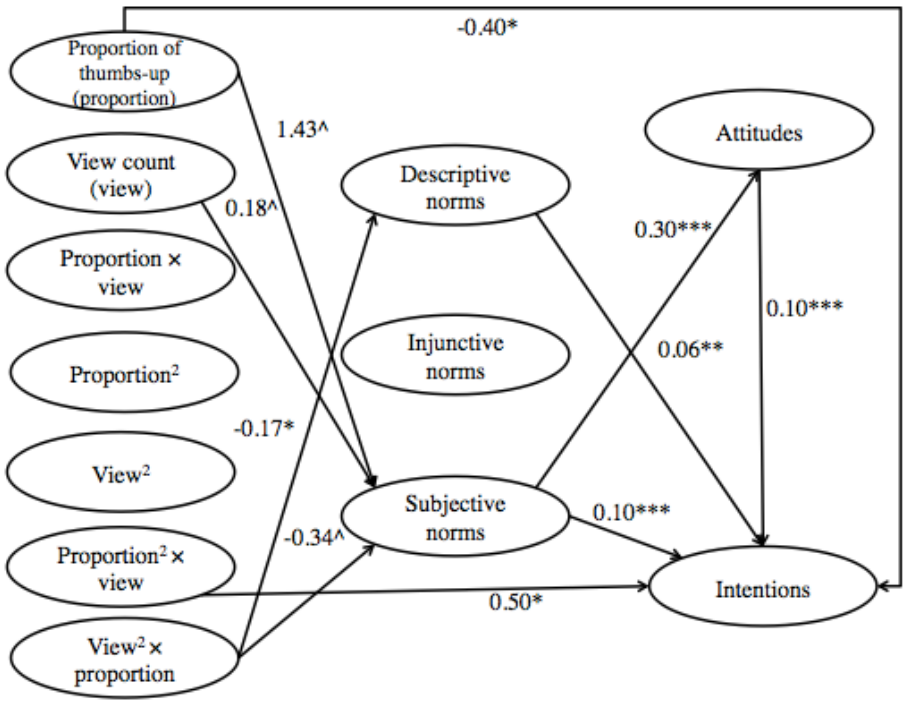


Figure 4.21. Study 2: Structural model in the texting while driving context.
Note. Only significant paths related to the hypotheses and research questions are shown.
^$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4.17

Study 2: Unstandardized Parameter Estimates and Standard Errors for the Norms-Mediated Model in the Texting While Driving Context

Path	Unstandardized path coefficient (*b*)	Unstandardized path coefficient standard error

		(*SE*)
Descriptive norms ON		
Proportion	0.43	0.34
View	-0.01	0.05
Proportion^2	-0.76	0.85
View^2	0.00	0.02
Proportion × view	-0.01	0.11
View^2 × proportion	-0.17*	0.08
Proportion^2 × view	0.01	0.46
Order 1	-0.26	0.21
Order 2	-0.02	0.20
Order 3	0.05	0.20
Order 4	0.05	0.19
Order 5	0.00	0.18
(R^2 = .02/R^2 = .01)		
Injunctive norms ON		
Proportion	0.04	0.08
View	-0.01	0.01
Proportion^2	0.24	0.22
View^2	0.01	0.01
Proportion × view	-0.02	0.03
View^2 × proportion	-0.02	0.02
Proportion^2 × view	0.10	0.12
Order 1	-0.08	0.05
Order 2	-0.03	0.05
Order 3	0.01	0.05
Order 4	-0.01	0.05
Order 5	0.03	0.05
(R^2 = .02/R^2 = .02)		
Subjective norms ON		
Proportion	1.43^	0.73
View	0.18^	0.11
Proportion^2	1.84	1.86
View^2	-0.02	0.05
Proportion × view	-0.03	0.24
View^2 × proportion	-0.34^	0.18
Proportion^2 × view	-1.33	0.98
Order 1	-0.38	0.41
Order 2	0.56	0.51
Order 3	-0.26	0.41
Order 4	-0.04	0.41
Order 5	0.12	0.41
(R^2 = .02^/R^2 = .02^)		
Attitudes ON		
Proportion	-0.12	0.49
View	-0.06	0.08

Proportion^2	-0.64	1.25
View^2	-0.00	0.04
Proportion × view	0.00	0.15
View^2 × proportion	-0.05	0.12
Proportion^2 × view	0.41	0.71
Descriptive norms	-0.08	0.25
Injunctive norms	0.37	0.06
Subjective norms	0.30***	0.05
Order 1	0.32	0.24
Order 2	0.40	0.29
Order 3	0.57	0.25
Order 4	0.34*	0.23
Order 5	0.41	0.29
(R^2 = .20***/R^2 = .22***)		
Intentions ON		
Proportion	-0.40*	0.16
View	-0.04	0.03
Proportion^2	0.28	0.40
View^2	-0.00	0.01
Proportion × view	0.02	0.05
View^2 × proportion	0.06	0.04
Proportion^2 × view	0.50*	0.22
Attitudes	0.10***	0.09
Descriptive norms	0.06**	0.02
Injunctive norms	-0.05	0.02
Subjective norms	0.10***	0.02
Order 1	0.07	0.08
Order 2	-0.01	0.09
Order 3	0.02	0.08
Order 4	0.09	0.08
Order 5	0.19^	0.10
(R^2 = .30***/R^2 = .36***)		

Note. Numbers shown on the left of the slash are for current distracted drivers and on the right of the slash are for non-current distracted drivers. Proportion refers to the proportion of thumbs-up. View refers to view count.
^p < .10. *p < .05. **p < .01. ***p < .001.

Discussion

Main study 2 examined H2, H4, H5, RQ1 and RQ4. H2 predicts that the proportion of positive thumbs-up is negatively related to people's favorable evaluation of a problem behavior. Findings from both ANCOVAs and SEMs across three health contexts provided limited support for H2. Only in the texting while

driving context, proportion of thumbs-up had a negative linear effect on people's texting while driving intentions. In most cases, it was found a concave upward relationship between proportion of thumbs-up and the perceptual outcomes. To explain this curvilinear effect, it is important to consider that aggregate ratings were ambiguous. For example, large proportion of thumbs-up for a video could be interpreted either as endorsement for the video or endorsement for the behavior depicted in the video. As indicated early, when people felt uncertain, they would look for other information to help them formulate opinions. Because the health promotion messages used in this study all highlight a problem behavior and the three health-risk behaviors are very prevalent among college students, potentially people in both small and large proportion of thumbs-up conditions interpreted the rating information as being in favor of the health risk behaviors. Hence, they provide higher estimates of norms about the behaviors than those in the medium proportion of thumbs-up condition, who might just ignore the rating scale due to its ambiguity.

RQ1 explores the relationship between view count and people's responses to health promotion messages on social media. In general, view count did not appear to have a negative linear relationship with people's favorable evaluations of a health risk behavior. Instead, majority of the findings suggested a positive linear relationship between view count and people's favorable evaluations of a health risk behavior. For example. in the smoking and binge drinking context, view count was positively related with intentions. View count was marginally positively related with texting while driving subjective norms. This suggested that increase in view count potentially

led people to believe that it did not violate social expectations to perform the health risk behavior depicted in the health promotion messages.

In addition to their independent effects, proportion of thumbs-up and view count also jointly influenced people's responses to health promotion messages. In the smoking and texting while driving context, view count had a concave upward relationship with descriptive norms at low level of proportion of thumbs-up. In the smoking and binge drinking context, at low levels of proportion of thumbs-up, view count had a positive linear relationship with intentions. As the proportion of thumbs-up increased, view count was more likely to have a concave downward relationship with intentions. Similar pattern of effect was also found for binge drinking attitudes. In the texting while driving context, when proportion of thumbs-up was medium, view count had a positive linear relationship with subjective norms. When messages were accompanied by a large proportion of thumbs-up, the relationship between view count and subjective norms was concave downward. It was also found at high levels of view count, proportion of thumbs-up had a concave upward relationship with smoking attitudes and texting while driving intentions although the effect was not very pronounced for smoking attitudes. Altogether, the findings suggested that view count and proportion of thumbs-up did not have an addictive effect. Namely, heath promotion messages with high view count and a large number of thumbs-up were not the most persuasive ones. Possibly when a health promotion message had a large number of views, people were likely to infer there were many smokers ("This message was designed for smokers and only smokers would look at this message.")

and hence interpreted a large number of thumbs-up as massive support for the health risk behavior.

H4 and H5 argue that norms mediate the influence of proportion of thumbs-up and view count on responses to health promotion messages, respectively. Among three social norms, subjective norms acted consistently as a mediator of the influence of proportion of thumbs-up on peoples' attitudes and intentions about a health risk behavior. H4 received partial support. However, H5 was not supported. Potentially the referents specified in the measurement of social norms were not the presumed video audiences in participants' opinion. Hence, all three norms did not play important roles in the influence of view count.

Noticeably, ANCOVAs found that people's health behavior status influenced their responses to health promotion messages accompanied by different aggregate user representations. In general, people who were currently engaged in a behavior or ever-smokers were more sensitive to the social cues appearing together with health promotion messages than those who were not currently engaged in a health risk behavior or never-smokers. This occurred possibly because compared with people who had health-risk behavior experiences, those who did not have the experiences had established firm opinions about the health-risk behaviors and it was difficult for the feedback features to further change their opinions.

Although ANCOVAs identified health status could influence people's responses to ratings and view count, multi-group modeling did not identify prominent group differences in the mediation effects. In addition to this, SEMs also generated some findings that were not found using ANCOVAs (for detailed differences between

ANCOVA and SEM results, see Appendix C). As mentioned in study 1, SEM controlled for measurement error. Also, SEM estimated the influence of exogenous variables on one endogenous variable with all other endogenous variables included in the model. For example, most significant interaction between health behavior status, view count, and proportion of thumbs-up was found for attitudes and intentions. Norms were not added to the ANCOVA model examining the influence of view count and proportion of thumbs-up on attitudes or intentions. However, in the SEM model, social norms were controlled for while estimating the influence of view count and proportion of thumbs-up on attitudes or intentions across two groups. Hence, the results could be slightly different.

Chapter 5. General Discussion

This chapter first summarizes the findings of the two main studies (see Appendix B and C for a summary of findings). Then, limitations of the research are addressed. Following this, this chapter discusses its theoretical contributions and practical implications. In the end, future research directions inspired by this work are presented.

Summary of Findings

The main purpose of this research is to explore the influence of web content feedback system on people's responses to health promotion messages on social media. Three types of web content feedback cues were explored in this research, which were comments, view count, and aggregate ratings. These cues were examined for their influences on people's responses to health promotion messages on YouTube website. To understand the influence of the three cues, this study proposed a norms-mediated model, in which three types of social norms were expected as the underlying causes of the feedback cues, including descriptive norms, injunctive norms, and subjective norms. Attitudes and behavioral intentions were used as the primary measures of the health promotion message effects.

Two experimental studies were conducted to test the norms-mediated model. The first experimental study examined the influence of textual comments, which was manipulated on two aspects: valence and focus. Comment valence was operationalized as the proportion of positive comments on a health promotion message. Based on previous studies, it is expected that a greater proportion of

positive comments is associated with lower perceived prevalence (descriptive norms), lower perceived social approval (injunctive norms), lower perceived expectation (subjective norms), more negative attitudes, and lower behavioral intentions toward a problematic health behavior (H1). Comment focus was manipulated to focus on either the executional features of health promotion messages or the behaviors depicted in the health promotion messages. Two research questions (RQ2 and RQ3) are proposed to examine whether comment focus had independent and joint effects (with comment valence) on people's responses to health promotion messages. Also, study 1 examined three social norms as mediators of the influence of proportion of positive comments on attitudes and intentions (H3). Study 2 examined the persuasive impacts of aggregate user presentations, including aggregate ratings and view count. Similar to study 1, study 2 expects that proportion of thumbs-up (indicator of liking for a message on YouTube) had a negative relationship with people's perceived prevalence (descriptive norms), social approval (injunctive norms), expectation (subjective norms), favorable attitudes and behavioral intentions toward a problem behavior (H2). Given some ambiguity surrounding the persuasive impact of view count, one research question was proposed to explore how view count is related to people's normative perceptions, attitudes, and behavioral intentions (RQ1). Also, study 2 proposed a research question to explore the combinatory effects of view count and aggregate ratings on people's responses to health promotion messages (RQ4). Finally, social norms are expected to serve as mediators of the influence of ratings and view count (H3 and H4). Study 1 and study 2 both examined their propositions in three health contexts: cigarette smoking, binge drinking, and texting while driving. Also,

people's health behavior status was added as another independent variable in statistical tests in order to accommodate the possible influence of health behavior status on people's responses to health promotion messages with different social feedback cues.

Study 1

Study 1 found across three health contexts, proportion of positive comments emerged significant only for injunctive norms and the influence of proportion of positive comments on injunctive norms differed across health contexts. In the smoking context, SEM analysis found that proportion of positive comments negatively predicted perceived social approval of smoking. The finding was similar to that in the texting while driving context. However, in the binge drinking context, proportion of positive comments had a concave downward relationship with perceived social approval of binge drinking. As said early, this different finding could be explained using HSM (Chaiken et al., 1989). When people lacked confidence in making a right conclusion, they were engaged in systematic evaluations of relevant information and potentially identified medium proportion of positive comments as unhelpful. In this case, they would search for other information in the social context to make decisions (Chaiken et al., 1989). Messages highlighting binge drinking might lead people to believe that the behavior was currently endorsed by many people (Cialdini, 2003; Jacobson, 2007; Nan & Zhao, 2015; Wang & Jiang, 2016). Hence, people estimated high social permissiveness toward binge drinking. To examine this possibility, future studies might want to measure the cognitive responses of those exposed to equal number of positive and negative comments.

Furthermore, study 1 found that comment focus could influence people's responses to health promotion messages. In the binge drinking context, behavior-focused comments were found to lead to fewer binge drinking intentions than the message-focused comments. In the texting while driving context, although most effects were not very pronounced, behavior-focused comments predicted less perceived texting while driving prevalence and social approval and less favorable texting while driving attitudes. Such findings suggested that even when people did not actually participate in the public discussion of a health-risk behavior, seeing other people's discussion about a health behavior has the capacity to foster more positive health beliefs.

Additionally, study 1 found that comment focus could moderate the influence of proportion of positive comments on people's perceived social norms and health attitudes in the texting while driving context. Specifically, the relationship between proportion of positive comments and injunctive norms and attitudes showed a concave downward pattern when the comments focused on the quality and features of the texting while driving messages. On the other hand, when the focus of the comments was texting while driving behavior, proportion of positive comments was negatively related to perceived social approval of texting while driving[9]. As mentioned previously, in order to have a better understanding of the norms

[9] According to subgroup analyses (Appendix D), this finding was from current distracted drivers. Similar interaction effect between proportion of positive comments and comment focus on norms was also obtained among current binge drinkers. Possibly compared with non-current distracted drivers and binge drinkers, current distracted drivers and binge drinkers were more likely to systematically process the information and identify medium proportion of positive comments as being unhelpful. The finding was not obtained among smokers possibly due to the small number of smokers in the sample.

surrounding texting while driving, possibly people spent more cognitive efforts on deciphering message-focused comments. Systematic information processing led people to realize medium proportion of positive message-focused comments unhelpful. Hence, people used health promotion messages highlighting texting while driving as indicators of social permissiveness toward the behavior and developed high normative inferences and more favorable attitudes. However, this study did not measure people's general impressions of message-focused comments. This speculation should be interpreted carefully. As suggested early, comment focus so far has received little attention from communication scholars. To better understand the role of comment focus in health persuasion, it is expected that more research should be conducted in the future to assess the effects and influence process of comment focus.

Although proportion of positive comments could influence injunctive norms across three health contexts, injunctive norms mediated the influence of proportion of positive comments only on smoking attitudes. Descriptive norms also contributed little to account for the influence of comments on people's responses to health promotion messages. Only comment focus influenced descriptive norms and this happened only in the texting while driving context[10]. Compared with injunctive norms and descriptive norms, subjective norms significantly predicted attitudes and

[10] When manipulation check measures were added as mediators of the influence of comment focus and valence (Appendix E), in both smoking and texting while driving context, proportion of positive comments was found to be negatively related with descriptive norms. Descriptive norms mediated the influence of proportion of positive comments on intentions. Furthermore, in the smoking context, it was found that message-focused comments were associated with less perceived descriptive norms. This suggested that manipulation check measures were important factors to consider when assessing the influence of comments on descriptive norms.

behavioral intentions across all three health behavior domains. This finding was consistent with the claim of the social norms literature that people were more likely to conform to the norms of those important others (Chung & Rimal, 2016). However, in this study, neither proportion of positive comments nor comment focus predicted perceived subjective norms, which prevents subjective norms to be a meaningful mediator of the influence of comment focus or valence. These outcomes were obtained possibly because people did not identify commenters as important social groups. However, this study did not measure people's identification with commenters. To test the validity of this explanation, future studies should include a measure of group identification. Potentially, comment focus or valence will have meaningful influences on subjective norms among those strong group identifers. Furthermore, as shown in Appendix E, comments focus or valence was able to influence subjective norms in smoking and binge drinking context when the variable's manipulation check measures were added as mediators. These findings demonstrate that comment valence or focus has the capacity to influence people's estimates of subjective norms via people's perceived comment focus or valence. However, possibly some other indirect effect offset the indirect effect mediated through perceived comment focus or valence. As a whole, comment focus or valence did not have significant effects on subjective norms. Future studies might want to further explore the mechanisms through which comments may influence subjective norms.

Taken altogether, study 1 provided limited support that social norms could mediate the influence of online comments on people's responses to health promotion

messages on social media. Also, although subgroup analyses (Appendix D) found that people with different health behavior status responded differently to health promotion messages accompanied with different comment stimuli in each of the three health contexts, study 1 did not identify the differences statistically significant. This point would be further discussed in the next section.

Study 2

The results of study 2 suggested a complex relationship of view count and aggregate ratings with people's responses to health promotion messages. In the texting while driving context, proportion of thumbs-up had a negative linear relationship with intentions. Except this finding, other findings, in general, revealed a concave upward relationship between proportion of thumbs-up and people's responses to health promotion messages. As explained early, aggregate ratings are ambiguous. To correctly interpret the meaning of a rating scale, people might need other information in the social context. Because the health-risk behaviors in this study are very prevalent among college students and all the health promotion messages in this study describe scenes of people performing a risky behavior, potentially people in both small and large proportion of thumbs-up condition interpreted the proportion of thumbs-up as being in favor of the health risk behaviors (i.e., interpreted small proportion of thumbs-up as disliking for the ad and hence liking for the health-risk behavior and large proportion of thumbs-up as liking for the health risk-behavior depicted in the message). Hence, they initiated less favorable responses to the health promotion messages than those in the medium proportion of thumbs-up condition. If people interpreted ratings based on their knowledge about the norms surrounding a

health-risk behavior, people who had personal experiences with the behaviors should be more likely to report a concave upward relationship between persuasive outcomes and proportion of thumbs-up. Indeed, supplementary analyses found, ever-smokers and current distracted drivers were more likely to report a curvilinear relationship between proportion of thumbs-up and their evaluations of the health risks (for details, see Appendix D).

Compared with aggregate ratings, view count had a positive effect on many of people's responses to health promotion messages. For instance, view count was positively related to people's smoking and binge drinking intentions. In the texting while driving context, view count had a weak positive impact on people's perceived social expectations of one's texting while driving behavior. Potentially, popular health promotion messages highlighting a problem behavior increased people's accessibility to images of people who performed the risk behavior in their memories and made them more likely to try the behavior.

In addition to the linear effects, view count was found to have a concave downward relationship with people's binge drinking attitudes. The pattern of the curvilinear relationship of aggregate ratings and view count with people's responses to health promotion messages was similar to Knobloch-Westerwick et al.'s (2005). Knoblock-Westerwick et al. found that the likelihood a news article was selected had a U-shaped relationship with the number of times the article had been read and an inverted U-shaped relationship with aggregate ratings of the news article. To explain why news articles with moderate number of views were less likely to be selected than the least popular ones, Knobloch-Westerwick et al. (2005, p. 310) said that people

possibly wanted to add some "self-uniqueness experience" by selecting the least popular news articles if that action did not violate social norms. In the current case, even if people reported positive attitudes towards the least popular health promotion messages, they did not violate the societal norms that suggested people stay away from binge drinking. So people reported more favorable binge drinking attitudes after being exposed to the least popular message than the moderately popular messages to increase their uniqueness. Also, possibly compared with the moderately viewed messages, least watched messages shown on the YouTube web page looked more novel to participants and hence attracted more attention and careful elaboration, leading to greater persuasive effects.

In spite of many findings about the influence of view count on people, across three health contexts, view count had limited influence on social norms. The findings ran counter to the previous IPI research (e.g., Chia, 2006; Cho & Choi, 2011; Gunther et al., 2006; Liao et al., 2016), in which perceived exposure was thought as an antecedent of social norms. Possibly people's presumed audiences of the health promotion messages were not the same referent groups for the norms estimated in this study. However, this study did not measure people's perception of who might have viewed the messages. Future studies should include this variable to better understand the relationship between view count and social norms. Also, according to prior IPI studies (Chia, 2006; Cho & Choi, 2011; Liao et al, 2016), it is suggested that future studies include presumed influence as a mediator between view count and social norms, which could provide a better understanding of the way how view count might influence social norms.

In addition to their independent effects, ratings and view count had complicated joint effects on people's normative perceptions, attitudes and behavioral intentions across three health domains. When health promotion messages had a small proportion of thumbs-up, view count had a concave upward relationship with the perceived prevalence of smoking and texting while driving behavior. Also, greater view count was associated with stronger smoking and binge drinking intentions. When the proportion of thumbs-up associated with health promotion messages was medium, view count had a positive linear relationship with texting while driving subjective norms. It had a concave downward relationship with binge drinking attitudes and intentions. When the proportion of thumbs-up was large, view count had a concave downward relationship with people's intentions to smoke and people's perceived subjective norms of texting while driving behavior. These findings altogether suggested that for lowly rated health promotion messages, increase in the view count is very likely to reduce the effectiveness of the messages. This occurred possibly because on YouTube website, people expected lowly rated videos to receive few views. When lowly rated health promotion messages were viewed many times, it might indicate the behavior depicted in the message was a problem in the society and they would not violate norms to perform the behaviors. Highly rated messages with low view count were likely to be more effective than those messages with moderate view count possibly because choosing highly rated health promotion messages with low views gave people opportunity to add unique experience without violating social norms. Or possibly, people expected highly rated health promotion messages to have a greater number of views on YouTube. When highly rated health promotion videos

were viewed less, this might indicate the health-risk behavior was not a problem currently ("Many people supported this ad but few people have watched this ad. So few people are currently performing this unhealthy behavior.")

Also, proportion of thumb-up was marginally related to smoking attitudes at high level of view count and the relationship showed a concave upward pattern. Similarly, in the texting while driving context, when health promotion messages had high view count, proportion of thumbs-up had a concave upward relationship with texting while driving intentions. As mentioned early, a message with a large number of views might suggest a problem behavior depicted in the message was prevalent among some people. In this case, people in both small and large proportion of thumbs-up were likely to interpret aggregate ratings to be in favor of the problem behavior and reported more favorable attitudes and intentions toward the problem behavior than people in the medium proportion of thumbs-up condition.

Findings of the influence of view count and proportion of thumbs-up should also be interpreted by considering people's health behavior status. Across three health contexts, in general, for people who had experience with a health topic, they were more likely to be influenced by ratings and view count[11]. For instance, view count was positively related to ever-smokers' smoking intentions and current binge drinkers' binge drinking intentions. Also, proportion of thumbs-up had a concave upward relationship with smoking intentions and attitudes of ever-smokers. View count did not influence these variables among never-smokers or non-current binge drinkers. Besides, in the texting while driving context, view count and proportion of

[11] Subgroup analyses in each health context generated similar findings (see Appendix D).

thumbs-up interacted to influence attitudes and intentions of only current distracted drivers.

These finding about the less sensitivity of lowly involved people to social cues accompanying online messages conflict with the general belief held by the marketing literature (Purnawirawan et al., 2015): People who are less familiar with a product are more likely to be influenced by user-generated feedback than those who are familiar with a product. Obviously, the way how people make decisions about adopting a health recommendation is different from purchasing a product. While purchasing a product, it is normal for people to check unfamiliar brands and consult others' opinions for a wise choice. However, for health promotion messages, people who are not currently engaged or will not be engaged in a problem behavior are not likely to pay attention to the messages. Also, people might have already developed extremely negative attitudes and strong normative beliefs about a health-risk behavior. Hence, social cues had limited influence on their perceptions.

Interestingly, although health behavior status could influence people's responses to ratings and view count, as aforementioned, it was not an important factor in people's responses to online comments on health promotion messages. This occurred possibly because processing of textual comments required more cognitive efforts. Due to this, the differences in responses to health promotion messages accompanied with different comments between people engaged and not engaged in a health behavior were too small to be meaningful.

The other interesting finding was that in study 1, results from the analyses of data pooled across ever-smokers and never-smokers primarily came from never-

smokers. However, in study 2, results from the analyses of the pooled data were primary from ever-smokers (see Appendix D). Hence, it seems that ever-smokers were more responsive to the change of aggregate ratings and view count. This occurred possibly because the smoking sample in study 1 was too small to generate any meaningful results ($N = 168$). Another possibility might be that both smoking messages in this study described a scene showing a person was smoking. The smoker image might make ever-smokers consider smoking as an important attribute of themselves. Because of this salient smoking identity and the fact that aggregate user representations could be more easily interpreted to be in favor of the smoking behavior than textual comments, ever-smokers were more responsive to the variations of aggregate user representations. Indeed, ever-smokers reported a concave upward relationship between proportion of thumbs-up and attitudes, subjective norms as well as intentions. Potentially ever-smokers interpreted a large proportion of thumbs-up as endorsement for smoking instead of the anti-smoking messages.

As for the mediation effects, study 2 found that subjective norms consistently served as a mediator across three health contexts. In the smoking and binge drinking context, subjective norms were found to be able to mediate the influence of proportion of positive comments on intentions and attitudes. In the texting while driving context, subjective norms mediated the influence of proportion of thumbs-up as well as the interaction between proportion of thumbs-up and the square of view count. Descriptive norms mediated the influence of proportion of thumbs-up on smoking attitudes. Descriptive norms mediated the influence of the interaction between proportion of thumbs-up and the square of view count on intentions in

texting while driving context. Descriptive norms also mediated the influence of the interaction between the square of view count and proportion of thumbs-up on smoking attitudes and intentions. Injunctive norms mediated the influence of the interaction between proportion of thumbs-up and view count on binge drinking intentions. However, for the indirect effects of the interaction terms, their confidence intervals were very close to cross zero (i.e., lower or upper bound of the confidence interval was close to zero, e.g., 0.001). The effects should be interpreted with caution.

Summary of Study 1 and Study 2

Study 2 overall provides better support for the norms-mediated model than study 1. However, only subjective norms consistently mediated the influence of the proportion of thumbs-up. Also, study 2 did not identify that social norms mediated the influence of view count. Taken results from study 1 and study 2 together, it could be concluded that social norms as an explanatory mechanism of the influence of web content feedback system on the effects of health promotion messages received limited support. The weak findings about social norms in the influence process of web content feedback system might be caused by both the weak relationship between norms and attitudes or behavioral intentions and the weak relationship between web content feedback system and norms. As it is shown in study 1 and study 2, only subjective norms consistently emerged as an important predictor of people's attitudes and behavioral intentions. However, web content feedback cues, in general, had limited effects on people's subjective norms perceptions. For instance, in study 1, neither comment focus nor comment valence predicted subjective norms. In study 2, proportion of thumbs-up consistently predicted subjective norms. However, the effect

was significant only in the binge drinking context. View count was weakly related to subjective norms in the texting while driving context.

The finding that aggregate user representations, such as view count and aggregate ratings, were more likely to influence subjective norms than textual comments was intriguing. The anonymous commentary system tested in this study was very similar to the online discussion system examined in prior SIDE experiments (Lee, 2004; 2006). Based on SIDE research, it is expected that exposure to the anonymous online discussion should be able to increase people's identification with the online discussion group and thus increase their conformity to the group norms. Extending this to the anonymous commentary system, it is expected that when people were exposed to anonymous comments, they would regard the other commenters as important peers and hence conform to these people's opinions (Walther, DeAndrea, et al., 2010). However, such expectation was not supported. On the other hand, study 1 consistently found that proportion of positive comments influenced people's perceive social approval of a health risk behavior, which indicated that people just treated the message commenters as general others. One possible reason why people identified more with people who voted for a video using aggregate rating system than commenters might be that textual commentary system contained more individuating information than aggregating rating system. For instance, in this experiment, although the same avatar was used to represent each commenter, each person was given a unique pseudonym. Another possible reason might be that people used aggregate rating system more often than the commentary system. Hence, it is easier for them to identify message raters. Indeed, in this research, study 1 found that only about 20% of

the sample reported having commented on YouTube videos whereas study 2 found that approximately 40% of the sample reported having rated a YouTube video using YouTube aggregate rating system. Additionally, more than 90% of people reported that they had paid attention to the number of views a video had received on YouTube.

This study tested the hypotheses and examined research questions using ANCOVA and SEM. These two analytical procedures generated some different results in both study 1 and study 2. Many different findings were about the influence of health behavior status in people's responses to aggregate ratings and view count. ANCOVA found health behavior status could interact with these features to influence people's responses to health promotion messages whereas SEM overall did not find health behavior status an important variable in people's responses to health promotion messages accompanied by different aggregate user representations. As it is shown in Appendix C, the influence of health behavior status was mostly found on attitudes and behavioral variables. In ANCOVAs, social norms were not controlled for when predicting attitudes and behaviors. On the other hand, social norms were controlled for in the SEM model. This might alter the influence of health behavior status on people's responses to web content feedback system. Second, the SEM model took measurement error into consideration. This might lead to some findings that were not identified in ANCOVA. Third, SEM did not control for people's health behavior status as ANCOVA did, which might also be one cause of the different findings between SEM and ANCOVA. In spite of some differences, SEM and ANCOVA did not produce contradictory findings.

Two post-hoc analyses were performed to better understand the hypotheses and research questions (i.e., subgroup analyses and mediation analyses involving manipulation checks as mediators; for details, see Appendix D and Appendix E). The results revealed that 1) In general, social feedback cues were more influential on the normative beliefs, attitudes and intentions of people who had experiences with the health-risk behaviors; 2) adding manipulation check measures as mediators of the influence of web content feedback cues on norms, attitudes and intentions led to more significant findings. For instance, in study 1, subjective norms were able to mediate the influence of comments focus on smoking attitudes and the influence of proportion of positive comments on binge drinking intentions. In study 2, view count was found to be able to influence descriptive norms and injunctive norms as well as attitudes in the smoking context. Subjective norms were able to mediate the influence of view count on smoking attitudes. This suggested that at least for current health issues, future studies should focus on investigating the effect of social media content feedback features on the effects of health promotion messages among people having prior experiences as these people might have more varied opinions about the issues. Second, people's perception of comment valence or focus and view count might be a number of variables that could explain why social media content feedbacks are able to influence the effects of health promotion messages. Future studies might want to further explore these complicated mechanisms. For instance, the influence of view count on norms might be explained from both an IPI perspective and a perspective that "more views indicate more people are currently engaged in the unhealthy

behavior." Both variables should be measured to understand which mechanism is more important in the process through which view count influences social norms.

Limitations

The study has several limitations that should be acknowledged. First, manipulation of comment valence was not orthogonal to manipulation of proportion of positive comments. Also, comment focus was not manipulated to the same degree across different proportion of positive comments conditions. Although this did not severely affect validity of the results (see Appendix E), it is advised that future studies be more careful in their construction of the experimental stimuli. For instance, future studies can conduct multiple tests of variables' manipulation before the main studies to make sure the manipulation was orthogonal.

Next, this study manipulated comment focus, view count, and rating valence at three levels. Such practice contributes to a better understanding of the nature of the relationship of web content feedback system with people's responses to health promotion messages than prior studies having manipulated the variables at two levels. Still it provided a coarse evaluation. Future studies might want to manipulate the variables at more levels and hence have a more precise understanding of the influence of these web content feedback cues.

Third, comments were studied separately from aggregate user representations. However, these cues might co-appear on some social media websites. The extent to which current findings can be generalizable to these sites is unclear. Future research should investigate the combinatory effects of comments, ratings, and view count by putting all these cues on one web page.

Fourth, alike many CMC experimental studies, the study suffered from low ecological validity. Though the faux YouTube web page was designed to be very similar to the actual YouTube web page, some common features on actual YouTube web page were eliminated to avoid confounding effects. Also, the web page was embedded in an online survey rather than the actual YouTube website. Due to this, people might be skeptical of the authenticity of the experimental stimuli, which in turn might affect their responses to the health promotion messages. Furthermore, to avoid the confounding effects of rating volume, rating volume was set to be equal to view count in this study. This makes the stimuli very unrealistic. Related to this point, another limitation of the study is that this study deliberatively instructed participants to read the experimental stimuli. However, in natural settings, people might not pay such substantial attention to either the health promotion messages or the user-generated information. The artificial procedure might affect the validity of the results. To address the low ecological validity and artificiality of this study, future studies could conduct field experiments, examine people's responses to health promotion messages posted on actual YouTube website, and provide more unobtrusive instructions. Additionally, for future experimental studies aiming to examine the influence of view count and proportion of thumbs-up, they should conduct vigorous pilot tests to ascertain that the manipulation of each variable was not only valid but also realistic.

Moreover, majority of the findings in this study had small effect size. This was consistent with prior web content feedback system studies (Lee & Shin, 2014; Tong et al., 2008; Winter et al., 2011). Given health behaviors investigated in this

study are well-known hard-to-change behaviors, even a small effect size might have practical significance. Still the small effect size underlines the importance of conducting more systematic investigation into the persuasive impact of web content feedback system on health communication in the future.

In addition to above limitations, the three health behaviors examined in this research are discussed very often in the society. Due to this, people might have established strong beliefs and attitudes about them. This restricts the study to identify significant influences of feedback cues on people's normative perceptions, attitudes, or behavioral intentions. Future studies may set in a context in which people have varied opinions.

Also, this study was unable to include all types of health promotion messages. On the other hand, all the promotion messages in this research depicted scenes of the health-risk behaviors. As mentioned early, this might lead people to interpret a large proportion of thumbs-up as greater social approval of the risk behaviors instead of the health advocacy. Hence, the study hypotheses were not supported. If the health promotion message depicted scenes of health-enhancing behaviors (e.g., people stay away from smoking and live a healthy lifestyle), probably the study would arrive at different conclusions. As message content might affect people's interpretation of social media content feedback cues, this factor should be integrated into future empirical studies.

Finally, this study measured behavioral intentions and attitudes instead of people's actual behaviors. Attitudes and behavioral intentions are not perfect predictors of actual behaviors. Given the end goal of many health communication

initiatives are to bring about health-enhancing behaviors, it is important for future study to directly measure how web content feedback systems interfere the influence of persuasive health messages on people's actual health behaviors.

Theoretical Contributions

As mentioned earlier, prior studies have approached the influence of web content feedback system from multiple research perspectives, which made the literature fragmented. This study used social norms theories and proposed a norms-mediated model to understand how various social media content feedback cues influence persuasive health communication online. The model integrates previous work into one unifying framework. Also, using the norms-mediated model, the study examined three types of social norms as possible mediators of the influence of collective social cues on people's responses to health promotion messages online. This practice expands the scope of previous research. Although the norms-mediated model received limited support through two experiments, some evidence has accumulated suggesting that different web content feedback cues might affect health communication effects through distinctive normative mechanisms. For instance, study 1 has found that online comments had a greater influence on injunctive norms whereas study 2 found aggregate user representations were more likely to influence subjective norms. This finding is an important expansion of previous work that tended to assume these endorsement cues influenced people's behaviors all through informational social influence mechanisms (Sundar et al., 2013). The proposition of a norms-mediated model also helps future theory development. For instance, much social norms literature has documented that the strength of normative influence

depends on individuals' personality characteristics (Chung & Rimal, 2016), such as self-monitoring and collectivism orientation. Using the norms-mediated model to explore the influence of web content feedback system, future studies could explore how these individual differences variables might affect people's use and interpretation of the various content feedback cues on social media.

Also, this study expands prior literature on the influence of online comments by making a distinction between behavior- and message-focused comments. In two health contexts (i.e., binge drinking and texting while driving), behavior-focused comments consistently generated less favorable responses to health-risk behaviors than message-focused comments. The finding was in line with prior interpersonal and health communication literature. Certainly, social media commentary system might have a mix of both types of comments. However, one type of comments might be more than the other for some health issues. For example, for a widely known health-risk behavior, people might discuss more on the message features than the health issue whereas for a less known health issue, possibly public discussion will be more around the health issue than the promotion message. Also, understanding the influence of message-focused and behavior-focused comments could help practitioners design public engagement strategies to enhance the effectiveness of their health promotion messages on social media (e.g., encourage people to talk about the health behavior depicted in their health promotion messages). Given this, it is important to differentiate between the effects of message-focused and behavior-focused comments. Examining the content of online comments on the effectiveness of health promotion messages on social media also expands previous literature that

examined the role of interpersonal discussion in promoting the adoption of mass media health messages and healthy lifestyles.

In addition to the above contributions, compared with prior work, this study also contributes to a more nuanced understanding of how each type of social cues might influence people's response to the PSAs by manipulating each cue at three levels. It found that compared with general user representations, it is more likely for online comments to have a negative linear relationship with people's evaluations of health risk behaviors in health promotion messages. Ratings were more likely to have a concave upward relationship, and view count was more likely to have a positive linear or concave downward relationship with people' perception of a health risk behavior depicted in a health promotion message. However, accurate interpretation of the influence of each feature needs to consider some other content feedback features on social media as well as people's health behavior status.

Practical Implications

Findings of this study hold several important practical implications. First, public engagement strategies used in social media-based health communication campaigns should devote to arousing more online discussion about the specific health risk behavior. According to the findings of this research, doing this could help people develop less favorable responses to a health-risk behavior than arousing discussion about the campaign messages. Though it might be difficult to have a full control of what people say about some social media content, active monitoring and wise guidance of public responses to health promotion messages on social media sites are important.

Second, in this study, it was found that aggregate ratings were very likely to have a concave upward relationship with people's favorable responses to health risk behaviors in health promotion messages. Possibly people misinterpreted a large number of thumbs-up as support for the unhealthy behavior depicted in the messages. View count could increase people's favorable evaluation of health risk behaviors in health promotion messages. Compared with ratings and view count, comments, however, tend to have a clear negative relationship with people's favorable evaluation of health risk behaviors depicted in health promotion messages. Hence, health communication practitioners aiming to increase the effectiveness of their health messages might want to focus more on increasing positive comments, particularly behavior-focused comments, towards health promotion messages than changing the valence of aggregate ratings or increasing the view count of the health promotion messages.

Third, many social media sites present various feedback cues simultaneously. Based on the current research, it seems that these cues had complicated interactive effects on people's interpretation of health promotion messages. Some key findings are that health promotion messages with high view count and a large proportion of thumbs-up are not the most effective ones and health promotion messages with a small number of thumbs-up and lowest view count are not the least effective. In comparison, health promotion messages with a large number of views and a small proportion of thumbs-up were very likely to be ineffective. Practitioners should take this finding into consideration when monitoring public responses towards their health promotion messages on social media platforms.

Furthermore, the study found that people with differing health behavior status might respond differently to various feedback cues. Particularly, people who are currently (or have ever smoked) engaged in a problem behavior were more likely to be influenced by aggregate user representations accompanying health promotion messages on a social media platform. Therefore, campaigns aiming to persuade people to stop a health-risk behavior should devote greater attention to the management of users' feedback to their health promotion messages.

Finally, the study suggested that aggregate user representations could influence subjective norms. Because subjective norms are an important predictor of people's health risk behavior attitudes and intentions, practitioners should prevent people who are exposed to aggregate user representations to develop incorrect perceptions about the subjective norms surrounding a health risk behavior. Offline education activities might be implemented to complement social media-based health education to ascertain that people develop healthy subjective norms perceptions.

Future Research Directions

This research suggests several future directions. First, as mentioned early, the research is limited in manipulating a full range of proportion of positive comments, view count and proportion of thumbs-up. To have a more accurate understanding of the relationship between web content feedback system and people's response to health promotion messages, it is important to add more levels to the current operationalization of the feedback features. Second, this research only investigated the effects of comments, ratings, and view count. While these three cues are the most common web content feedback cues, other feedback cues, such as people's evaluation

of general users' comments and ratings of comments usefulness as well as the number of times a message is saved by other people, might also influence people's responses to the messages posted on a social media site, which could be explored in future studies.

Moreover, as mentioned early, many feedback cues are ambiguous and people might evaluate these cues based on their prior knowledge about a behavior or other information in the social context. For example, a large proportion of thumbs-up might be interpreted as greater public endorsement for smoking instead of anti-smoking messages as smoking is frequently mentioned as one of the most prevalent health-risk behavior among college students. Also, high message views might indicate many people are currently engaged in the health-risk behavior depicted in the health promotion messages because health promotion messages are designed primarily for those unhealthy behavior performers. However, this study failed to fully explore the cognitive, affective, or psychological mechanisms underlying the influence of web content feedback system. It is expected that future studies perform this task to better understand the dominant factors that help people interpret social cues accompanying health promotion messages.

Additionally, so far limited studies have investigated the influence of web content feedback on people's actual behaviors. Given fostering health-enhancing behaviors in the long term is the eventual goal of many public health education efforts, it is important to investigate the effects of web content feedback systems on people's actual behaviors. Closely related to this point, future studies should also assess how web content feedback system influences people's beliefs, attitudes and

behaviors in the long term not immediately following people's exposure to the web content feedback.

Also, YouTube differs from other social media sites on several aspects, such as Facebook and Twitter. Future studies could examine this study's propositions on a different social media site. For example, one's Facebook network usually consists of familiar people or at least people sharing some common goals or interest. Would the norms-mediated model work more prominently in that context? It would be an interesting future research direction.

Furthermore, similar to previous research (Lee & Jang, 2010; Knobloch-Westerwick et al., 2005), this study found that different web content feedback cues had differential influences on people's responses to the messages shared on a social media site. The causes for such differences go beyond the scope of this work. However, to advance theory development, it is important for future research to develop a theoretical account for why different social media content feedback cues might influence people's response to persuasive social media messages differently.

An additional area of future research is, as suggested early, the interaction between persuasive message content and web content feedback system. In the current study, all health promotion messages depicted health-risk behaviors and talked about their negative impacts on one's health. Hence, people might interpret many thumbs-up as support for the unhealthy behavior. If the health promotion messages describe healthy behavior or are gain-framed, would it more possible to find a positive linear relationship between the number of thumbs-up and people's positive responses to health promotion messages? This question warrants future examination.

Conclusion

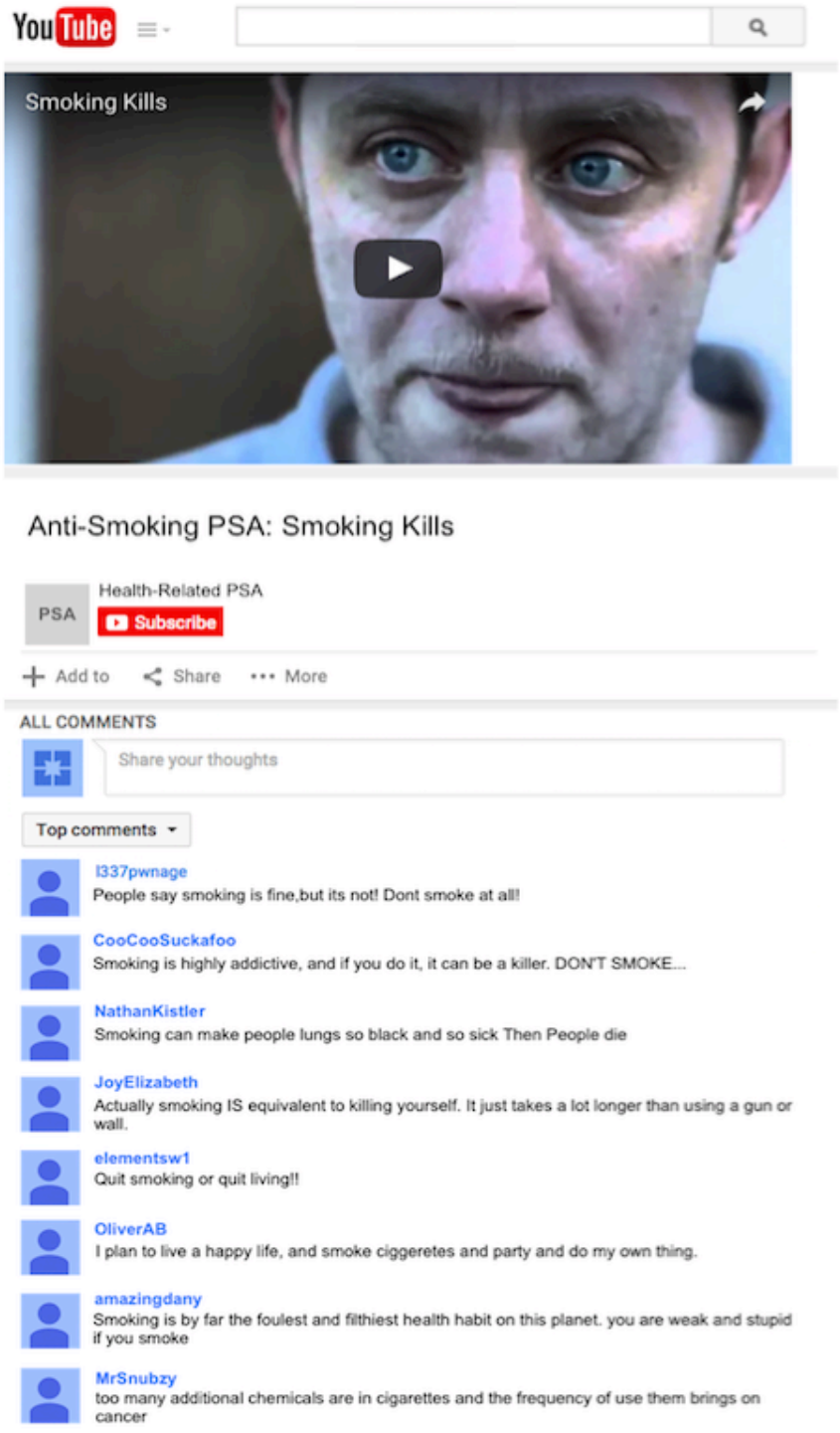
To sum up, this study examined the influence of three common social media content feedback cues on people's responses to health promotion messages on one social media site YouTube by exploring descriptive norms, injunctive norms and subjective norms as meditators. Some evidence has accumulated suggesting that injunctive norms acted as an important variable in the influence of comments on people's responses to health promotion messages, and subjective norms appeared to be more important in explaining the influence of aggregate user representations. Also, this study found that the influence of comments, ratings, and view count on people's evaluation of health behaviors varied across health contexts, people's health behavior status, and other features of the web content feedback system.

As more people are using user-generated information to evaluate online messages and an increasing number of health communication efforts are using social media to deliver health promotion messages, it is now impossible to ignore the influence of web content feedback cues on health communication effectiveness. In spite of substantial attention to the persuasive effects of web content feedback in the past decade, much remains to be explored in the area of health communication. This dissertation aims to provide useful insights into this topic.

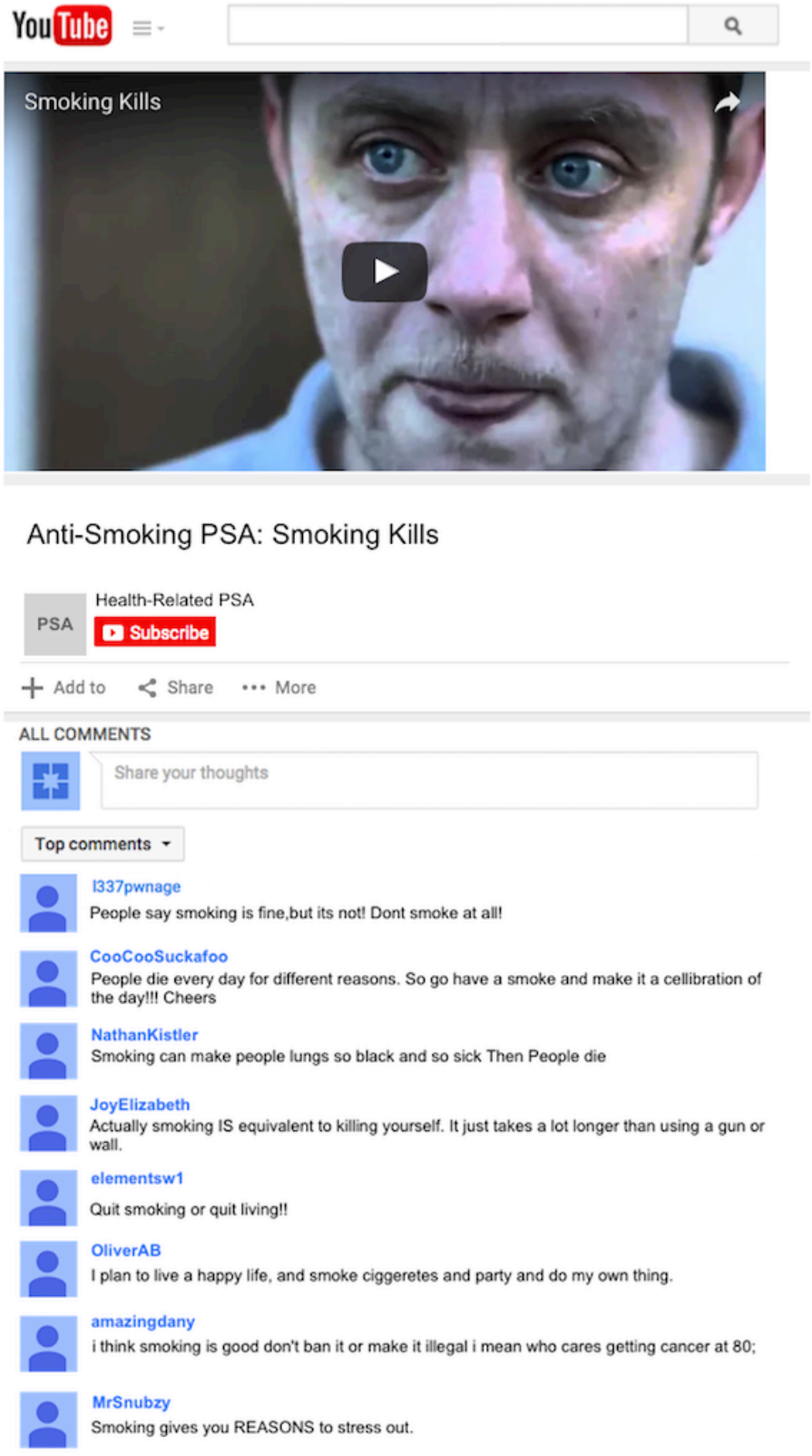
Appendix A: Message Stimuli Example in Main Studies

Study 1

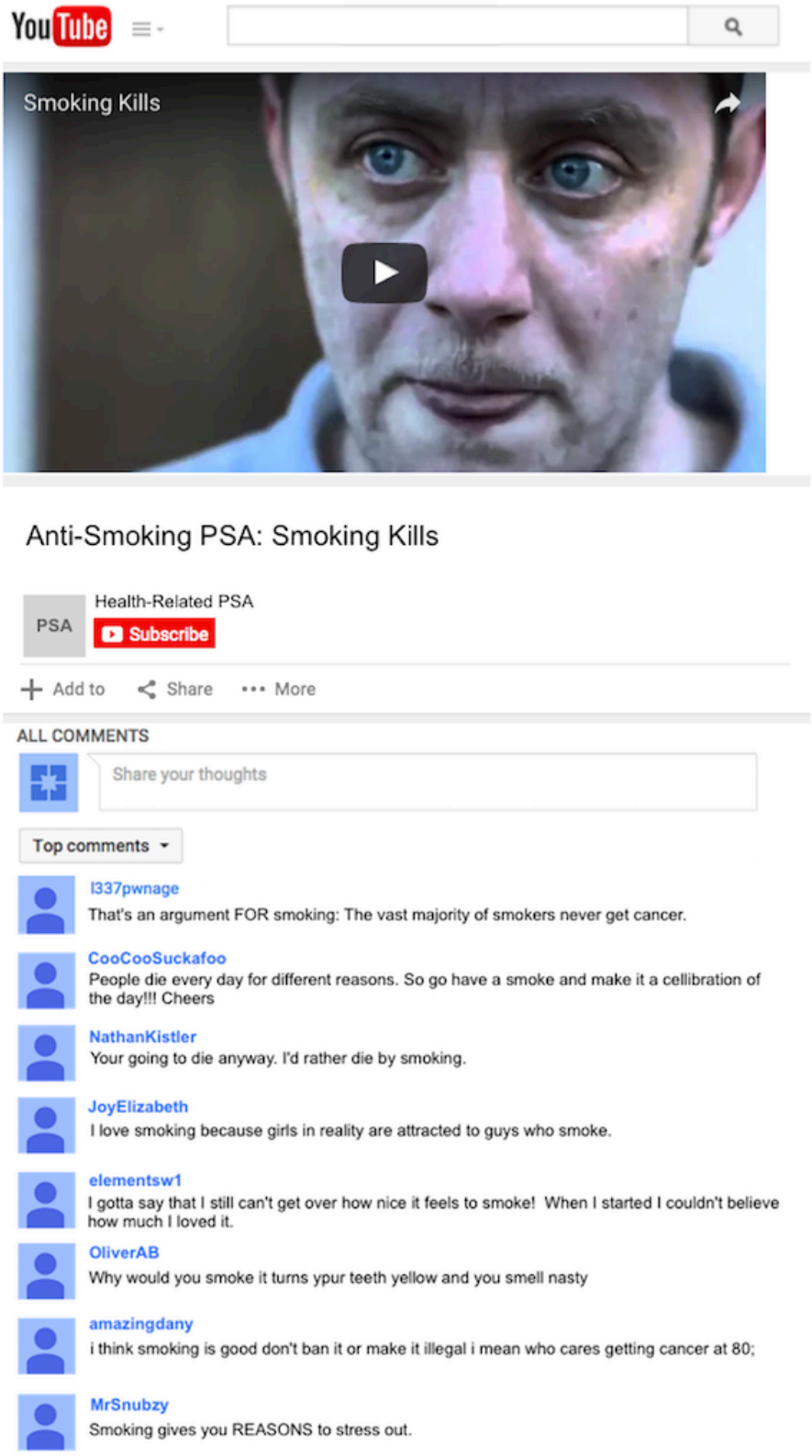
Anti-Smoking message with large proportion of positive behavior-focused comments.



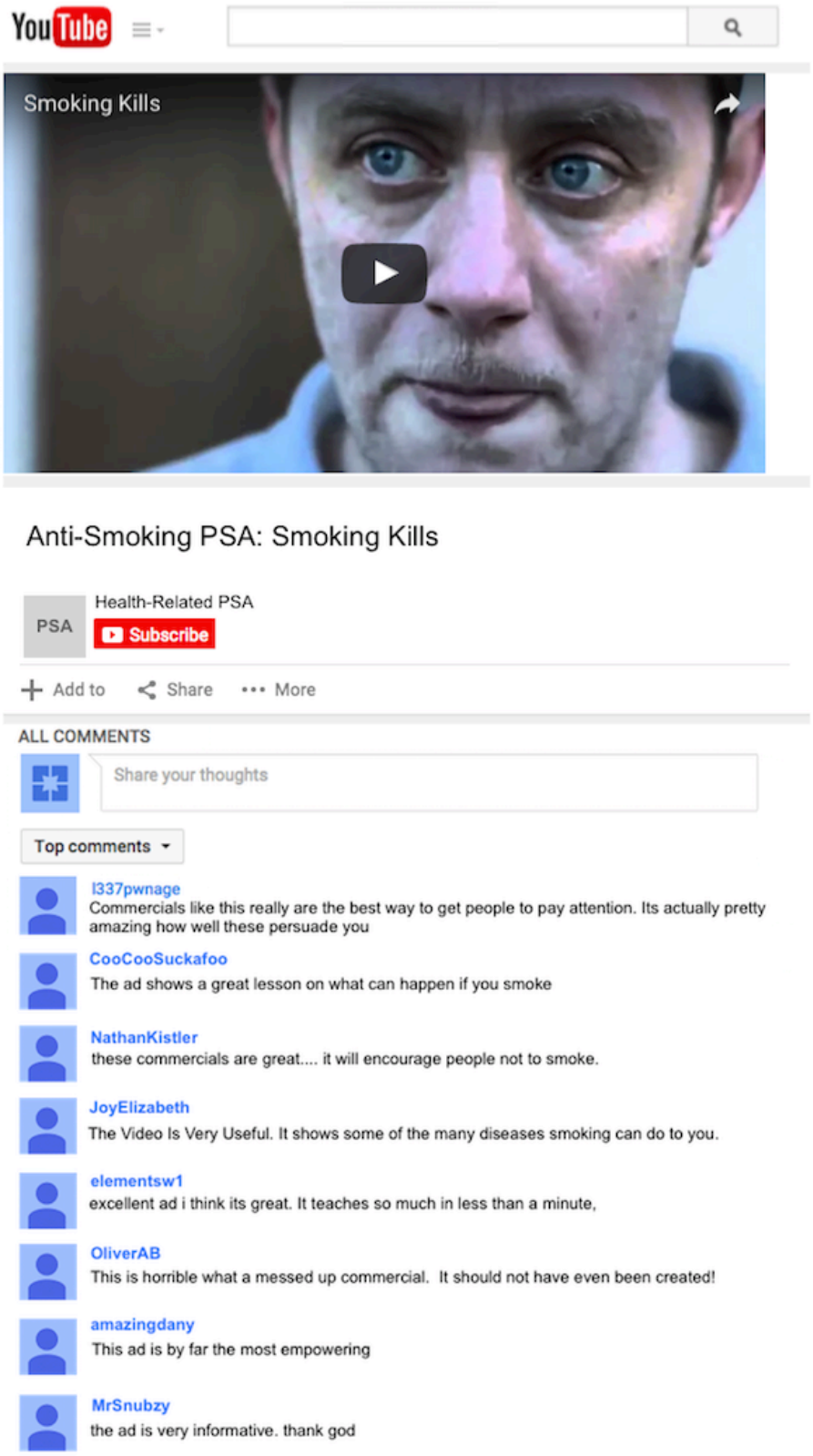
Anti-Smoking message with medium proportion of positive behavior-focused comments.



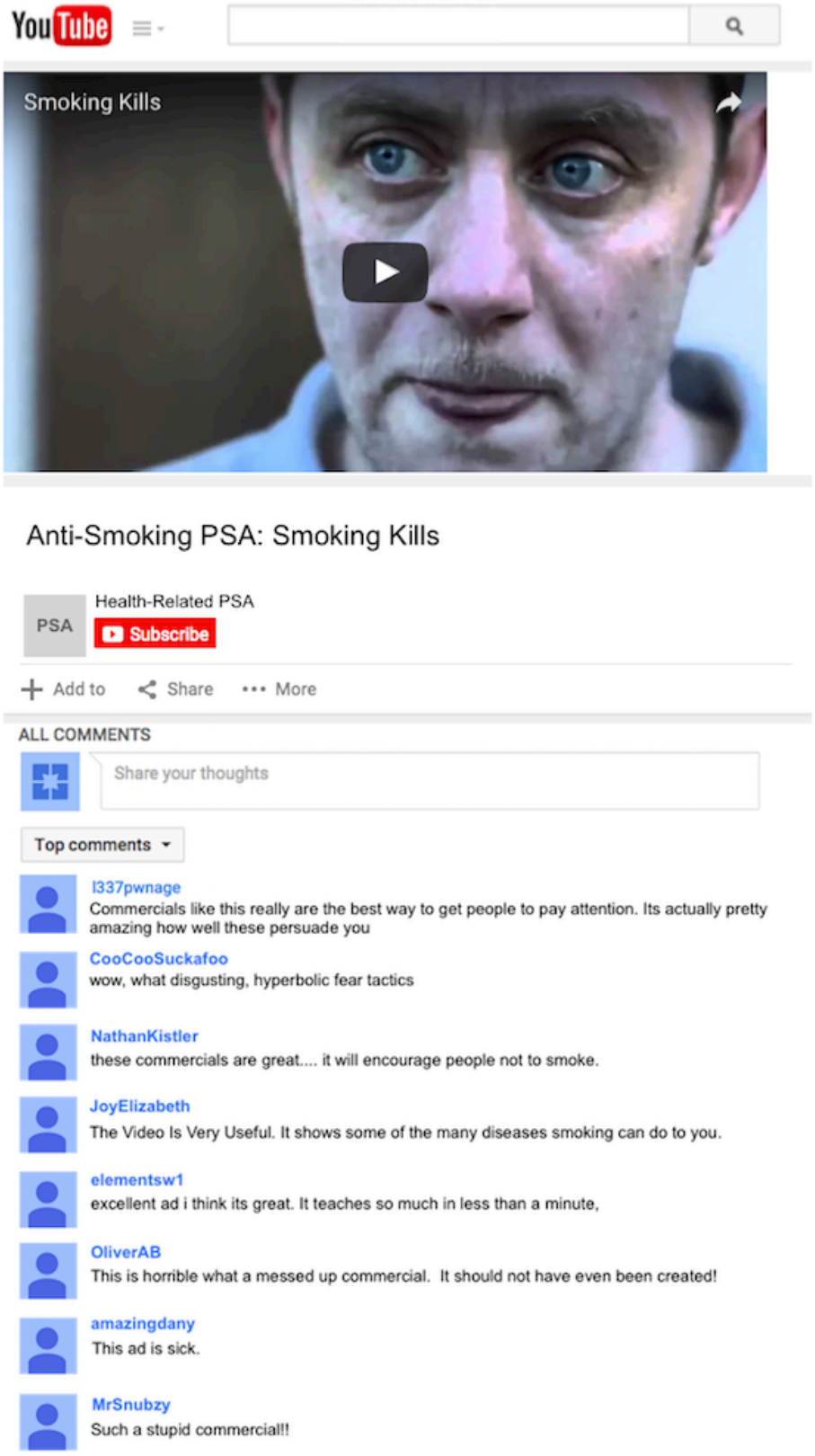
Anti-Smoking message with small proportion of positive behavior-focused comments.



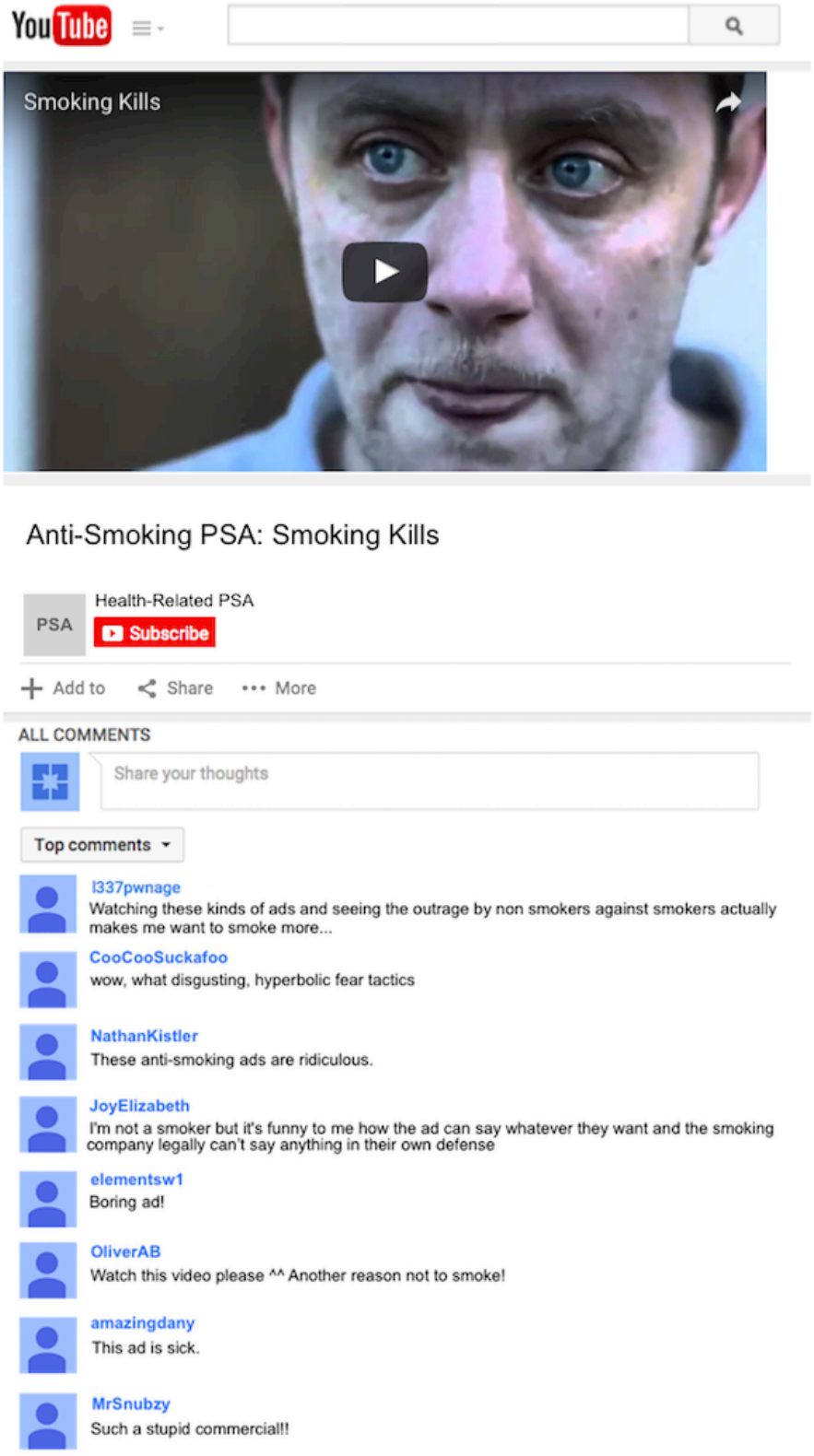
Anti-Smoking message with large proportion of positive message-focused comments.



Anti-Smoking message with medium proportion of positive message-focused comments.

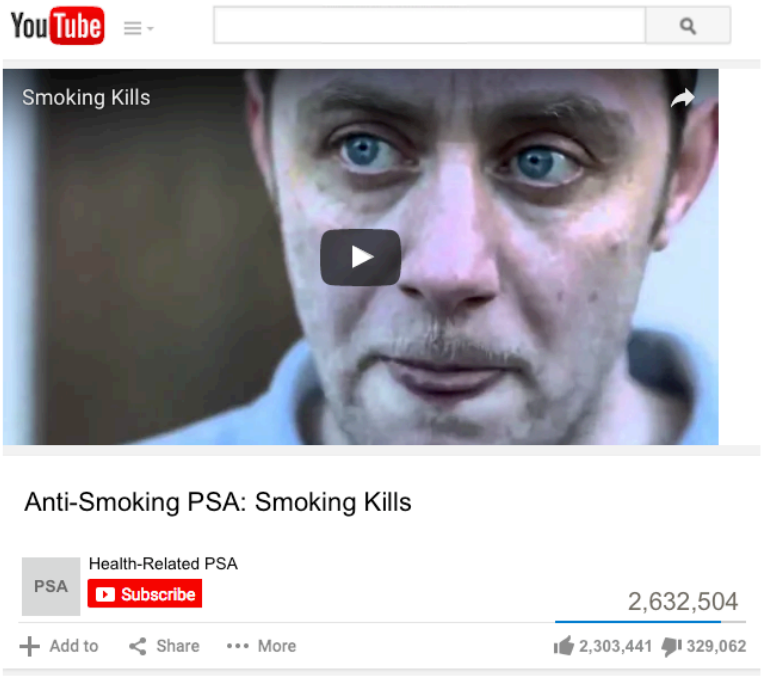


Anti-Smoking message with small proportion of positive message-focused comments.



Study 2

Anti-Smoking message with large proportion of thumbs-up and high view count.



Anti-Smoking message with large proportion of thumbs-up and medium view count.

Anti-Smoking message with large proportion of thumbs-up and low view count.

Anti-Smoking message with medium proportion of thumbs-up and high view count.

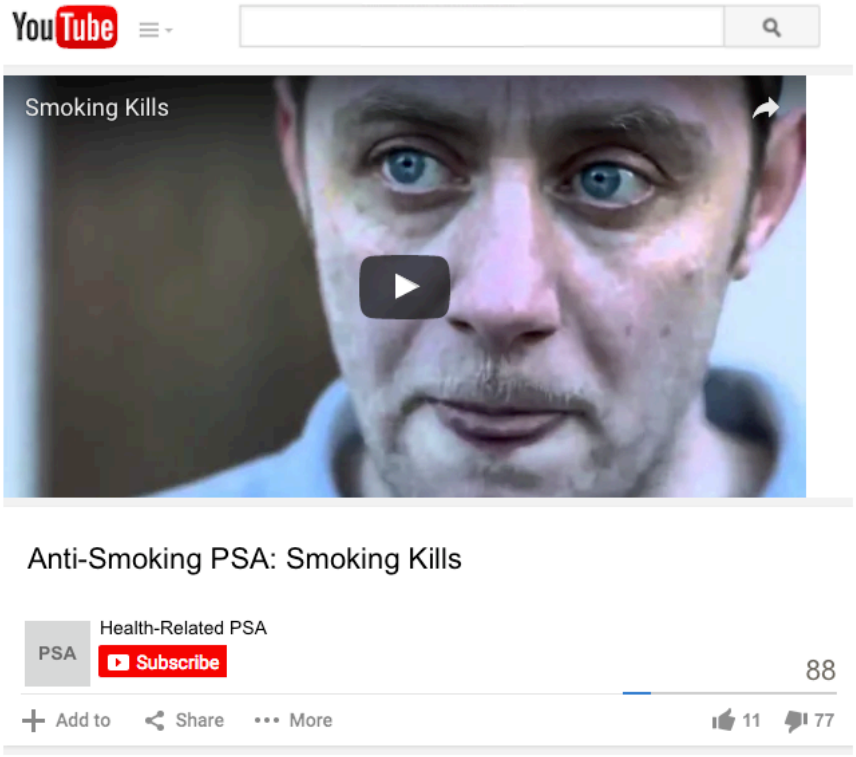
Anti-Smoking message with medium proportion of thumbs-up and medium view count.

Anti-Smoking message with medium proportion of thumbs-up and low view count.

Anti-Smoking message with small proportion of thumbs-up and high view count.

Anti-Smoking message with small proportion of thumbs-up and medium view count.

Anti-Smoking message with small proportion of thumbs-up and low view count.



Appendix B: Study 1 Summary of Findings

Effects	Strategies	Smoking	Binge drinking	Texting while driving
Main effects	ANCOVA		Proportion → inj (quadratic, t = -2.02, p < .05, negative linear t = -1.98, p < .05), p < .05, η_p^2 = .02, *rejected H1.* Focus → intentions (behavior < message), p < .05, η_p^2 = .01.	Proportion →inj (negative linear, t = -3.44, p < .001), p < .01, η_p^2 = .02, *supported H1.* Focus→des (behavior < message), p < .05, η_p^2 = .01.
	SEM	Proportion → inj, b = -0.05, p < .05, *supported H1.*	Proportion^2 → inj (b = -1.86, p = .05), *rejected H1.*	Proportion → inj, b = -0.20, p < .001, *supported H1.* Focus → des (behavior < message), b = 0.38, p = .06. Focus → inj (behavior < message), b = 0.13, p = .07. Focus → att (behavior < message), b = 0.81, p = .08.
Two-way interaction	ANCOVA			Proportion × focus → inj (message: quadratic, t = -2.04, p < .05; behavior: linear, t = -3.87, p < .001), p = .01, η_p^2 = .02.

				Proportion × focus → att (message: quadratic, t = -2.08, p < .05), p = .08, η_p^2 = .01.
	SEM		Proportion^2 × focus → intentions (simple slope *ns*), b = 8.26, p < .05.	Proportion × focus → inj (message: b = -0.09, p = *ns*; behavior: b = -0.31, p < .001), b = 0.22, p = .05. Proportion^2 × focus → inj (message: b = -0.15, p < .05; behavior: b = 0.45, p = *ns*), b = -1.26, p < .05.
Three-way interaction	ANCOVA			
	SEM			
Mediation		Proportion → inj → att, b = -0.12, BC 95% CI = [-0.32, -0.02], *supported H3*.		Focus → des → intentions, b = 0.01, BC 95% CI = [0.001, 0.03]. Total indirect effect of focus → intentions, b = 0.06, BC 95% CI = [0.003, 0.11].

Note. Underlined text refers to findings unique to each analysis. Proportion: proportion of positive comments; focus: comments focus; inj: injunctive norms; des: descriptive norms; att: attitudes.

Appendix C: Study 2 Summary of Findings

Effects	Strategies	Smoking	Binge drinking	Texting while driving
Main effects	ANCOVA	Proportion → sub (quadratic, t = 2.45, $p < .05$), $p = .01$, $\eta_p^2 = .01$, *rejected H2.* Proportion → att (quadratic, t = 2.18, $p < .05$), $p < .05$, $\eta_p^2 = .01$, *rejected H2.* Proportion → intentions (quadratic, $t = 3.97$, $p < .001$), $p < .001$, $\eta_p^2 = .03$, *rejected H2.* View → intentions (positive linear, $t = 1.98$, $p < .05$, quadratic, $t = -1.72$, $p = .09$), $p < .05$, $\eta_p^2 = .01$.	Proportion → sub (quadratic, t = 2.51, $p < .05$), $p < .05$, $\eta_p^2 = .01$, *rejected H2.* View → att (quadratic, $t = -2.67$, $p < .01$ and linear, $t = 2.82$, $p < 0.01$), $p = .001$, $\eta_p^2 = .02$. View → intentions (positive linear, $t = 2.35$, $p < .05$), $p < .05$, $\eta_p^2 = .01$.	Proportion → intentions (negative linear, $t = -2.23$, $p < .05$), $p = .08$, $\eta_p^2 = .01$, *weakly supported H2.*
	SEM	Proportion → des, $b = 0.81$, $p < .01$, *rejected H2.* Proportion^2 → sub, $b = 2.38$, $p = .06$, weakly *rejected H2.* Proportion^2 → intentions, $b = 1.97$, $p < .05$, *rejected H2.*	Proportion^2 → sub, $b = 0.64$, $p < .01$, *rejected H2.* View^2 → att, $b = -0.03$, $p < .01$.	Proportion → sub, $b = 1.43$, $p = .05$, *rejected H2.* Proportion → intentions, $b = -0.40$, $p < .05$, *supported H2.* View → sub, $b = 0.18$, $p = .08$,

Two-way interaction	ANCOVA	Proportion × view → intentions (small proportion: positive linear, $t = 3.21$, $p < .01$; large proportion: quadratic, $t = -2.10$, $p < .05$), $p = .05$, $\eta_p^2 = .01$ **Proportion × status → inj (ever-smokers: p = *ns*; never-smokers: linear, $t = -1.68$, $p = .09$), $p < .05$, $\eta_p^2 = .01$).** **Proportion × status → att (ever-smokers: quadratic, $t = 2.30$, $p < .05$; never-smokers: *ns*), $p < .05$, $\eta_p^2 = .01$.** **Proportion × status → intentions (ever-smokers: quadratic, $t = 3.68$, $p < .001$; never-smokers: *ns*), $p < .05$, $\eta^2 = .01$.** **View × status → intentions (ever-smokers: positive linear, $t = 2.67$, $p < .01$; never-smokers: *ns*), $p < .05$, $\eta_p^2 = .01$**	Proportion × view → att (small proportion: positive linear, $t = 2.45$, $p < .05$; medium proportion: quadratic, $t = -3.74$, $p < .01$/linear, $t = 2.26$, $p < .05$; large proportion: *ns*), $p < .05$, $\eta_p^2 = .01$ Proportion × view → intentions (small proportion: positive linear, $t = 2.14$, $p < .05$; medium proportion: quadratic, $t = -2.49$, $p < .05$; large proportion: *ns*), $p = .08$, $\eta_p^2 = .01$. **View × status → att (current binge drinkers: positive linear, $t = 3.65$, $p < .001$; non-current binge drinkers: quadratic, $t = -2.18$, $p < .05$), $p < .05$, $\eta_p^2 = .01$.** **View × status → intentions (current binge drinkers: positive linear, $t = 3.28$, $p < .01$; non-current binge drinkers: *ns*), $p = .06$, $\eta_p^2 = .01$.**	Proportion × view → sub (small proportion: *ns*; medium proportion: positive linear, $t = 2.53$, $p < .05$; large proportion: quadratic, $t = -2.11$, $p < .05$), $p < .05$, $\eta_p^2 = .02$.
	SEM	Proportion × view^2 → des (small proportion: $b = 0.11$ $p < .01$), $b =$	Proportion × view → inj (small proportion: $b = -0.01$, $p = .05$), b	Proportion × view^2 →des (small proportion: $b = .07$, $p = .09$), $b =$ -

		-0.21, $p < .01$ Proportion^2 × view → att (high view: $b = 4.05$, $p = .08$), $b = 1.38$, $p = .09$.	$= 0.02$, $p = .07$. Proportion × view → att (small proportion: $b = 0.05$, $p < .05$), $b = -0.07$, $p = .097$.	0.17, $p < .05$. Proportion × view^2 → sub (simple: *ns*), $b = -0.34$, $p = .05$. Proportion^2 × view → intentions, (high view: $b = 1.45$, $p < .05$), $b = 0.50$ $p < .05$.
Three-way interaction	ANCOVA			**Proportion × view × status → sub (current distracted drivers: medium proportion: positive linear, $t = 3.18$, $p < .01$; large proportion: quadratic, $t = -1.96$, $p = .05$; negative linear: $t = -1.86$, $p = .06$; non-current distracted drivers: *ns*), $p < .05$, $\eta_p^2 = .02$.** **Proportion × view × status → att (current distracted drivers: small proportion: quadratic, $t = 2.25$, $p < .05$; medium proportion: positive linear, $t = 2.01$, $p < .05$; large proportion: *ns*; non-current distracted drivers: *ns*), $p = .03$, $\eta_p^2 = .02$.**
	SEM			

Mediation	Proportion^2 → sub → att, *b* = 0.65, BC 95% CI = [0.02, 1.64], *supported H4.* Proportion → des → att, *b* = -0.11, BC 95% CI = [-0.32, -0.01], *supported H4.* Total indirect effect of proportion^2 → att, *b* = 0.73, BC 95% CI = [0.05, 1.75]. View^2 × proportion → des → att, *b* = 0.03, BC 95% CI = [0.003, 0.09]. **Proportion^2 → sub → att → intentions, *b* = 0.33, BC 95% CI = [0.02, 0.85].** **View^2 × proportion → des → att → intentions, *b* = 0.02, BC 95% CI = [0.002, 0.05].**	Proportion^2 → sub → att, *b* = 0.26, BC 95% CI = [0.08, 0.53], *supported H4.* Total indirect effect of proportion^2 → att, *b* = 0.28, BC 95% CI = [0.09, 0.48]. Proportion^2 → sub → intentions, *b* = 0.43, BC 95% CI = [0.15, 0.85], *supported H4.* Proportion^2 → sub → att → intentions, *b* = 0.21, BC 95% CI = [0.08, 0.42]. Proportion^2 × view → inj → att → intentions, *b* = 0.01, BC 95% CI = [0.001, 0.03].	Proportion → sub → att, *b* = 0.43, BC 95% CI = [0.04, 0.95], *supported H4.* Proportion → sub → intentions, *b* = 0.14, BC 95% CI = [0.01, 0.30], *supported H4.* Proportion → sub → att → intentions, *b* = 0.04, BC 95% CI = [0.01, 0.10]. Proportion × view^2 → sub → att, *b* = -0.10, BC 95% CI = [-0.23, -0.01], Proportion × view^2 → des → intentions, *b* = -0.01, BC 95% CI = [-0.03, -0.001]. Proportion × view^2 → sub → intentions, *b* = -0.03, BC 95% CI = [-0.07, -0.001]. Proportion × view^2 → sub → att → intentions, *b* = -0.01, BC 95% CI = [-0.03, -0.002]. Total indirect effects of

			Proportion × view^2 → intentions, *b* = -0.06, BC 95% CI = [-0.11, -0.01].

Note. Underlined text refers to findings unique to each analysis. Bold text indicates significant effects involving behavior status. Proportion: proportion of thumbs-up; view: view count; sub: subjective norms; inj: injunctive norms; des: descriptive norms; att: attitude

Appendix D: Supplementary Analyses—Subgroup Analyses

In each health context, hypotheses and research questions were examined separately for people engaged and not engaged in the behavior.

Study 1

Smoking

For both ever-smokers and never-smokers, comment focus, proportion of positive comments, or their interaction did not influence norms, attitudes, or intentions.

Mediation analyses found that for never-smokers, greater proportion of positive comments reduced people's perceived social approval of smoking, which in turn reduced people's positive attitudes toward smoking, b = -0.13, BC 95% CI = [-0.41, -0.01].

Binge Drinking

For current binge drinkers, the interaction between proportion of positive comments and comment focus approached significance on injunctive norms, $F(2, 261) = 2.46$, $p = .09$, $\eta_p^2 = .02$, and on subjective norms, $F(2, 261) = 2.65$, $p = .07$, $\eta_p^2 = .02$. Further trend analyses found that when comments focused on the message, proportion of positive comments had a negative linear relationship with injunctive norms, $t = -2.40$, $p < .05$. The quadratic relationship approached significance, $t = -1.91$, $p = .06$. Proportion of positive message-focused comments had a concave downward relationship with subjective norms, $t = -2.35$, $p < .05$.

For non-current binge drinkers[12], comment focus approached significance on intentions, $F(2, 269) = 3.67$, $p = .06$, $\eta_p^2 = .01$. Message-focused comments led to greater binge drinking intentions than topic-focused comments.

For either current or non-current binge drinkers, mediation analyses did not identify any significant indirect effects of comments focus or valence through the mediation of social norms.

Texting While Driving

For current distracted drivers, proportion of positive comments approached significance on descriptive norms, $F(2, 201) = 2.92$, $p = .06$, $\eta_p^2 = .03$ and was significant on injunctive norms, $F(2, 201) = 3.47$, $p < .05$, $\eta_p^2 = .03$. Further trend analyses revealed a marginally significant concave downward relationship between descriptive norms and proportion of positive comments, $t = -1.78$, $p = .08$, and a negative linear relationship between proportion of positive comments and injunctive norms, $t = -2.52$, $p < .05$. The interaction between focus and proportion of positive comments approached significance for injunctive norms, $F(2, 201) = 2.95$, $p = .05$, $\eta_p^2 = .03$. Trend analysis suggested that when comments focused on health behavior, proportion of positive comments had a negative linear relationship with injunctive norms, $t = -2.92$, $p < .01$.

Mediation analyses conducted among current distracted drivers found that message-focused comments increased perceived subjective norms, which in turn increased people's favorable attitudes toward binge drinking, $b = 0.83$, BC 95% CI =

[12] Assumption check found that order interacted with the focus and proportion of positive comments on injunctive norms among non-current binge drinkers, $F(10, 244) = 2.14$, $p < .05$, $\eta_p^2 = .08$. The interaction term was kept in the model.

[0.002, 2.01]. Also, subjective norms mediated the influence of comment focus on intentions to binge drink, $b = 0.03$, BC 95% CI = [0.003, 0.08]. The interaction between the square of proportion of positive comments and focus was marginally related to subjective norms, $b = -16.48$, $p = .07$. Subjective norms mediated the influence of the interaction between the square of proportion of positive comments and focus on attitudes, $b = -7.53$, BC 95% CI = [-18.03, -0.75], and on intentions, $b = -0.50$, BC 95% CI = [-1.18, -0.01]. The influence of the interaction between the square of proportion of positive comments and focus on intentions was further mediated by subjective norms and attitudes, $b = -0.22$, BC 95% CI = [-0.67, -0.03].

For non-current distracted drivers, focus approached significance on descriptive norms, $F(1, 295) = 3.54$, $p = .06$, $\eta_p^2 = .01$. Message-focused comments led to greater perceived texting while driving prevalence. Proportion of thumbs-up approached significance on injunctive norms, $F(2, 295) = 2.72$, $p = .07$, $\eta_p^2 = .02$ and on intentions, $F(2, 295) = 2.88$, $p = .06$, $\eta_p^2 = .02$. Trend analyses suggested a negative linear relationship between proportion of positive comments and injunctive norms, $t = -2.32$, $p < .05$, and a concave downward relationship between proportion of positive comments and intentions, $t = -2.39$, $p < .05$.

The influence of comment focus on intentions was mediated by descriptive norms, $b = 0.02$, BC 95% CI = [0.004, 0.05] and attitudes, $b = 0.05$, BC 95% CI = [0.002, 0.09], respectively.

Study 2

Smoking

For ever-smokers, proportion of thumbs-up approached significance on injunctive norms, $F(2, 194) = 2.72$, $p = .07$, $\eta_p^2 = .03$, was significant on subjective norms, $F(2, 194) = 3.40$, $p < .05$, $\eta_p^2 = .03$, approached significance on attitudes, $F(2, 194) = 2.41$, $p = .09$, $\eta_p^2 = .02$, and was significant on intentions, $F(2, 194) = 3.66$, $p < .05$, $\eta_p^2 = .04$. Trend analyses suggested that proportion of thumbs-up had a marginally significant positive linear relationship with injunctive norms, $t = 1.65$, $p < .10$ and subjective norms, $t = 1.88$, $p = .06$. For subjective norms, proportion of thumbs-up also had a marginally significant concave upward relationship with it, $t = 1.79$, $p = .08$. Proportion of thumbs-up had a marginally significant concave upward relationship with attitudes, $t = 1.69$, $p = .09$ and a significant concave upward relationship with intentions, $t = 2.69$, $p < .01$. The main effect of view count approached significance on injunctive norms, $F(2, 194) = 2.38$, $p = .095$, $\eta_p^2 = .02$. View count had a marginally significant negative linear relationship with injunctive norms, $t = -1.82$, $p = .07$.

Mediation analyses found that the square of proportion of thumbs-up was positively related to subjective norms, which in turn was positively related to people's favorable smoking attitudes, $b = 2.16$, BC 95% CI = [0.27, 5.60]. The influence of the interaction between the square of proportion of thumbs-up and view count on subjective norms was marginally significant, $b = -2.31$, $p < .10$. When view count was low and medium, square of proportion of thumbs-up had a concave upward relationship with subjective norms. Subjective norms mediated the influence of the interaction between the square of proportion of thumbs-up and view count on attitudes, $b = -1.00$, BC 95% CI = [-2.68, -0.01]. Subjective norms and attitudes

mediated the influence of the interaction between the square of proportion of thumbs-up and view count on intentions, b = -0.47, BC 95% CI = [-1.44, -0.02].

For never-smokers, proportion of thumbs-up interacted with view count on descriptive norms, $F(4, 536) = 3.26$, $p < .05$, $\eta_p^2 = .02$. Trend analysis found that at small proportion of thumbs-up, view count had a marginally significant concave upward relationship with descriptive norms, $t = 1.95$, $p = .05$, and had a significant concave downward relationship with descriptive norms for large proportion of thumbs-up, $t = -2.67$, $p < .01$. Proportion of thumbs-up approached significance on intentions, $F(2, 537) = 2.98$, $p = .05$, $\eta_p^2 = .01$. Trend analysis revealed a concave upward relationship between proportion of thumbs-up and intentions, $t = 2.44$, $p < .05$.

Increase in proportion of thumbs-up increased perceived descriptive norms, which in turn reduced people's favorable smoking attitudes, b = -0.15, BC 95% CI = [-0.40, -0.02]. Descriptive norms mediated the influence of the interaction between proportion of thumbs-up and the square of view count on attitudes, b = 0.04, BC 95% CI = [0.01, 0.12].

Binge Drinking

For current binge drinkers[13], view count was significant on attitudes, $F(2, 336) = 6.53$, $p < .01$, $\eta_p^2 = .04$, and on intentions, $F(2, 336) = 3.99$, $p < .05$, $\eta_p^2 = .02$. View count further interacted with proportion of thumbs-up on attitudes, $F(4, 336) = 2.79$, $p < .05$, $\eta_p^2 = .03$, and the interaction approached significance on intentions, $F(4, 336) =$

[13] Assumption check found that view interacted with order to influence subjective norms among current binge drinkers, $F(10, 296) = 3.26$, $p < .05$, $\eta_p^2 = .02$. The interaction term was kept in the model.

2.21, $p = .07$, $\eta_p^2 = .03$. Trend analyses suggested that when proportion of thumbs-up was small and medium, view count had a positive relationship with attitudes, $t = 2.32$, $p < .05$ (small), and, $t = 2.53$, $p < .05$ (large). When proportion of thumbs-up was medium, the quadratic relationship between view count and attitudes was also significant, $t = -3.27$, $p < .01$. Similarly, at small and medium proportion of thumbs-up, view count had a positive relationship with intentions, $t = 1.88$, $p = .06$ (small), and, $t = 2.38$, $p < .05$ (medium; quadratic $t = -2.38$, $p < .05$). None of the norms mediated the influence of proportion of thumbs-up or view count on attitudes or intentions.

For non-current binge drinkers, proportion of thumbs-up was significant on subjective norms, $F(2, 396) = 3.04$, $p < .05$, $\eta_p^2 = .02$. Trend analysis suggested a concave upward relationship between proportion of thumbs-up and subjective norms, $t = 2.04$, $p < .05$. View count approached significance on attitudes, $F(2, 396) = 2.90$, $p = .06$, $\eta_p^2 = .01$. Trend analysis suggested a concave downward relationship between view count and attitudes, $t = -2.39$, $p < .05$.

Subjective norms mediated the influence of the square of proportion of thumbs-up on attitudes, $b = 0.25$, BC 95% CI = [0.05, 0.55] and intentions, $b = 0.40$, BC 95% CI = [0.09, 0.90]. Subjective norms and attitudes mediated the influence of proportion of thumbs-up squared on intentions, $b = 0.18$, BC 95% CI = [0.04, 0.45].

Texting While Driving

For current distracted drivers[14], proportion of thumbs-up approached significance on descriptive norms, $F(2, 285) = 2.34$, $p = .098$, $\eta_p^2 = .02$. Proportion of thumbs-up interacted with view count on subjective norms, $F(4, 285) = 3.36$, $p < .05$, $\eta_p^2 = .05$ and the interaction approached significance on attitudes, $F(4, 285) = 3.33$, $p = .06$, $\eta_p^2 = .03$. When proportion of thumbs-up was medium, view count had a positive linear relationship with subjective norms, $t = 2.80$, $p < .01$ and when proportion of thumbs-up was large, view count had a concave downward relationship with subjective norms, $t = -1.73$, $p < .05$. When proportion of thumbs-up was small, view count had a concave upward relationship with attitudes, $t = 1.87$, $p = .06$, and when proportion of thumbs-up was medium, view count had a positive linear relationship with attitudes, $t = 1.87$, $p = .06$.

For current distracted drivers, the total indirect effects of view count on intentions were significant, $b = 0.07$, BC 95% CI = [0.01, 0.13]. Greater view count was associated with greater perceived subjective norms, which in turn increased people's favorable attitudes toward texting while driving, $b = 0.23$, BC 95% CI = [0.10, 0.42], and intentions to text while driving, $b = 0.06$, BC 95% CI = [0.02, 0.11]. Subjective norms and attitudes mediated the influence of view count on intentions, $b = 0.01$, BC 95% CI = [0.001, 0.03]. The square of proportion of thumbs-up was related with injunctive norms, which in turn was positively related with intentions, $b = 0.36$, BC 95% CI = [0.03, 0.92]. Injunctive norms and attitudes mediated the influence of the square of proportion of thumbs-up on intentions, $b = 0.03$, BC 95%

[14] Assumption check found that view interacted with order and proportion of thumbs-up to influence subjective norms for current distracted drivers, $F(20, 245) = 1.63$, $p < .05$, $\eta_p^2 = .12$. The interaction term was kept in the model.

CI = [0.001, 0.16]. The interaction between the proportion of thumbs-up and view count influenced attitudes, *b* = -0.35, BC 95% CI = [-0.81, -0.09], and intentions, *b* = -0.09, BC 95% CI = [-0.20, -0.02], via subjective norms. The interaction between the proportion of thumbs-up and view count influenced intentions via subjective norms and attitudes, *b* = -0.02, BC 95% CI = [-0.06, -0.001]. Subjective norms mediated the influence of the interaction between the square of proportion of thumbs-up and view count on attitudes, *b* = -1.66, BC 95% CI = [-3.34, -0.42] and intentions, *b* = -0.42, BC 95% CI = [-0.85, -0.09]. Subjective norms and attitudes mediated the influence of the interaction between the square of proportion of thumbs-up and view count on intentions, *b* = -0.08, BC 95% CI = [-0.23, -0.01]. The total indirect effects of the interaction between proportion of thumbs-up squared and view count on attitudes were significant, *b* = -1.65, BC 95% CI = [-3.36, -0.12]. The total indirect effects of the interaction between proportion of thumbs-up squared and view count on intentions were significant, *b* = -0.54, BC 95% CI = [-1.07, -0.02].

For noncurrent distracted drivers, greater proportion of thumbs-up was related with greater perceived subjective norms, which in turn was related with more favorable texting while driving attitudes, *b* = 0.33, BC 95% CI = [0.02, 0.90]. Subjective norms and attitudes mediated the influence of proportion of thumbs-up on intentions, *b* = 0.04, BC 95% CI = [0.01, 0.14].

Appendix E: Supplementary Analyses—Mediation Analyses Involving Manipulation Checks as Mediators

O'Keefe (2003, p. 251) advised that "when message variations are defined in terms of intrinsic features, message manipulation checks, under that description, are unnecessary but similar measures may usefully be understood and analyzed as assessments of potential mediating states." Post-hoc analyses were performed by including manipulation check measures as mediators of the influence of feedback features (i.e., comments, ratings, and view count) on five dependent variables (i.e., norms, attitudes, and behavioral intentions).

Study 1

Smoking

By adding manipulation check items as mediators, it was found that proportion of positive comments was marginally, negatively related with intentions, $b = -0.51$, $p = .07$. Message-focused comments was associated with less perceived descriptive norms, $b = -0.49$, $p < .05$. In addition to these findings, there were several significant indirect effects of comment focus and valence via the mediation of manipulation check measures.

Proportion of positive comments reduced descriptive norms, $b = -0.33$, BC 95% CI = [-0.65, -0.02] and injunctive norms, $b = -0.04$, BC 95% CI = [-0.08, -0.01], by reducing people's perception that message comments were against the health promotion messages. Message-focused comments increased perceived subjective norms, by reducing people's perception that comments focused on the health

behavior, b = 0.29, BC 95% CI = [0.10, 0.62]. Comment focus was indirectly associated with attitudes, b = 0.08 BC 95% CI = [0.03, 0.21], and intentions, b = 0.12, BC 95% CI = [0.03, 0.28], via people's perception that comments focused on the health behavior and subjective norms. Message-focused comments increased people's perceptions that comments focused on the message, which in turn increased people's perceived subjective norms and then smoking intentions, b = 0.09, BC 95% CI = [0.01, 0.22]. People's perceived comment focus, subjective norms, and attitudes mediated the influence of comment focus on intentions (focus on message: b = 0.01, BC 95% CI = [0.001, 0.05]; focus on topic: b = 0.02, BC 95% CI = [0.004, 0.06]).

The interaction between focus and the square of proportion of positive comments was related with descriptive norms, b = -0.41, BC 95% CI = [-1.39, -0.01] and injunctive norms b = -0.05, BC 95% CI = [-0.16, -0.00] through people's perception that comments were against the message. The interaction between focus and the square of proportion of positive comments was indirectly related with attitudes via people's perception that comments were against the message and injunctive norms, b = -0.12, BC 95% CI = [-0.49, -0.01]. The interaction between focus and the square of proportion of positive comments was related with people's perception that comments focused on the behavior. When comments focused on the behavior, square of proportion of positive comments had a concave upward relationship with the perception that comments focused on the behavior. The interaction between focus and the square of proportion of positive comments was related with subjective norms, b = 1.20, BC 95% CI = [0.18, 3.11], via people's perception that comments focused on the behavior. Furthermore, the interaction

between focus and the square of proportion of positive comments was indirectly related with attitudes $b = 0.35$, BC 95% CI = [0.08, 1.04] and intentions, $b = 0.49$, BC 95% CI = [0.09 1.44] via people's perception that comments focused on the behavior and subjective norms. People's perception that comments focused on the behavior, subjective norms and attitudes further mediated the influence of the interaction between focus and the square of proportion of positive comments on intentions, $b = 0.07$, BC 95% CI = [0.01, 0.32].

Binge Drinking

Similar to the analyses without adding manipulation check measures as mediators, the interaction between the square of proportion of positive comments and comment focus on intentions was significant, $b = 7.97$, $p < .05$. By adding manipulation check items as mediators, it was further found that the square of the proportion of positive comments was negatively related with intentions, $b = -1.91$, $p < .05$. In addition to these findings, there were some significant indirect effects of comment focus and valence via the mediation of manipulation check measures.

Proportion of positive comments was negatively related with injunctive norms, $b = -0.41$, BC 95% CI = [-0.71, -0.14], by reducing people's perception that comments were against the health promotion messages.

For non-current binge drinkers, people's perception that comments were against the health promotion messages and subjective norms mediated the influence of proportion of thumbs-up on intentions, $b = -0.18$, BC 95% CI = [-0.51, -0.002]. People's perception that comments were against the health promotion messages,

subjective norms, and attitudes mediated the influence of proportion of thumbs-up on intentions, b = -0.10, BC 95% CI = [-0.27, -0.001].

Texting While Driving

Similar to the analyses without adding manipulation check measures as mediators, proportion of positive comments was negatively related with injunctive norms, b = -0.14, $p < .05$. The interaction between proportion of positive comments and comment focus was marginally significant on injunctive norms, b = 0.21, p = .07. The interaction between the square of proportion of positive comments and focus was significant on injunctive norms, b = -1.22, $p < .05$. By adding manipulation check items as mediators, it was further found that proportion of positive comments was marginally, negatively related with descriptive norms, b = -0.46, p = .07. Descriptive norms mediated the influence of proportion of positive comments on intentions, b = -0.01, BC 95% CI = [-0.03, -0.001]. In addition to these findings, there were several significant indirect effects of comment focus and valence via the mediation of manipulation check measures.

Proportion of positive comments influenced injunctive norms by increasing people's perception that the comments focused on the message, b = 0.01, BC 95% CI = [0.002, 0.04]. Message-focused comments reduced people's perceived texting while driving prevalence, b = -0.11, BC 95% CI = [-0.25, -0.01], and increased people's favorable attitudes toward texting, b = 0.15, BC 95% CI = [0.003, 0.38] by reducing people's perception that comments focused on the health behavior. Message-focused comments increased perceived injunctive norms by increasing people's perception that comments focused on the message, b = 0.05, BC 95% CI = [0.01, 0.09].

The interaction between proportion of positive comments and comment focus was significant on people's perception that comments focused on the health behavior, $b = 0.94$, $p = .05$. There was a weaker negative relationship between comment focus and people's perception that comments focused on the health behavior as proportion of positive comments increased. The interaction between proportion of positive comments and comment focus was positively related with descriptive norms, by being positively related with people's perception that comments focused on the health behavior, $b = 0.09$, BC 95% CI = [0.001, 0.32].

Study 2

Smoking

Similar to the analyses without adding manipulation check items as mediators, proportion of thumbs-up was positively related with descriptive norms, $b = 1.09$, $p < .01$. Descriptive norms mediated the influence of proportion of thumbs-up on attitudes, $b = -0.14$, BC 95% CI = [-0.43, -0.002]. The square of proportion of thumbs-up was positive related with intentions, $b = 2.10$, $p < .05$, and subjective norms, $b = 2.36$, $p = .08$. The interaction between the square of view count and proportion of thumbs-up was negatively related with descriptive norm, $b = -0.21$, $p < .01$. The effect of the interaction between square of proportion of thumbs-up and view count on attitudes was marginally significant, $b = 1.41$, $p = 0.09$. The interaction between the square of view count and proportion of thumbs-up was related with attitudes, via descriptive norms, $b = 0.03$, BC 95% CI = [0.001, 0.08]. In addition to these findings, there were several significant indirect effects of proportion of thumbs-up and view count via the mediation of manipulation check measures.

Greater view count increased perceived descriptive norms by increasing people's perception that the message has been viewed by many people, $b = 0.11$, BC 95% CI = [0.02, 0.21]. So did the square of proportion of view count, $b = 0.02$, BC 95% CI = [0.003, 0.04]. Greater view count increased perceived injunctive norms by reducing people's perception that the message has been viewed by few people, $b = 0.16$, BC 95% CI = [0.06, 0.34]. So did the square of proportion of view count, $b = 0.02$, BC 95% CI = [0.004, 0.04]. Greater view count reduced people's favorable attitudes by reducing people's perception that the message has been viewed by few people, $b = -0.10$, BC 95% CI = [-0.21, -0.03]. So did the square of proportion of view count, $b = -0.01$, BC 95% CI = [-0.03, -0.003]. View count was indirectly related with attitudes by people's perception that the message has been viewed by few people and by subjective norms, $b = .05$, BC 95% CI = [0.02, 0.12]. So was the square of proportion of view count, $b = 0.01$, BC 95% CI = [0.001, 0.02]. View count was indirectly related with intentions by reducing people's perception that the message has been viewed by few people and by subjective norms, $b = 0.08$, BC 95% CI = [0.03, 0.19]. So was the square of view count, $b = 0.01$, BC 95% CI = [0.002, 0.03].

For ever-smokers, view count was indirectly related with intentions via people's perception that the message has been viewed by few people and attitudes, $b = -0.05$, BC 95% CI = [-0.12, -0.01]. View count was indirectly related with intentions by people's perception that the message has been viewed by few people, subjective norms, and attitudes, $b = 0.02$, BC 95% CI = [0.01, 0.06]. So was the

square of view count, $b = 0.003$, BC 95% CI = [0.001, 0.01] and proportion of thumbs-up, $b = 0.02$, BC 95% CI = [0.001, 0.08].

Binge Drinking

Similar to the analyses without adding manipulation check items as mediators, it was found that the square of proportion of thumbs-up was related with subjective norms, $b = 0.53$, $p < .05$. Subjective norms mediated the influence of the square of proportion of thumbs-up on attitudes, $b = 0.22$, BC 95% CI = [0.04, 0.45]. Subjective norms and attitudes mediated the influence of the square of proportion of thumbs-up on intentions, $b = 0.18$, BC 95% CI = [0.04, 0.40]. The influence of the interaction between view count and proportion of thumbs-up on injunctive norms was marginally significant, $b = 0.02$, $p = .07$. By adding manipulation checks as mediators, it was further found that proportion of thumbs-up was negatively, marginally related with subjective norms, $b = -0.19$, $p = .06$. View count was marginally, negatively related with attitudes, $b = -0.04$, $p = .09$. The square of view count was negatively related with attitudes, $b = -0.03$, $p < .01$. The square of view count was indirectly related with intentions via attitudes, $b = -0.02$, BC 95% CI = [-0.04, -0.01]. Manipulation check measures did not mediate the influence of proportion of thumbs-up or view count.

Texting While Driving

Similar to the analyses without adding manipulation check items as mediators, it was found that the interaction between the square of view count and proportion of thumbs-up was related with descriptive norms, $b = -0.18$, $p < .05$ and subjective norms, $b = -0.34$, $p = 0.06$. The interaction between the square of proportion of thumbs-up and view count was significant on intentions, $b = 0.51$, $p < .05$.

Descriptive norms mediated the influence of the interaction between the square of view count and proportion of thumbs-up on intentions, b = -0.01, BC 95% CI = [-0.03, -0.002]. Subjective norms mediated the influence of proportion of thumbs-up on attitudes, b = 0.52, BC 95% CI = [0.04, 1.08] and intentions, b = 0.16, BC 95% CI = [0.01, 0.36]. Subjective norms and attitudes mediated the influence of proportion of thumbs-up on intentions, b = 0.05, BC 95% CI = [0.01, 0.12]. By adding manipulation checks as mediators, it was further found that proportion of thumbs-up was related with descriptive norms, b = 1.68, $p < .05$. View count was marginally related with intentions, b = -0.05, p = .08. Descriptive norms was related with the interaction between the square of view count and proportion of thumbs-up, b = -0.18, $p < .05$. At small proportion of thumbs-up, view count squared was related with descriptive norms marginally, b = 0.07, p = .07. Descriptive norms mediated the influence of the interaction between the square of view count and proportion of thumbs-up on attitudes, b = 0.02, BC 95% CI = [0.001, 0.06] and intentions, b = -0.01, BC 95% CI = [-0.03, -0.002]. In addition to these findings, there were several significant indirect effects of proportion of thumbs-up and view count via the mediation of manipulation check measures.

Proportion of thumbs-up was related with attitudes via increasing people's perception that many people have watched the message, b = 0.02, BC 95% CI = [0.002, 0.07]. Proportion of thumbs-up squared was indirectly related with intentions via increasing people's perception that there were more thumbs-up than thumbs-down, b = -0.08, BC 95% CI = [-0.20, -0.02]. Greater view count was related with more intentions via increasing people's perception that many people have watched

the message and changing people's favorable attitudes toward texting while driving, *b* = 0.01, BC 95% CI = [0.001, 0.01]. Greater view count was related with less intentions via reducing people's perception that few people have watched the message and changing people's attitudes, *b* = -0.01, BC 95% CI = [-0.02, -0.003]. Greater view count reduced people's favorable attitudes via reducing people's perception that few people have watched the message, *b* = -0.09, BC 95% CI = [-0.18, -0.03]. The square of view count was related with attitudes via being positively related with people's perception that many people have watched the message, *b* = 0.01, BC 95% CI = [0.002, 0.04] and negatively related with people's perception that few people have watched the message, *b* = -0.01, BC 95% CI = [-0.03, -0.002].

The interaction between view count and proportion of thumbs-up was related with people's perception that many people have watched the message, *b* = 0.21, *p* < .001. At small proportion of thumbs-up, the relationship between view count and people's perception that many people have watched the message was stronger (0.72, 0.70, 0.67, p < .001). The interaction between view count and proportion of thumbs-up was related with attitudes by changing people's perception that many people have watched the message, *b* = 0.03, BC 95% CI = [0.003, 0.07].

The interaction between the square of proportion of thumbs-up and view count was positively related with people's perception that many people have watched the message, *b* = 2.10, *p* < .001, and was negatively related with people's perception that few people have watched the message, *b* = -1.50, *p* < .01. At low levels of view count, the relationship between the square of proportion of thumbs-up and people's perception that many people have watched the message was negative, *b* = -4.85, *p* =

.001; the relationship between the square of proportion of thumbs-up and people's perception that few people have watched the message was positive, $b = 3.43$, $p < .01$. At high levels of view count, the square of proportion of thumbs-up was positively related with people's perception that many people have watched the message, $b = 4.55$, $p = .001$; the square of proportion of thumbs-up was negatively related with people's perception that few people have watched the message, $b = -3.13$, $p = .01$. The interaction between the square of proportion of thumbs-up and view count changed attitudes by increasing people's perception that many people have watched the message, $b = 0.27$, BC 95% CI = [0.03, 0.68] and reducing people's perception that few people have watched the message, $b = -0.26$, BC 95% CI = [-0.65, -0.06]. The interaction between the square of proportion of thumbs-up and view count indirectly influenced intentions by reducing people's perception that few people have watched the message and changing people's attitudes, $b = -0.03$, BC 95% CI = [-0.07, -0.01].

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