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TO TWEET OR TO RETWEET?

THAT IS THE QUESTION FOR DOCTORS ON MICROBLOGS

A Thesis in

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ABSTRACT

The intent of this study is to investigate the effect of interface cues conveying source attributes on credibility of health messages sent via Twitter, a microblogging platform. Based on the MAIN model (Sundar, 2008), an online experiment (N = 63) was conducted to explore the impact of those cues on perceived credibility of content, content liking, behavior intention, perceived credibility of source and that of a distal source by utilizing a 2 (authority cue: a professional (high) vs. a layperson (low)) X 2 (bandwagon cue: large (high) vs. small number of followers (low)) X 2 (source proximity cue: a proximate source (retweet) vs. distal source (tweet)) mixed factorial design. A significant three-way interaction effect on perceived credibility of content was found, such that for tweets from a high authority source, higher bandwagon means greater perceived content credibility, whereas for low authority sources, higher bandwagon leads to lesser perceived credibility of health content. For retweets from a high-authority source, however, higher bandwagon leads to lesser perceived credibility of the content whereas for a low-authority source, higher bandwagon leads to higher perceived credibility of the content. The study results also show that content credibility was significantly associated with higher perceived expertise of proximal source for tweets, whereas for retweets, perceived trustworthiness of proximal source are significant predictors of content credibility. An indirect effect test shows that when a low-authority source retweets, the distal source becomes appears more authoritative in comparison, thus leading to higher content credibility. Theoretical and practical implications, as well as limitations of this study, are discussed.

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Introduction

The Internet has become a common tool for disseminating and accessing health information (Baker, Wagner, Singer, & Bundorf, 2003; Fox & Rainie, 2002; Kommalage & Thabrew, 2008). In the United States, 61% of Internet users have searched for health information on the Internet (Fox & Jones, 2009). In fact, patients are now more likely to seek health-related information through the Internet than to visit health professionals (Veronin, 2002). This phenomenon indicates that health information obtained online has an enormous influence on users' decision-making (Jadad, Haynes, Hunt, & Browman, 2000).

One of the most interesting characteristics of Internet-based health information is the fact that it is provided by both regular Internet users and professionals and organizations, and is widely shared by numerous Internet users. According to Hu and Sundar (2010), online health information is disseminated via a variety of venues, including websites run by organizations, home pages and blogs owned by individuals and doctors, and online bulletin boards on which users readily share health information. In their study, Hu and Sundar (2010) found that individuals perceive online health information differently when the source of the information is a professional rather than a layperson. This result indicates that authority cues—namely, those factors that indicate whether a source is a content expert—are important for Internet users' assessments of online health information.

However, even though scholars have found that authority cues are important in this context, another question arises: are authority cues more powerful than other interface cues (such as bandwagon cues) when individuals perceive online health information? In his MAIN model, Sundar (2008) argues that bandwagon cues can trigger a bandwagon heuristic, which follows the

logic that “if others think that something is good, then I should, too” (p.83). In other words, the bandwagon cue can also help users decide what online health information is credible. Previous studies (Sundar, Xu, & Oeldorf-Hirsch 2009; Chen 2008) have shown that various interface features that contain bandwagon cues have a strong bandwagon effect on individuals’ product judgments and purchase intentions. Thus, bandwagon cues may also impact their assessments of online health information.

Although it is likely that both authority cues and bandwagon cues have a significant influence on users’ evaluations of online information, it is still unclear which cue is more important for appraising the credibility of online health information. This issue is especially pertinent for individuals who obtain health information through Twitter, as Twitter users can be exposed to both authority cues through user names and also to bandwagon cues through an individual’s number of followers. In this case, it is unclear which cue is more important in determining users’ perceptions of online health information. Aside from helping users, this issue is also pertinent to health planners and professionals, who are always looking for effective ways to promote the right kind of health attitudes and behaviors using the latest online tools, including Twitter. Some literature suggests the importance of emphasizing medical expertise (i.e., promote the authority cue in the message) while recent studies have stressed the importance of “patient expertise” or other laypersons’ opinions (or bandwagon cues) in health forums (Kim & Sundar, 2011). In order to ascertain which of these appeals to source credibility is more important in a restricted message platform such as Twitter, this study aims to reveal the relative impact of authority cues and bandwagon cues on users’ online health information processing in this microblogging environment. Moreover, this study will also examine how individuals perceive

retweets, as compared to tweets, when they determine the quality of online health information.

Chapter 1

Literature Review

Twitter

Twitter is a microblogging platform where each user has his/her own Webpage on which every one of his/her tweets (i.e., 140-character expressions) as well as those from his/her followers are aggregated (Jansen, Zhang, Sobel, & Chowdury, 2009). Although this technology has a relatively short history compared to other social media sites, such as Facebook and MySpace, Twitter presently has 105,779,710 registered users (Lee, 2010), a number that continues to rise rapidly. In fact, according to McGiboney (2009), the number of tweets grew 1382% in 2008. In other words, Twitter has become very popular and has been dramatically adopted by Internet users (Sankaranarayanan, Samet, Teitler, Lieberman, & Sperling, 2009).

There are two primary characteristics that make Twitter popular: the convenient information updating feature and easy information distribution. First, since users can easily tweet through a variety of devices, including mobile phones and computers, Twitter enables users to instantly update their information. Each tweet is limited to 140 characters in length, which enables users to concisely update their followers about diverse information topics from interpersonal communication to social issues (Sankaranarayanan et al., 2009). Second, based on the asymmetrical relationship between friends and followers, Twitter can easily diffuse information (Lee, Kwak, Park, & Moon, 2010; Sankaranarayanan et al., 2009). For instance, if user A wants to obtain all of the tweets written by user B, user A can follow user B, and a friend-follower relationship is established. In this case, user A becomes user B's follower and can read

user B's tweets on his/her own Twitter page without obtaining mutual permission. However, user B will not receive any tweets written by user A since user B does not follow user A. In other words, it is not necessary for user B to follow those who follow him/her (Lee et al., 2010). Moreover, with the "retweet" function, which enables users to post other users' tweets on their pages, users can also share other people's tweets with their followers. Thus, a retweet is analogous to forwarding information from blogs or other websites. Returning to the example, followers of user A cannot read any tweets written by user B. However, if user A retweets a tweet from user B, followers of user A will be exposed to user B's tweet on user A's page with the following information: the retweet icon, the name of the original author, and the original tweet. This unidirectional relationship of friends and followers (and the retweet function) makes Twitter a unique medium for disseminating information (Lee et al., 2010).

Because of its convenient information updating feature as well as its unique and powerful dissemination functions, Twitter is widely used by a number of businesses and organizations (Jansen et al., 2009). For instance, health organizations, including the U.S. Department of Health and Human Services, World Health Organization, and AIDS.gov, use Twitter to spread health information. Thus, it is important for scholars to study the effects of health communications via this new medium. While we can expect the widely documented message effects found with traditional media to apply to tweets as well, the effects of the Twitter interface on users' perceptions of health content are yet to be determined. This thesis represents an attempt in this direction, by investigating the effects of three specific interface cues pertaining to the Twitter source--authority, bandwagon, and proximity.

Authority Cues

Sundar et al. (2009) defined a cue as "a piece of information provided by a medium that allows for evaluation of that information, possibly by triggering heuristics" (p. 4233), and they defined heuristic as "mental generalizations of knowledge based on experiences that provide shortcuts in processing information" (p. 4233). The heuristic-systematic model (HSM) considers such reliance on mental shortcuts (for evaluating information based on memory) as heuristic processing (Chaiken, 1980). For instance, an official organization or professional can trigger the "expertise heuristic," which makes individuals think that the information provided by these entities is credible (Sundar, 2008). In his MAIN model, Sundar (2008) argues that in the case of digital media, there are four different technological factors that can cue cognitive heuristics pertinent to the evaluation of credibility: modality, agency, interactivity, and navigability.

As an agency cue, the authority cue can trigger the authority heuristic, which relies on endorsement (Sundar, 2008). In fact, authority cues are not a new concept in the social sciences. Various fields, including information science and technology (Rieh, 2002) and communications (Briggs, Burford, De Angeli, & Lynch, 2002; Eysenbach & Köhler, 2002; Stanford, Tauber, Fogg, & Marable, 2002; Sundar, Knobloch-Westerwick, & Hastall, 2007), have investigated the impact of authority cues on individuals' credibility assessments. In their study of the impacts of news cues on online news credibility, Sundar et al. (2007) found that users' perceptions of a news story's credibility is mainly determined by the authority heuristic triggered by the source of the news story. Even in the case of judging the credibility of online health information, authority cues are a central consideration (Eysenbach & Köhler, 2002). For instance, in her study of the impact of sources on online information judgments, Rieh (2002) asked participants to perform

four Internet searches for basic information on medicine, computers, travel, and research, and found that Internet users are more likely to be concerned about the source of information when they look for information on medicine as compared to other topics.

Prior studies in health communication have examined the impact of authority cues on the credibility of health information. In their study of trust in online advice, Briggs, et al. (2002) found that individuals are more likely to trust university organizations and government institutions than any other type of site. In addition, the study also revealed that individuals tend to follow advice given from university sites more than the advice given from any other site (Briggs et al., 2002). Similarly, Dutta-Bergman (2003) demonstrated that individuals consider personal doctors, medical universities, and federal governments as the most trusted sources of online health information, and Stanford et al. (2002) found that the source of online health information is a key factor for health experts' appraisal of message credibility. Furthermore, based on focus group interviews, Eysenbach and Köhler (2002) examined the way Internet users appraise online health information and found that one of the most important indicators for determining online health information credibility is the source of the information. Thus, individuals are more likely to trust health information authored by credible sources, such as major health institutions or physicians (Freeman & Spyridakis, 2003).

In Twitter specifically, users are recognized by their user names, which identify them as either regular users or professionals (Sankaranarayanan et al., 2009). For instance, professionals are likely to include their title, such as Dr. or MD, in their user name. Thus, it is expected that high authority cues would have a positive impact on users' perceived credibility of the health information as well as their behavioral intentions to act on that information. Thus, the following

hypotheses are posited:

H1: Authority cues will influence users' perceptions of content credibility.

H2: High authority cues will positively influence users' behavioral intentions more than low authority cues.

Bandwagon Cues

In their study of online news sources, Sundar and Nass (2001) found that users' favorite sources are actually other users rather than news editors, who have journalistic expertise. Individuals like news stories more and rate it to be more newsworthy and of higher quality when they are attributed to other users than when they are attributed to news editors. The researchers explained this by suggesting that study participants were likely "getting on the bandwagon," persuaded more by peer opinion than expert opinion. As a result, this study predicts that individuals are more likely to have positive attitudes about content when it is voted upon by a vast number of other laypersons just like them. Thus, we predict the following:

H3: Bandwagon cues will positively influence users' liking of content.

The primary reason that individuals like online news stories that are chosen by other users is due to the bandwagon heuristic (Sundar, 2008). Chaiken (1987) argued that individuals generally believe a certain opinion when a large number of other people also believe that opinion to be correct. With the abundance of information available on the Internet, the tendency to follow others' opinions has increased among Internet users. According to Bonabeau (2004), when individuals are presented with a great deal of information, they are more likely to imitate others' decisions. Thus, bandwagon cues can actually help users assess online information.

Previous studies (Knobloch-Westerwick, Sharma, Hansen, & Alter 2005; Sundar, Oeldorf-Hirsch, & Xu 2008; Sundar & Nass 2001) have found strong bandwagon effects for product judgment and online news judgment. In their study of the bandwagon effects of collaborative filtering technology, Sundar et al. (2008) found that individuals are more likely to have higher purchase intentions and favorable attitudes towards products and to perceive higher product quality and credibility when they are exposed to bandwagon cues (such as high star ratings and sales rank). Sundar et al. (2009) also found that study participants are more likely to purchase a product when they are exposed to a positive review of that product. The results of these two studies indicate that users are heavily influenced by their peers' opinions when they appraise products for potential purchase. Another study about the impact of popularity in online news selection found that articles were chosen more by study participants if a portal featured explicit recommendations (Knobloch-Westerwick et al., 2005).

Although the bandwagon effect has been dealt with in a variety of communication areas, only a few studies in the health communication field have examined its impact on users' health information processing. Thus, this study will investigate the impact of the bandwagon effect on online health information credibility. In Twitter, individuals can infer bandwagon based on the number of people following a particular user. Thus, it seems likely that a high number of bandwagon cues will positively impact users' perceptions of content credibility, their attitudes towards the content, and their behavioral intentions. Based on this discussion, the following hypotheses are proposed:

H4: High bandwagon cues will positively influence users' perceptions of content.

H5: High bandwagon cue will positively influence users' behavioral intentions.

Source Primacy Effect

However, there is no guarantee that individuals will be influenced by bandwagon cues when there are other cues present on the interface. Users might not use more than one cue to evaluate the perceived credibility of content even when there are multiple cues available (Sundar et al., 2007). For instance, if source credibility is high, the other cues, such as a bandwagon cue, might not have any impact on the perceived credibility of the content. On the other hand, other cues can be used for assessing content only if source credibility is low. Such a "source primacy effect" was found with online news cues by Sundar et al. (2007)--when source credibility is low, other interface cues (related to timeliness and bandwagon) influenced the content's perceived credibility, whereas these other cues made no difference to the perceived credibility of content when source credibility was high. Thus, this present study hypothesizes the following:

H6: If authority is high, the bandwagon heuristic triggered by a bandwagon cue would not have any impact on the perceived credibility of the content.

Source Proximity Cues

Because of its multiple source layers, it is difficult to identify one particular source of online content as compared to the content provided through more traditional media (Sundar & Nass, 2001). For instance, news-aggregator sites, such as Google News, display a multitude of source labels for a piece of news on their sites (Kang, Bae, & Zhang, 2009). As a result of the complexity of online sources, Sundar and Nass (2001) created a framework to conceptualize online sources. According to their typology of communication sources, in addition to the original source (i.e., the individual that is actually responsible for creation of the core content), there are

three different “selecting sources”: “visible sources,” “technological sources,” (referring to media technology delivering content), and “receiver sources” (referring to individual receivers who choose content for consumption). Original source refers to the person or entity who originates the content, whereas, visible source can be defined as “the source seen by the receiver to be delivering the message or content” (Sundar & Nass, 2001, p. 58). For instance, in the case of a newspaper, the reporter or anchor would be considered the visible source. Although visible sources act as gatekeepers, they are often perceived as original sources (Sundar & Nass, 2001). In their study of source effects in online product reviews, Dou, Walden, Lee, & Lee (2010) found that study participants were more likely to perceive a reviewer (a visible source) in a product review video to be an original source, and they evaluated the review differently based on whether they thought the video was made by a general product user, an independent website, or a product company. Thus, it is likely that the visible source influences individuals’ perceptions of content.

Often, both original sources and visible sources are visible together on the interface. For instance, in the Twitter environment, a user (user B) who retweets a post reveals both him/herself as a visible source in addition to the original source (user A) who initially posted the tweet. According to Kang et al. (2009), this phenomenon brings up a new cue—a source proximity cue—which is based on users’ psychological distance from a news delivery source. For instance, in the previous example, if a person reads a retweet from user B (the visible source), the person would perceive user B to be the proximate source but would perceive user A (the original source) as the distal source. Thus, people might perceive multiple sources of online content as a set of layers based on the level of perceived proximity to the reader (Kang et al., 2009).

In their study of source cues in online news, Kang et al. (2009) examined the impact of

proximal source cues (such as a news portal site) and distal source cues (such as a news agency). Their findings showed that individuals are more likely to evaluate content credibility based on portal credibility rather than news agency credibility. In addition, they found that if perceived portal credibility is high, perceived agency credibility is positively associated with individuals' content credibility judgments. Thus, based on the literature review of source cues, we hypothesize the following:

H7: Proximal source credibility will be positively associated with content credibility.

H8: Distal source credibility will not be associated with content credibility.

H9: If proximal source credibility is high, distal source credibility will be positively associated with content credibility.

Perceived Source Credibility

A number of social scientists have examined source credibility in terms of its impacts on users' perceptions of messages and attitude changes (Anderson, 1971; Birnbaum and Stegner 1979; Hovland, Janis, & Kelley, 1953; Ohanian, 1990). The two most commonly identified dimensions of source credibility are expertise and trustworthiness (Hovland, et al., 1953). Expertise refers to the degree to which the audience perceives the knowledge of the source to be adequate enough to make valid and correct assertions (Hovland, et al., 1953). On the other hand, trustworthiness refers to the degree to which the audience perceives the goodness or morality of the source in terms of providing truthful or unbiased information (Ohanian 1991; Stanford, et al., 2002). Thus, it is likely that trustworthiness is associated with the bandwagon cue, while expertise is associated with the authority cue.

In most research, expertise is generally associated with authority cues. According to Rosnow and Robinson (1967), expertise changes based on reputation, demonstrated ability, and experience. Briefly, if an authority cue is high in these factors, the expertise also increases. Moreover, expertise sources generally lead to positive persuasive effects (Maddux & Rogers, 1980). Several previous studies have demonstrated that perceived source expertise is associated with perceived message credibility and attitude changes. In the advertising context, Homer and Kahle (1990) found that high expertise sources were more persuasive than low expertise source. Similarly, in the sales context, Woodside and Davenport (1974) demonstrated that an expert salesperson is more likely to persuade customers to purchase products than a non-expert salesperson. Crano (1970) also found that study participants are more likely to comply with an experimenter when he/she was perceived to be an expert source than when the experimenter was perceived to be a non-expert source.

In terms of health communication, previous research has also demonstrated the persuasive effects of perceived expertise on individuals' perceived message credibility and behavioral intentions. According to a survey by the California Healthcare Foundation, individuals tend to view major health institutions and physicians as being highly credible sources who deliver highly credible messages. Furthermore, in their study of the effects of perceived expertise ("Dr." vs. "Mr.") and the strength of advice (positive vs. neutral) on behavioral compliance, Crisci and Kassinove (1973) found that study participants were more likely to accept recommendations when the experimenter introduced himself as "Dr." rather than as "Mr." Similarly, in his study of the impacts of source expertise on online health information, Eastin (2001) found that source expertise influences individuals' perceptions of online health

information. Mugny, Tafani, Falomir, Juan, and Layat (2000) also demonstrated that individuals are more likely to take advice and suggestions from highly credible sources. In terms of source expertise effects in hospital advertising, Braunsberger and Munch (1998) also revealed that information delivered by expert sources generated more positive attitudes towards the advertisement as well as its source.

Previous research has investigated that trustworthiness is generally associated with bandwagon cues and that high-trustworthy sources have more influence than low-trustworthy sources. In their study of the effects of reviewers' characteristics on product sales, Hu, Liu, and Zhang (2008) found that individuals are more likely to have positive attitudes towards reviews written by reviewers with high exposure to readers. Bickart and Schindler (2001) also found that study participants who gather product information from online discussions, such as Internet forums and bulletin boards, are more likely to have greater interests in product topics than participants who gather the same information from marketing-generated online information, such as corporate websites. In their reviews of source effects for online products, study participants tend to perceive general product users as trustworthy sources, while they are likely to perceive a product company as an untrustworthy source (Dou et al., 2010). Dou et al. (2010) also found that study participants who were told that an online product review video was made by a general product user reported significantly higher levels of trustworthiness towards the reviewer in the video than participants who were told that the video was made by a product company although participants in all conditions were exposed to an identical product review.

Based on the Elaboration Likelihood Model of persuasion (ELM) (Petty & Cacioppo,1981, 1986) and HSM (Chaiken, Liberman, & Eagly, 1989), Priester and Petty (1995,

2003) demonstrated that individuals are more likely to engage in greater message scrutiny when they receive messages from untrustworthy sources. In such cases, systematic processing is activated. On the other hand, individuals are more likely to unthinkingly accept information that is provided by a trustworthy source, which is a heuristic cue that triggers heuristic processing (Priester & Petty, 1995, 2003). It is also likely that source expertise has a similar effect on message elaboration (Nan, 2009). In other words, people might engage in greater message scrutiny if they receive messages from low-expert sources. On the other hand, if they receive messages from expert sources, people might accept the message with less cognitive effort.

Although trustworthiness and expertise are associated with different cues, it is likely that people will perceive a source to be more credible if the source is more trustworthy and/or if it has higher expertise (Dholakia & Sternthal, 1977). Interestingly, people generally tend to use a combination of trustworthiness and expertise to estimate information credibility (Stanford et al., 2002). Thus, this study hypothesizes the following:

H10a: Perceived trustworthiness will mediate the relationships between bandwagon cues and content judgments (content credibility, attitudes towards content and sources, and behavioral intentions).

H10b: Perceived expertise will mediate the relationships between authority cues and content judgments (content credibility, attitudes towards content and sources, and behavioral intentions).

Chapter 2

Methods

Design Overview

A 2 (authority cue: professional (high) vs. layperson (low)) X 2 (bandwagon cue: large (high) vs. small number of followers (low)) X 2 (source proximity cue: a proximate source (retweet) vs. distal source (tweet)) mixed factorial design tested the impacts of authority cues, bandwagon cues, and source proximity cues on content credibility, liking of content, and behavioral intentions to use the tweeted health information. Authority cues and bandwagon cues were between-subject factors, while the source proximity cue was a within-subject factor.

Participants

A total of 76 undergraduate students participated in this study. Students received extra course credit for completing the experiment. The age of respondents ranged from19 to 23 (M = 22.47, SD = 0.67) with 73 percent of the respondents being female. Additionally, 96 percent of the respondents were in their junior or senior year in college. Among the 76 participants, only 63 participants completed all three sessions of this study. Thus, only data from these 63 participants were used for the final analysis.

Procedure

All participants had access to the questionnaires and stimulus via a link in a recruitment email from the researcher. Upon clicking the link, they were randomly assigned to one of the

four conditions. In an informed consent form, they were told that they would be participating in a Twitter study, which required them to participate in two additional sessions. To be specific, participants were told that they would need to periodically check their Twitter feeds because they would be sent six tweets from a person whom they sign up to follow. Participants were also informed that, in addition to these six tweets, they would receive two tweets from the researcher asking them to fill out questionnaires. (The researcher's tweet said "Please participate in Session 2/Session3 at…if you have not yet participated."). Upon providing their consent, participants were asked to visit a specific person's Twitter page and then sign up to follow that person by clicking on the link embedded in the study's instructions page. After being accepted as a follower, participants were asked to read all of the tweets and retweets posted on the person's Twitter page. Then, they were asked to sign up to follow the researcher by clicking on the link embedded in the study's instructions page, after which they were asked to disclose their email address so that the researcher could later send them an email asking them to fill out a questionnaire. Participants were also reminded that they would need to periodically check their Twitter feeds because they would be sent tweets from the researcher asking them to fill out the questionnaire. Participants were also asked to make sure that they read all of the new tweets and retweets posted by the person before they filled out the second questionnaire.

Three days later, participants received either tweets or retweets depending on the condition to which they were assigned. For instance, participants in the retweet condition received three retweets, while participants in the tweet condition received the same messages as tweets from the experimental source whom they signed up to follow. Additionally, there was a time interval among the first and second tweet/retweet and the second and third tweet/retweet. At

the same time when participants received the third tweet/retweet from the experimental source, participants also received a tweet that asked them to participate in the study by clicking the embedded link in the tweet from the researcher. To prevent participants from missing the tweet, participants also received an email from the researcher asking them to fill out questionnaires. Before filling out the questionnaire, participants were asked to make sure that they read all of the person's newly posted tweets or retweets. Then, they were asked to fill out the questionnaire, including items for message credibility, manipulation checks, source credibility, content liking, behavioral intentions, and demographics. After completing the questionnaire, they were thanked for participating and told that they would need to periodically check their Twitter feed because they would be sent a tweet asking them to fill out a questionnaire again.

After two days, participants received either tweets or retweets depending on their conditions. However, this time, participants in the retweet condition (i.e., those who were sent retweets the previous time) now received three tweets, while participants in the tweet condition received the same messages as retweets. After this step, the procedure was the same as in the previous stage (except for the last part reminding participants to check for more tweets).

Experimental Treatment Conditions

Four different Twitter pages containing identical health information were created by varying the source and the number of followers: high authority cue X high bandwagon cue, high authority cue X low bandwagon cue, low authority cue X high bandwagon cue, and low authority cue X low bandwagon cue. For the two authority cue levels, two different sources were created based on Hu and Sundar (2010). The professional source for the high-authority source

conditions was operationalized as a doctor. In particular, the professional source was identified as “Paul Morris, MD.” On the other hand, the layperson source for the low authority source was referred to as “Paul Morris” (without the “MD”).

The bandwagon cue in this study was operationalized in terms of the number of followers for the Twitter source. For the high bandwagon condition, the experimental Twitter account had 983 followers. For the low bandwagon condition, the experimental Twitter account had 21 followers. For the two levels of the source proximity cue, retweets and tweets were used. The proximal source was operationalized as a tweet in this study whereas the distal source was operationalized as a retweet. Since the source proximity cue is a within-subject factor, participants in all conditions were exposed to both tweets and retweets. Depending on the condition, the same message was posted as either a tweet or a retweet by the proximal source with the experimental manipulation of authority and bandwagon cues. The distal source was a constant across all conditions and was chosen based on Kang et al.’s (2009) results. They found the highest perceived content credibility when the perceived credibility of both the proximal source and the distal source was high in the high-involvement condition. In the low-involvement condition, however, only the proximal source’s perceived credibility influenced content credibility. Since participants with high involvement may also be influenced by the perceived credibility of the distal source, this study chose a highly credible source as a distal source. Thus, the distal source for this study was a professional source, James Miller, MD, who had three followers. All retweets used for this study were based on James Miller, MD’s tweets.

Four different Twitter accounts were also created in order to send tweets asking participants in each condition to fill out the questionnaires. The user name for the researcher’s

Twitter accounts was “The Researcher” to make the recruit tweet more credible.

Since this study used Twitter, the layout of the stimulus Twitter pages was identical across all conditions except for the source of the Twitter account, the number of followers, and the identification of tweets as either tweets or retweets. The health content of the tweets was identical across conditions.

Weight loss was chosen as the health topic for this study because it has become a growing concern in the United States. According to Fox and Jones (2009), 33% of Internet users search for information about weight loss. Among them, 42% are females ranging in age from 18 to 49. Furthermore, females are more likely to use Twitter than males (Fox, Zichuhr, & Smith, 2009). Twitter demographics show that 55% of users are female, and that 69% of these females are between the ages of 18 to 49 (Quantcast, 2010). Thus, given that the demographic for the sample used in this study is similar to the demographic of Twitter users in general, a health issue such as weight loss is likely to be a relevant topic.

Once the topic was selected, the researcher searched for articles about weight loss from a variety of sources, such as medical journals, health websites, newspapers, and magazines. Among 20 pieces of content initially selected about the weight loss issue, the 11 most controversial messages were selected based on a pretest. Then, the chosen 11 pieces of content were converted to tweets and used as stimuli in the experiment (see Appendix C).

Measurements

Dependent Measures

Content credibility. The primary dependent measure of perceived content credibility of

the tweets and retweets was measured using a seven-point Likert type scale modified from Sundar (1999). Participants were asked to indicate how well 17 adjectives, including “accurate,” “believable,” “biased,” “fair,” “objective,” “clear,” “coherent,” “comprehensive,” “concise,” “disturbing,” “important,” “informative,” “insightful,” “relevant,” “sensationalistic,” “timely,” and “well-written,” described the health information that they read on Twitter. All items were anchored between "Describes Very Poorly" and “Describes Very Well” (Cronbach’s $\alpha = .92$).

Liking of health information. In his factor analysis for users’ perception of news, Sundar (1999) labeled the factor relevant to the study participants’ affective reaction to news stories, including boring and enjoyable, as liking. Thus, in the present study, liking was operationalized as users’ overall feelings toward the health information. Liking for the health information was measured based on Sundar (1998). Participants were asked to indicate how well a series of five adjectives (boring, lively, enjoyable, interesting, and pleasing) described the health information that they read using a seven-point scale ranging from “Describes Very Poorly" to "Describes Very Well" (Cronbach’s $\alpha = .71$).

Behavioral Intentions. Three items modified from Hu and Sundar (2010) were used to measure behavioral intentions to use health information. The items included “I would like to act on the advice that is offered in the message,” “I would recommend the advice on Twitter to others,” and “I would retweet the health information to my acquaintances.” All three items were measured using a seven-point scale ranging from extremely unlikely to extremely likely (Cronbach’s $\alpha = .91$).

Mediating Measures

Source credibility. Source credibility for both the proximal source and the distal source were measured using two dimensions—trustworthiness and expertise—based on previous research by Ohanian (1990). Trustworthiness towards Paul Morris, MD/Paul Morris was measured using a seven-point semantic differential scale with a series of five adjectives (dependable/undependable, honest/dishonest, reliable/unreliable, sincere/insincere, and trustworthy/untrustworthy) (Cronbach's $\alpha = .90$). Perceived trustworthiness of the distal source was measured using the same items (Cronbach's $\alpha = .86$). The expertise of the proximal source for health information was measured by asking participants "How do you describe the Twitter source (Paul Morris, MD/Paul Morris) in terms of his expertise in health information?" A five-item, seven-point semantic differential scale (expert/not expert, experienced/inexperienced, knowledgeable/unknowledgeable, qualified/unqualified, and skilled/unskilled) followed the question (Cronbach's $\alpha = .94$). Similarly, the expertise of the distal source was measured by asking participants "How do you describe James Miller, MD who initially tweeted the tweet to which you were just exposed in terms of his expertise in health information?" using the same items (Cronbach's $\alpha = .95$).

Control Measures

Frequency of media use. Rosenvinge, Laugerud, and Hjortdahl (2003) stated that individuals' perceptions of and behavioral intentions towards information can be affected by a certain medium. Thus, in this study, how frequently individuals used media was measured with open-ended questions asking participants "How many minutes on average do you read tweets on

Twitter in a given day" and "How many minutes on average do you write tweets or retweet on Twitter in a given day?"

Chapter 3

Results

Manipulation Check

Overall, 56% of participants successfully passed the manipulation check item by correctly recognizing the source of the health messages. Cross-tabulations revealed that there were significant differences between high authority and low authority conditions in the tweet condition, $\chi 2$ (1, N = 63) = 16.11 $p < .0001$, whereas no significant differences was found in the retweet condition, $\chi 2$ (1, N = 63) = 0.92 $p = .34$. In total, 72% of the participants in the low authority condition passed the manipulation check for the authority cue, whereas 41% of the participants in the high-authority conditions successfully passed it. A smaller number of participants in the high authority condition recognized the authority of the source they were following compared to participants in the low authority condition. Hu and Sundar (2010), who used the same subtle manipulation (adding MD to the name of the source name), also found that participants in the high authority condition were less likely to recognize the source authority than participants in the low authority condition.

Participants in the retweet conditions were also asked to indicate the name of the original source of the health messages and the source's authority as a manipulation check for the source proximity cue. Only 43% of the participants got the correct name of the original source, whereas 60% of the participants identified the authority of the source. About 70% of participants recognized whether the messages were tweeted or retweeted from the source they are following.

Participants were asked to indicate whether the source that they were following is

popular and trustworthy. An omnibus mixed-design model was employed to assess whether participants in the high bandwagon condition rated popularity and trustworthiness of the experimental source higher than did participants in the low bandwagon condition (popularity: $F(1, 59) = 24.12$, $p < .0001$ and trustworthiness: $F(1, 59) = 24.12$, $p < .0001$). The experimental source in the high bandwagon conditions was rated higher in popularity ($M = 3.47$, $SD = 1.76$) and trustworthiness ($M = 3.14$, $SD = 1.70$) than the experimental source in the low bandwagon condition (popularity: $M = 1.85$, $SD = 1.16$ and trustworthiness: $M = 2.28$, $SD = 1.53$).

Perceived Credibility of Content

Perceived Content Credibility was examined using a 2 (Authority: high vs. low) X 2 (Bandwagon: high vs. low) X 2 (Source Proximity cue: tweet vs. retweet) mixed-model analysis of variance (ANOVA) with source proximity cue as the within-subjects factor. A significant three-way interaction effect between authority, bandwagon, and source proximity cues was found, $F(1, 59) = 17.74$, $p < .0001$ on Content Credibility (see Figure 1 for a plot of the means). When a high authority source tweets, higher bandwagon cues mean greater perceived content credibility; however, for low authority sources, it is the reverse such that higher bandwagon cues lead to lower perceived credibility of the health content. For retweets, however, the exact opposite pattern was revealed such that for retweets from a high authority source, higher bandwagon leads to lesser perceived credibility of the content, while for a low authority source, higher bandwagon cues lead to higher perceived credibility of the content. Table 1 reports the means and standard errors associated with this interaction.

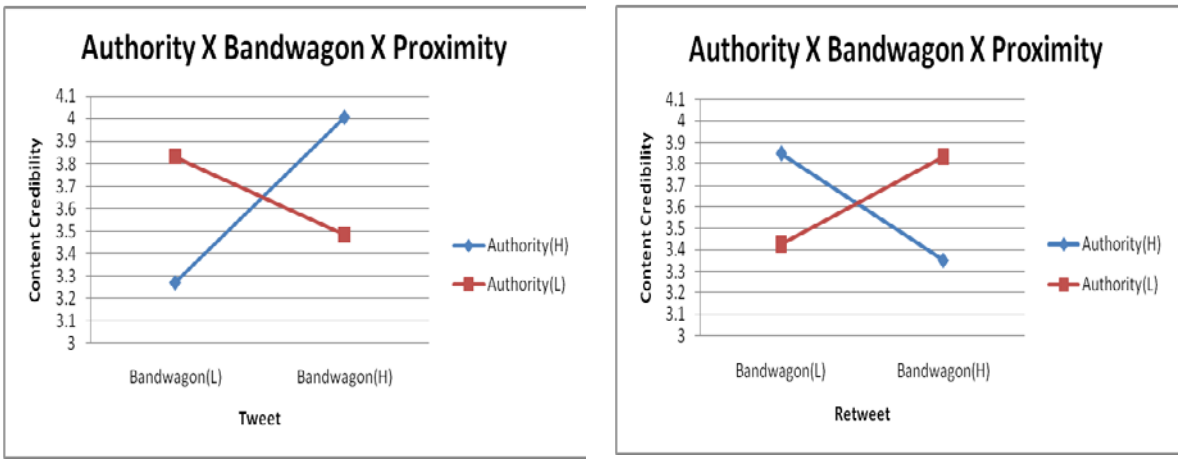


FIG. 1. Three-way interaction effect on Content Credibility

Table 1
Content Credibility: Authority X Bandwagon X Proximate Interaction

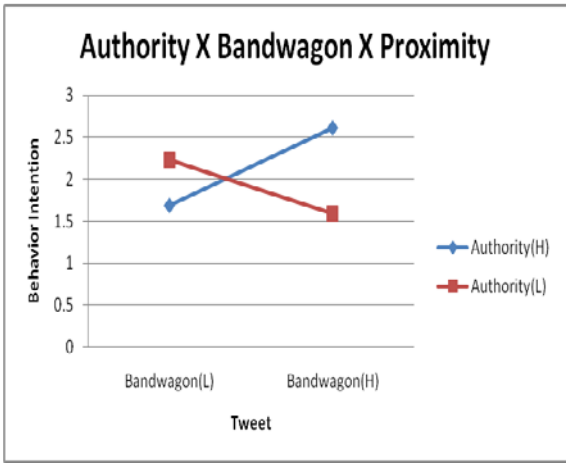
		Tweet		Retweet	
		Bandwagon			
Authority		High	Low	High	Low
High	*M*	4.01	3.27	3.35	3.85
	SE	.26	.30	.26	.30
Low	*M*	3.43	3.83	3.83	3.43
	SE	.32	.29	.32	.29

F (1, 59) = 17.74, $p < .0001$, partial $\eta 2 = .23$.

Behavior Intention

Similarly, a significant three-way interaction effect between authority, bandwagon cues, and source proximity cues with Behavior Intention, F (1, 59) = 14.20, $p < .0005$, (see Figure 2 for a plot of the means) revealed that for tweets from a high authority source, high bandwagon leads to higher behavioral intention, while for a low authority source, high bandwagon leads to lesser behavior intentions. In the retweet condition, however, the opposite result was found such that when bandwagon is high, retweets from a high authority source resulted in lower behavioral intentions; however, when bandwagon is low, authority of the proximal source did not make any

difference in behavioral intention. Table 2 reports the means and standard errors associated with this interaction.



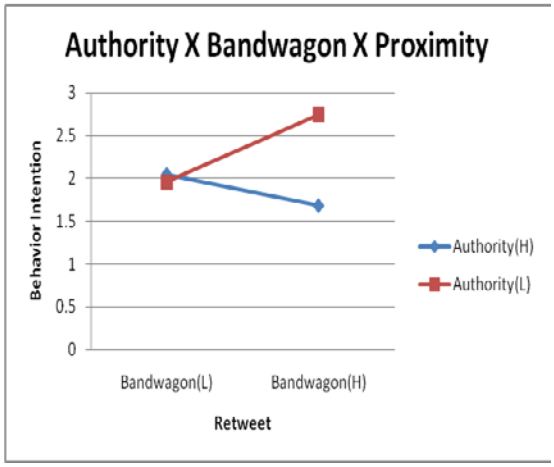


FIG. 2. Three-way interaction effect on Behavior Intention

Table 2
Behavior Intention: Authority X Bandwagon X Proximate Interaction

		Tweet		Retweet	
		Bandwagon			
Authority		High	Low	High	Low
High	*M*	2.61	1.69	1.68	2.04
	SE	.33	.37	.33	.37
Low	*M*	1.59	2.23	2.74	1.96
	SE	.40	.36	.40	.36

F (1, 59) = 14.20, p < .0005, partial η2 = .19.

Content Liking

A marginally significant three-way interaction effect was obtained for Content Liking, $F(1, 59) = 3.95$, $p = .05$. An examination of the means reveals that for tweets from a high bandwagon source, authority does not seem to influence content liking, while for a low bandwagon source, higher authority leads to lesser liking of the content of the tweet (see Figure 3 for a plot of the means). In the retweet condition, however, the opposite result was found.

When bandwagon is high, retweets by a high-authority proximal source were liked less than retweets by a low-authority source, but when bandwagon is low, authority did not make any difference in content liking. Table 6 reports the means and standard errors associated with this interaction.

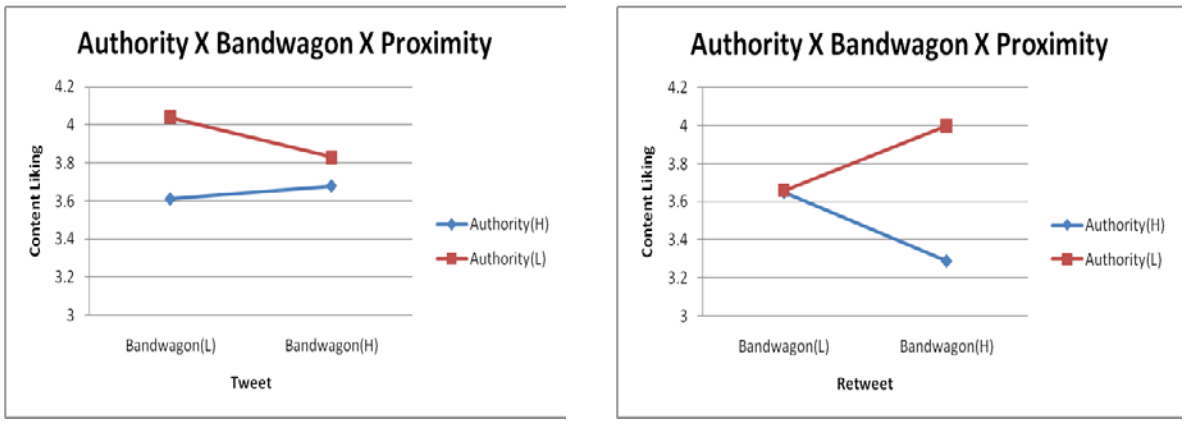


FIG. 3. Three-way interaction effect on Content Liking

Table 3
Content Liking: Authority X Bandwagon X Proximate Interaction

		Tweet		Retweet	
		Bandwagon			
Authority		High	Low	High	Low
High	*M*	3.68	3.61	3.29	3.65
	SE	0.22	0.25	0.22	0.25
Low	*M*	3.83	4.04	4.00	3.66_a
	SE	0.27	0.24	0.27	0.24

F (1, 59) = 3.95, *p* = .05, partial η2 = .06.

Perceived Trustworthiness of Source

A significant three-way interaction effect between authority, bandwagon cues, and source proximity cues was found, $F(1, 59) = 4.35$, $p < .05$ on Perceived Source Trustworthiness (see Figure 4 for a plot of the means). The results revealed that the patterns of means are very

similar to the patterns of means for Content Liking. In other words, for tweets, authority does not seem to have an impact on the perceived trustworthiness of the source when bandwagon is high, whereas higher authority leads to lower perceived trustworthiness of the source when bandwagon is low. For retweets, however, the opposite result was found, such that authority does not make any difference on the perceived trustworthiness of the source when a low bandwagon source retweets, while a low authority leads to higher perceived trustworthiness of the source when a high bandwagon source retweets. Table 4 reports the means and standard errors associated with this interaction.

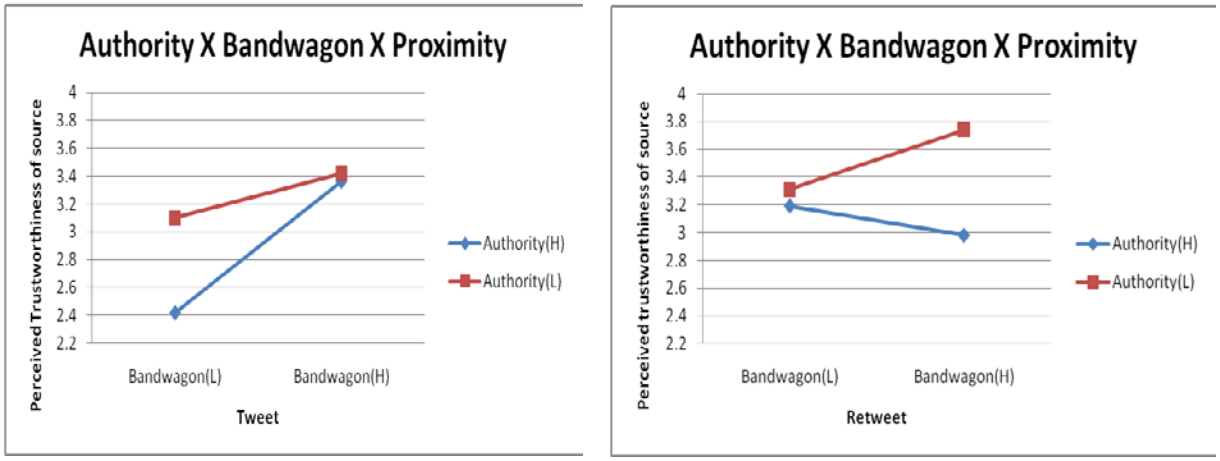


FIG. 4. Three-way interaction effect on Perceived Trustworthiness of Source

Table 4
Perceived Trustworthiness of Source: Authority X Bandwagon X Proximate Interaction

		Tweet		Retweet	
		Bandwagon			
Authority		High	Low	High	Low
High	*M*	3.36	2.43	2.98	3.19
	SE	.34	.39	.34	.39
Low	*M*	3.42	3.10	3.74	3.31
	SE	.41	.37	.41	.37

F (1, 59) = 4.35, $p < .05$, partial $\eta 2 = .07$.

Perceived Expertise of Source

There was also a significant three-way interaction effect between authority, bandwagon cues, and source proximity cues, $F(1, 59) = 11.64$, $p < .005$ on Perceived Source Expertise, with some interesting patterns of means (see Figure 5 for a plot of the means). For tweets, when high authority sources tweet, higher bandwagon cues lead to greater perceived expertise of the source, whereas for low authority sources, it is the reverse such that higher bandwagon leads to lower perceived expertise of the source. For retweets, however, the exact opposite pattern was revealed such that for retweets from a high authority source, higher bandwagon leads to lower perceived expertise of the source, whereas for a low authority source, higher bandwagon leads to higher perceived expertise of the source. Table 5 reports the means and standard errors associated with this interaction.

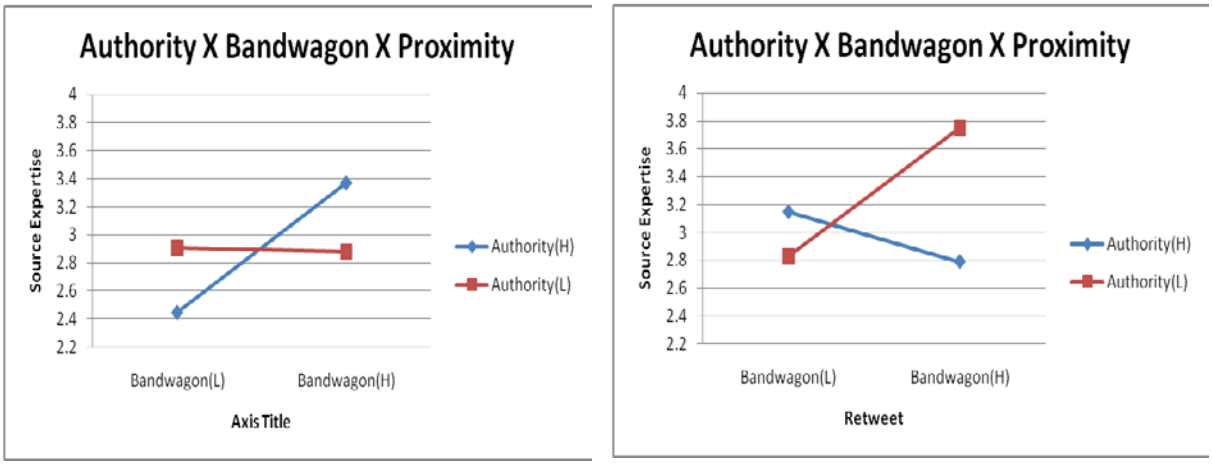


FIG. 5. Three-way interaction effect on Perceived Expertise of Source

Table 5
Perceived Expertise of Source: Authority X Bandwagon X Proximate Interaction

		Tweet		Retweet	
		Bandwagon			
Authority		High	Low	High	Low
High	*M*	3.37	2.45	2.79	3.15
	SE	.37	.42	.37	.42
Low	*M*	2.88	2.91	3.75	2.83
	SE	.45	.40	.45	.40

F (1, 59) = 11.64, p < .005, partial η2 = .17.

Perceived Trustworthiness of Distal Source

A marginally significant main effect for authority on perceived trustworthiness of distal source was also found, $F(1, 59) = 3.91$, $p = .05$, partial $\eta^2 = .06$, such that participants in the high authority condition ($M = 2.88$, $SE = 0.23$) rated the distal source lower in perceived trustworthiness than did participants in the low authority condition ($M = 3.54$, $SE = 0.24$). This result indicates that retweets by a high-authority proximal source lead to lower perceived trustworthiness of the distal source, while retweets from a low-authority proximal source lead to higher perceived trustworthiness of the distal source.

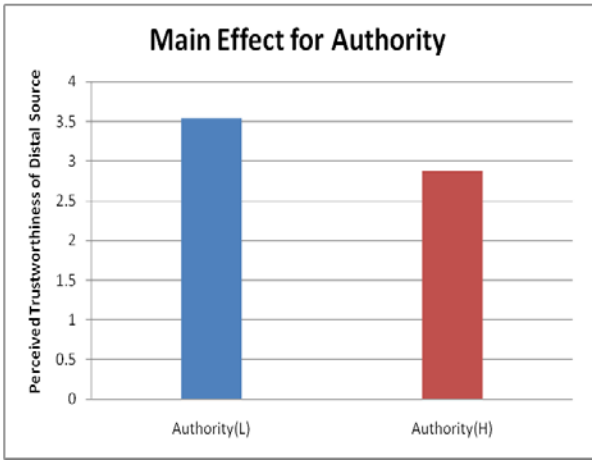


FIG. 6. Main effect on Perceived Trustworthiness of Distal Source

H1 and H2, which predicted that a high authority source has positive impacts on users' perceptions of health information credibility and behavior intention, did not receive direct support from this study data because the main effect for the authority cue was not statistically significant.

H3, H4, and H5, which predicted that high bandwagon cues positively influences users' perceptions of content liking, content credibility, and behavior intention, were not supported since no significant main effect for bandwagon cue was found. Since the study found no significant main effects for either authority or bandwagon cues, H6, which predicted that the bandwagon heuristic triggered by bandwagon cues is more powerful in content evaluation than the authority heuristic triggered by authority cues, was also not supported.

H6 predicted the source primacy effect that the bandwagon heuristic triggered by bandwagon cues would not have any impact on perceived credibility of content if authority was high. The study results, however, found a significant three-way interaction effect between authority, bandwagon cues, and source proximity cues on content credibility, $F(1, 59) = 17.74$, $p < .0001$. When a high authority sources tweets, higher bandwagon cues mean greater perceived content credibility, whereas for low authority sources, higher bandwagon cues leads to lower perceived credibility of the health content. On the other hand, for retweets from a high authority source, higher bandwagon leads to lower the perceived credibility of content, whereas for a low authority source, higher bandwagon leads to higher perceived credibility of content. Thus, H6 was not supported.

H7 predicted proximal source credibility would be positively associated with content credibility. Multiple regression was employed to examine the perceived credibility of proximal

source (the perceived trustworthiness of the proximal source and the perceived expertise of the proximal source) as predictors of content credibility. Table 7 reports the statistics associated with this analysis. The model, F (2, 60) = 46.31, R^2adj = .607, $p < .001$, indicates that the perceived expertise of the proximal source accounted for a significant portion of the variance in content credibility, β = .66, $p < .005$, whereas the perceived trustworthiness of proximal source did not, β = .13, $p = .55$. Thus, H7 was partially supported.

Table 6
Predictors of Content Credibility

	B
Proximal Source Trustworthiness	.13
Proximal Source Expertise	.66***

$F(2, 60) = 46.31$, Adjusted $R^2 = .61$, $p < .001$.
*** $p < .001$

H8 predicted distal source credibility would not be associated with content credibility was examined. Multiple regression was also employed to test the perceived credibility of the distal source (the perceived trustworthiness of the distal source and the perceived expertise of the distal source) and the perceived credibility of the proximal source (the perceived trustworthiness of the proximal source and the perceived expertise of the proximal source) as predictors of the retweeted content credibility. Table 8 reports the statistics associated with this analysis. The model, F (4, 58) = 9.78, $Radj^2 = .362$, $p < .0001$, indicates that perceived trustworthiness of the proximal source, $\beta = .72$, $p < .005$, is a significant predictor of the retweeted content credibility. Thus, H8 was supported.

Table 7
Predictors of Retweeted Content Credibility

	β
Distal Source Trustworthiness	.17
Distal Source Expertise	-.19
Proximal Source Trustworthiness	.72***
Proximal Source Expertise	-.10

$F(4, 58) = 9.78$, Adjusted $R^2 = .36$, $p < .0001$.
***$p < .001$, *$p < .05$

H9 predicted that the perceived credibility of distal source would be positively associated with content credibility when the perceived credibility of the proximal source is high. The model, F (3, 59) = 19.67, $R_{adj^2} = .47$, $p < .0001$, found a significant main effect for the perceived trustworthiness of the proximal source, $\beta = .29$, $p < .05$, as well as a main effect for the trustworthiness of the distal source, $\beta = .32$, $p < .05$, on content credibility. However, no significant interaction was found, $\beta = -.07$, $SE = .04$, $t = -1.62$, $p = .11$. For source expertise, the model, F (3, 59) = 18.64, $R_{adj^2} = .46$, $p < .0001$, found not only a main effect for the perceived expertise of the proximal source $\beta = .20$, $p < .05$, but also a main effect for the perceived expertise of the distal source $\beta = .35$, $p < .005$. No significant interaction, however, was found, $\beta = -.02$, $p = .87$. Thus, H9 was not supported.

According to H10a, bandwagon cues are predicted to influence content credibility, content liking, and behavioral intentions through perceived source trustworthiness. The results showed that there is no significant indirect effect of bandwagon cues on content credibility ($B = .08$, 95% CI from -.10 to .52), content liking ($B = -.08$, 95% CI from -.62 to .14), or behavioral intentions ($B = -.12$, 95% CI from -1.11 to .14). Thus, H10 was not supported.

Similarly, there was no significant indirect effects of authority cues on content credibility (*B* = .01, 95% CI from -.40 to .41), content liking (*B* =.01, 95% CI from -.34 to .48), or behavioral intentions (*B* = .01, 95% CI from -.66 to .62). Thus, H10b was not supported.

Unexpectedly, a significant indirect effect of authority cues on retweeted content credibility, which is mediated by perceived trustworthiness of the distal source, was found (*B* = -.36, 95% CI from -.78 to -.02). This result shows a comparison effect between the proximal source and distal source. In other words, when a high authority source retweets messages from a medical doctor, the distal source becomes less authoritative in comparison, which leads to reduced credibility of the content.

The same analysis was performed with data excluding those who failed manipulation-check items (N = 35). The effects of authority, bandwagon, and source proximity cues on the perceived credibility of the content, content liking, the perceived credibility of the proximal source, the perceived credibility of the distal source, and behavior intentions remained the same. Specifically, the study found significant three-way interaction effects on perceived credibility of content, $F(1, 41.23) = 19.99$, $p < .0001$, the perceived trustworthiness of the source, $F(1, 31.23) = 7.87$, $p < .01$, the perceived expertise of the source, $F(1, 21.44) = 10.85$, $p < .005$, and behavior intentions, $F(1, 21.44) = 10.85$, $p < .005$, while showing the same pattern for the means. The results also found significant three-way interaction effects on content liking, $F(1, 40.08) = 6.71$, $p < .05$, and the perceived trustworthiness of the distal source, $F(3, 31) = 2.15$, $p < .05$, which were marginally significant before, with the same pattern of the means. There was also a marginally significant three-way interaction with the perceived expertise of the distal source, $F(3, 31) = 2.02$, $p = .05$. When messages were retweeted, participants in the high authority conditions

perceived the distal source as being less credible ($M = 2.38$, $SE = 0.36$) than participants in the low authority conditions ($M = 3.39$, $SE = 0.35$). Since this analysis that excludes the data for the failed authority manipulation-check items also yielded the same pattern of results, it can be concluded that the ontological manipulation has the same effect regardless of the success or failure of accurately recognizing the source's authority.

In summary, the study results found a significant three-way interaction effect between authority, bandwagon cues, and source proximity cues on participants' perceptions of content credibility and content liking, behavioral intentions, source trustworthiness, and source expertise with interesting patterns of means. Specifically, for tweets from high-authority sources, higher bandwagon leads to higher perceived content credibility, behavior intention, and perceived source expertise, whereas for tweets from low-authority sources, higher bandwagon leads to lesser perceived credibility of the health content, behavior intention, and perceived source expertise. For retweets by a high-authority proximal source, however, higher bandwagon leads to lower perceived credibility of the content and behavioral intentions, whereas for retweets by a low-authority source, higher bandwagon leads to higher perceived credibility of the content and behavioral intentions. In the case of behavior intentions, when bandwagon is low, authority did not make any difference. These study findings also show that for tweets, authority does not seem to have an impact on content liking or the perceived trustworthiness of the source when bandwagon cues are high, whereas higher authority leads to lesser content liking and perceived trustworthiness of the source when bandwagon cues are low. For retweets, however, the opposite result was found, such that authority makes no difference on content liking and the perceived trustworthiness of the source when a low bandwagon source retweets; however, a low authority

source leads to higher content liking and perceived trustworthiness of the source in the presence of high bandwagon. A marginally significant main effect for authority on the perceived trustworthiness of the distal source was also found, such that retweets from a high authority source lead to lower perceived trustworthiness of the distal source, whereas retweets from a low authority source lead to higher perceived trustworthiness of the distal source. The study results also show that content credibility was significantly associated with higher perceived expertise of the proximal source when messages were tweeted. In the retweet condition, however, the perceived trustworthiness of the proximal source was a significant predictor of content credibility. A significant indirect effect of authority cues on retweeted content credibility, which is mediated by the perceived trustworthiness of the distal source, was revealed such that when a high authority source retweets, the distal source becomes less authoritative in comparison, leading to reduced content credibility.

Chapter 4

Discussion

The findings of this study demonstrate that interface cues on Twitter interact with each other in influencing users' perceptions of health content in a microblogging environment. The three-way interaction effect of authority, bandwagon, and source proximity cues made a difference to content credibility, content liking, behavioral intentions, the perceived credibility of the proximal source, and the perceived credibility of the distal source, whereas each cue alone did not show a significant main effect. The study results might be due to the unique characteristics of Twitter, which allows users to be simultaneously exposed to authority cues through user names, bandwagon cues through the number of followers, and source proximity cues through tweet and retweet. Additionally, this study's results imply that no cue can be overlooked in Twitter.

This study extends Sundar and Nass' (2001) source typology by applying source proximity cues based on visible sources to the microblogging platform. Consistent with the results of previous studies (Dou, et al., 2010), the findings of this study also demonstrate that the visible source has an impact on the original source, which influences the perceived credibility of the content. In particular, through the indirect effect of visible source authority on content credibility, which is mediated by the perceived trustworthiness of the original source, this study discovered that high authority of the visible source tends to lower perceived trustworthiness of the original source and leads to lesser perceived content credibility.

The Elaboration Likelihood Model of persuasion (ELM) (Petty & Cacioppo, 1981, 1986) posits that individuals use two different types of information processing—systematic processing

and heuristic processing—when they judge information. We are more likely to cognitively elaborate judgment-relevant information when we activate systematic processing, whereas we are more likely to evaluate information based on a peripheral cue (i.e. source credibility) when we engage in heuristic processing. In the latter scenario, the heuristic-systematic model (HSM) (Chaiken, 1980, 1987; Chaiken, et al., 1989) suggests that we rely primarily on mental shortcuts (for evaluating information based on memory) as heuristic processing (Chaiken, 1980). This heuristic processing would lead individuals to think that a message is more credible when it comes from an expert or is endorsed by many people (Chaiken & Maheswaran, 1994). In his MAIN model, Sundar (2008) refers to these as "authority heuristic," triggered by authority cues on the digitial media interface, and bandwagon heuristics, triggered by bandwagon cues of other-user endorsment, respectively.

Given the simultaneous presence of multiple cues in many contexts, previous studies (Chaiken & Trope, 1999; Sundar, et al., 2007) have proposed a cue-cumulation effect on receiver processing of the information. Under this formulation, heuristics can be triggered by all cues, which in turn lead to an additive effect and boost the perceived credibility of the content. For instance, if two positive cues are available, the perceived credibility of the content would be higher than when just one positive cue is available. The findings in the current study lend support to this prediction. Specifically, when a high authority and high bandwagon source tweeted, participants perceived the content and source to be more credible. However, when there was misalignment between two heuristic cues (i.e. high authority and low bandwagon/low authority and high bandwagon), users' perceptions of both source and content credibility diminished. This result implies that one particular cue is not superior to other cues, at least in Twitter. In other

words, individuals may simultaneously use all cues available for information judgment. This also suggests that the consistency between heuristic cues may be also an important factor that can influence users' online information processing.

The HSM model also argues that heuristic and systematic processing may co-occur with various types of hypothesis—additivity, biased, and attenuation hypotheses (Chaiken, et al., 1989). In particular, as an attenuation hypothesis, if one heuristic cue (i.e. high authority) is not congruent with other available judgment-relevant information, the systematic processing tends to kick in and attenuates the effect of the heuristic cue (Chen & Chaiken, 1999). Chaiken et al. (1989) also stated that when systematic processing activates, heuristic cue effects often lessen.

This attenuation hypothesis on the HSM model may account for the current study results of the three-way interaction effect between authority, bandwagon cues, and source proximity cues on content credibility. We found that content credibility was higher when a high authority and high bandwagon source tweets messages compared to when the same source retweets messages. This implies that when they receive tweets from the high authority and high bandwagon source, participants might use heuristic processing based on authority and bandwagon cues for evaluating the credibility of the content and that of the source. In other words, participants might rate the perceived credibility of the source and content more highly solely because the source is a medical doctor with many followers. On the other hand, the lower rating for retweets from the same high authority and high bandwagon source implies that participants might use heuristic processing first when they receive retweets from a medical doctor having many followers. Then, participants might have high expectations about the retweets and read the messages very carefully using systematic processing since heuristic

processing can lead individuals to expect messages to be more credible when an expert sends the messages (Chaiken & Maheswaran, 1994). However, the health content that participants received was highly controversial and may not have met their expectation. It could have been enough to have a negative impact on participants' appraisal of source credibility and content credibility. Moreover, based on the attenuation hypotheses, from the moment systematic processing activates the heuristic cues, a medical doctor having many followers did not have any impact on content evaluation. This result implies that individuals may perceive tweets and retweets differently by activating different routes—heuristic processing for tweets and heuristic processing first then systematic processing for retweets. The retweet cue itself could be an important source cue, altering the reader to the presence of multiple layers of sourcing and thereby triggering a more systematic approach to the content being communicated.

Other study findings—namely, the main effect for authority on the perceived trustworthiness of the distal source and the indirect effect of authority on content credibility, which is mediated by the perceived trustworthiness of the distal source—also support the explanation of the systematic processing on retweets. The results revealed that when a low-authority source retweets, the perceived trustworthiness of the distal source is higher (because the distal source is a doctor), which in turn leads to higher perceived credibility of the content. This result also implies that retweeted messages may be perceived as being verified messages. In Twitter, in general, retweeted messages are something interesting and popular. Namely, the fact that users retweet others' messages makes those messages more credible. In this sense, in Twitter, similar to the number of followers, retweets can be perceived as a bandwagon cue, especially when it comes to evaluating the credibility of the distal source.

Interestingly, the study also revealed that tweets are also rated higher in content credibility when low authority sources with fewer followers tweeted. Based on the HSM, this result should be opposite since the two cues, authority and bandwagon, are both low. Thus, this result may have occurred due to the unique characteristics of Twitter, which allows users to have a follower-friend relationship. In particular, this result might be explained through an exclusiveness effect. In other words, participants in low authority and low bandwagon conditions might perceive themselves to be an exclusive follower for the source among a select few followers, which in turn leads them to rate the perceived content credibility higher. The reason why retweets were rated lower in perceived credibility of content and perceived expertise of source may be the same as that of a high authority and high bandwagon source. In other words, since their expectation of the source's retweets was high, they read the messages carefully (i.e., systematic processing), which leads to lower perceived credibility of the content.

Another interesting finding is that the patterns of means for content liking are quite different from that for the perceived credibility of content. The data indicate that when a high bandwagon source tweets, authority does not matter for content liking, whereas when a low bandwagon source tweets, high authority leads to lesser content liking. This result is consistent with Sundar and Nass (2001), who found that when other users (others as source) select online news stories, content liking scored higher than when news editors (high authority source) choose them. Thus, this result implies that bandwagon cues are somewhat more influential for individuals' perception on content liking.

This study's findings have significant practical implications in health communication. First, the results of this study demonstrate how people evaluate online health information and

adopt the information for behavioral changes. Our findings suggest that health planners should pay close attention to all authority, bandwagon, and source proximity cues when they promote behavioral intentions with accurate health information through Twitter. Since health planners are high-authority sources, it is critical for them to attract many followers with various methods rather than simply tweeting health information. In addition, the study results also suggest that health planners need to disseminate health information through tweets rather than retweets since the study results show that for a high-authority source, the retweet function is likely to have a negative impact on content credibility.

The results of this study also have implications for professionals who want to disseminate health information through Twitter. Our findings suggest that tweeted health information and retweeted health information might be perceived differently depending on the source of content. Thus, it is recommended that professionals who just started using Twitter and have only a few followers try to retweet other source's health related messages rather than to tweet. After becoming a more credible source by increasing the numbers of followers, professionals need to focus on tweeting rather than retweeting. This strategy might be helpful not only to increase the number of followers but also to disseminate health information that is received well.

Limitations

The current study has several limitations. First, this study lacks external validity since it only used health content as a study stimulus. Since it is possible that other types of content may lead to different results, this study's findings may not be generalizable to other contexts.

Also, since this study recruited undergraduate students rather than actual Twitter users as participants, it may not be generalizable to the broader population. There might be differences between Twitter users and non-Twitter users or even between power users and regular users when they process information on Twitter. Further, users from different demographics might perceive the information on Twitter differently.

Future Studies

The current study used only weight loss content as a stimulus. However, today, you can easily find various types of health content, from substance abuse to cancer screening, on Twitter. Moreover, it is also common to see tweets or retweets regarding advertising and promotion in Twitter. Thus, future studies should investigate how individuals process other types of health as well as non-health content that appear on Twitter. In addition, the distal source for this study was consistant in all conditions as a medical doctor. However, it is possible that a low-authority distal source might negatively influence the proximal source, which could lead to lower content crediblity. Thus, it would also be beneficial for future studies to examine how different types of distal sources have effects on content credibilty and proximal sources.

Conclusion

In conclusion, this thesis demonstates the complex interplay of interface cues relating to sources purveying health information via the microblogging platform of Twitter. In addition to investigating the effects of authority and bandwagon in this new medium, this study operationalizes yet another source cue, namely source proximity, by conceptually distinguishing

between tweets and retweets. By showing systematic differences between tweets and retweets, this thesis empirically verifies the concept of source-layering in online media, and shows that users are quite cognizant of both visible sources and distal sources when processing information from a Twitter stream. This awareness appears to translate into their perception of both source and content of tweets. Results show not only that Twitter users pay attention to source cues, but indeed. Thus, this study has the potential to explore and even extend traditional communication models and theories as well as newer communication models and theories to the microblogging platform, as this becomes an increasingly pervasive vehicle for users to obtain, provide, and share information.

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Appendix A
(Questionnaire)

Part 1 (Day 1)
1. Introduction
All you have to do is follow these very simple steps:

- Sign up to follow a person today.
- Sign up to follow the researcher of this study today.
- You will receive no more than six tweets/retweets from the person during this week.
- You will need to periodically check your twitter feeds because you will be sent a tweet that asks you to fill out a questionnaire. The tweet will say: "Please participate in the Twitter study @ http://...."
- You have the extra credit if you finish two different questionnaires during the course of this study. Not to worry, both are short questionnaires.
- You will obtain only one tweet from the researcher to fill out each questionnaire. There will be only two such occasions during the week. No more, no less.

Also, please note that you must be 18 years old or older to participate.

[Pre-questionnaire]
Do you have a Twitter account? That is, have you registered on Twitter.com?
Yes/ No

2. [Follow Experimental Source]
Please visit the following Twitter page by clicking the link below and sign up to follow the person.
Please note that in order to participate in this study, you MUST FOLLOW the person. Before clicking the link below, please read the following instructions carefully:

1) Please follow the person.
2) After following the person, please read all of the tweets on the Twitter page.
3) After reading all of the tweets, please make sure you close the Twitter page and come back to this page.
Please click the following link: https://twitter.com/Paul_Morris_MD

3 [Follow researcher]
Please visit the following Twitter page by clicking the link below and sign up to follow the researcher of this study. Please note that to participate in this study, you MUST FOLLOW the researcher. Before clicking the link, please read the following instructions carefully:

1) Please follow the researcher.
2) After following the person, please come back to this page.
Please click the following link: http://twitter.com/PSU_Researcher

4. Email
Please write down your email address so the researcher can have a record of who participated. The researcher will also send you an email to fill out the questionnaire later. Email address:

5. <Pre-study Twitter behaviors >

5-1 When did you first start using Twitter?
① Today ② Within the last six months ③ A year ago ④ Two or three years ago
⑤ more than three years ago

5-2 How many followers do you have?
_____

5-3 How many people are you following?
_____

5-4 About how often do you check your Twitter feed?
① Several times a day
② About once a day
③ 3 to 5 days a week
④ 1 to 2 days a week
⑤ Every few weeks
⑥ Less often
⑦ Don't know
⑧ Never

5-5 How frequently do you tweet?
① Several times a day
② About once a day
③ 3 to 5 days a week
④ 1 to 2 days a week
⑤ Every few weeks
⑥ Less often
⑦ Don't know
⑧ Never

<Facebook Usage>

How many Facebook friends do you have?

_____

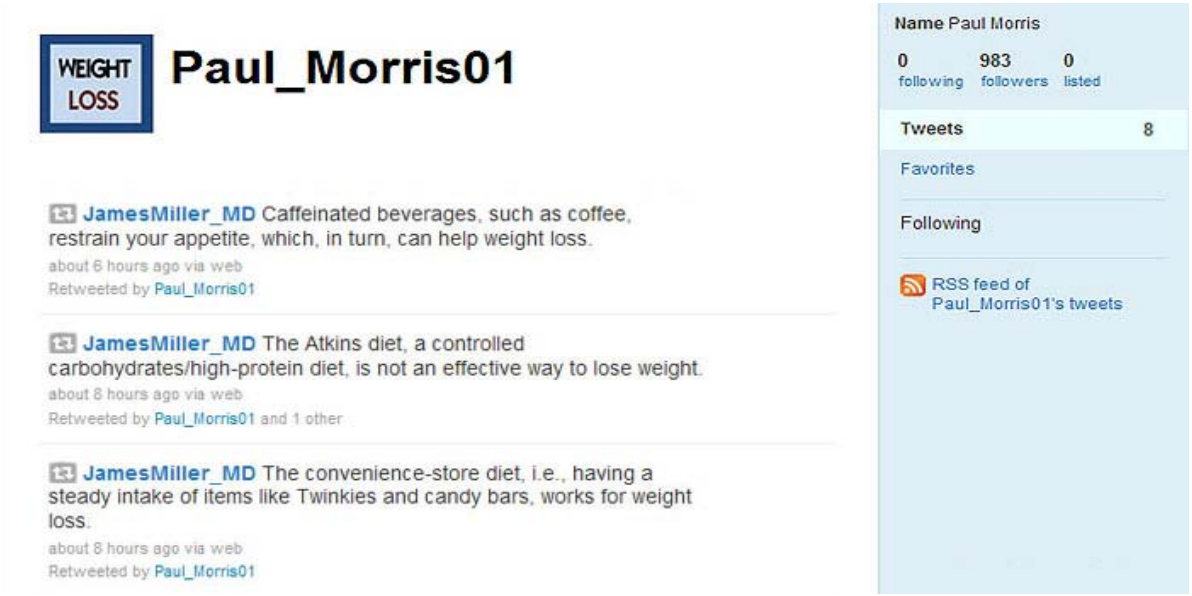
About how often do you visit Facebook?
① Several times a day
② About once a day
③ 3 to 5 days a week
④ 1 to 2 days a week
⑤ Every few weeks
⑥ Less often
⑦ Don't know

Reminder
Please keep an eye on your Twitter feed because you will be sent two separate tweets from the researcher asking you to fill out the questionnaire. The tweet will say: “Please participate in the Twitter study @ http:// ….. . You will also receive two separate reminder emails from the researcher asking you to fill out the questionnaire before session 2 and session 3.

Thank you.

Part 2 (After participants receive three tweets/ retweets from experimental sources)

Newly Posted Tweets/Retweets
Before participating in this part of the Twitter study, we want to get a sense of whether you came across the following newly posted health messages by the person whom you signed up to follow in Session 1 during the past few days:



Did you see the health messages in your Twitter feed during the last 48 hours?
0Yes /1No

Would you say that you recall coming across just one, just two, or all three of these health messages during the past few days?

____None of them
____Just one of them
____Just two of them
____All three of them

Please check one of the following two options: The health messages which you read were

(a) written by the person whom you are following. (0)
(b) written by someone else, but forwarded by the person whom you are following. (1)

Content Credibility
Please indicate how well the following words describe the health messages that you read. *

	Describes Very						Describes Very

	Poorly						Well
Believable	1	2	3	4	5	6	7
Accurate	1	2	3	4	5	6	7
Biased	1	2	3	4	5	6	7
Objective	1	2	3	4	5	6	7
Fair	1	2	3	4	5	6	7
Sensationalistic	1	2	3	4	5	6	7
Clear	1	2	3	4	5	6	7
Comprehensive	1	2	3	4	5	6	7
Concise	1	2	3	4	5	6	7
Disturbing	1	2	3	4	5	6	7
Important	1	2	3	4	5	6	7
Informative	1	2	3	4	5	6	7
Insightful	1	2	3	4	5	6	7
Relevant	1	2	3	4	5	6	7
Timely	1	2	3	4	5	6	7
Well-Written	1	2	3	4	5	6	7
Coherent	1	2	3	4	5	6	7

Liking of Content

Please indicate how well the following words describe the health messages that you read.

	Describes Very Poorly						Describes Very Well
Boring	1	2	3	4	5	6	7
Lively	1	2	3	4	5	6	7
Enjoyable	1	2	3	4	5	6	7
Interesting	1	2	3	4	5	6	7
Pleasing	1	2	3	4	5	6	7

Behavior Intention

Please indicate the likelihood of each of the following:

1) I would like to act on the advice that is offered in the messages. *

Extremely unlikely						Extremely likely
1	2	3	4	5	6	7

2) I would recommend the advice from this Twitter account to others. *

Extremely unlikely						Extremely likely

1	2	3	4	5	6	7

3) I would retweet the health information to my acquaintances. *

Extremely unlikely						Extremely likely
1	2	3	4	5	6	7

Manipulation Check for Authority Cue
Please identify who tweeted the health messages to which you were exposed.
A medical doctor / A layperson

MC for Bandwagon cue
Do you think the Twitter source whom you followed is popular? *
Not at all 1 2 3 4 5 6 7 Very Popular

How many people would you say trust the Twitter source whom you followed? *
Very Few People 1 2 3 4 5 6 7 A Lot of People

MC for Proximate Source Cue
Please identify who originally tweeted the health messages that you read.*
1 James Miller
2 Paul Morris
3 David Anderson
4 Harold Gale

Please identify whether the original source is a medical doctor or a layperson. *
0 A medical doctor
1 A layperson

Trustworthiness of the Source
Thinking back to the health messages to which you were exposed via the Twitter account of the person whom you signed up to follow in Session 1, would you say that the source of the tweet (Paul Morris, MD) is:

Trustworthiness of the Distal Source
Thinking back to the health messages to which you were exposed via the Twitter account you signed up to follow in Session 1, would you say that the source of the tweets (James Miller, MD) you received is:

Trustworthiness of the Proximate Source
Thinking back to the health messages that you read via Paul Morris, MD's Twitter account, would you say that the person (Paul Morris, MD) whom you signed up to follow in Session 1 is:

Undependable	1	2	3	4	5	6	7	Dependable
Dishonest	1	2	3	4	5	6	7	Honest
Unreliable	1	2	3	4	5	6	7	Reliable
Sincere	1	2	3	4	5	6	7	Insincere
Untrustworthy	1	2	3	4	5	6	7	Trustworthy

Expertise of the source
Thinking back to the health messages to which you were exposed via the Twitter account of the person whom you signed up to follow in Session 1, would you say that the source of the tweet (Paul Morris, MD) is:

Expertise of the Distal Source
SourceTrust] Thinking back to the health messages to which you were exposed via the Twitter account you signed up to follow in Session 1, would you say that the source of the tweets (James Miller, MD) you received is:

Expertise of the Proximate Source
Thinking back to the health messages that you read via Paul Morris, MD's Twitter account, would you say that the person (Paul Morris, MD) whom you signed up to follow in Session 1 is:

Not expert	1	2	3	4	5	6	7	Expert
Experienced	1	2	3	4	5	6	7	Inexperienced
Unknowledgeable	1	2	3	4	5	6	7	Knowledgeable
Unqualified	1	2	3	4	5	6	7	Qualified
Unskilled	1	2	3	4	5	6	7	Skilled

Age
14 [AGE] What year were you born?(YYYY)
Please write your answer here:

Media Consumption
15 [11]How many minutes on average do you spend on the Internet on a given day? (____hours ____ minutes) *

16 [11-2]How many minutes on average do you write tweets or retweet on Twitter in a given day? (____hours ____ minutes)

< During-study Twitter behavior>
About how often did you check your Twitter feed during the past 48 hours?
① Several times a day
② About once a day
③ 3 to 5 days a week

④ 1 to 2 days a week
ᘓ Every few weeks
ᨐ Less often
ᨒ Don't know
ᨑ Never

5-5 How frequently did you yourself tweet during the past 48 hours?
① Several times a day
② About once a day
③ 3 to 5 days a week
ᨐ 1 to 2 days a week
ᘓ Every few weeks
ᨐ Less often
ᨒ Don't know
ᨑ Never

Atti toward Twitter
What best describes your attitude toward Twitter?

Dislike	1	2	3	4	5	6	7	Like
Unfavorable	1	2	3	4	5	6	7	Favorable
Positive	1	2	3	4	5	6	7	Negative
Bad	1	2	3	4	5	6	7	Good

Ethnicity
What ethnic group do you belong to? *
Please choose only one of the following:
1 Asian
2 Pacific Islander
3 African American
4 Caucasian
5 Hispanic
6 Other

Education Level
What is the highest education level you have attained? *
1 Freshmen
2 Sophomore
3 Junior
4 Senior
5 Graduate

Gender
What is your gender?
0 Male/1 Female

Previous Exposure
Have you seen this health content before? *
0 Yes
1 No

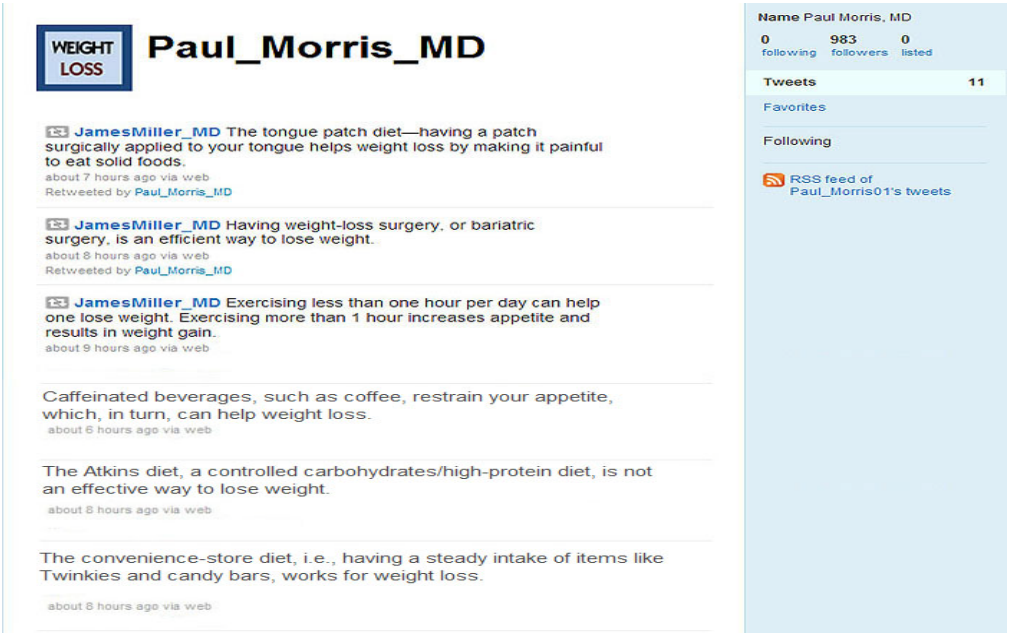
Remind
Please remember that you will need to periodically check your Twitter feed because you will be sent a tweet from the researcher asking you to fill out the questionnaire. The tweet will say: "Please participate in the Twitter study @ http:// ….." You will also be asked to make sure that you read all of the new health messages posted by the person before you fill out the questionnaire later.
Thank you.

Part3 (Day 5: After participants receive three tweets/ retweets from experimental sources)

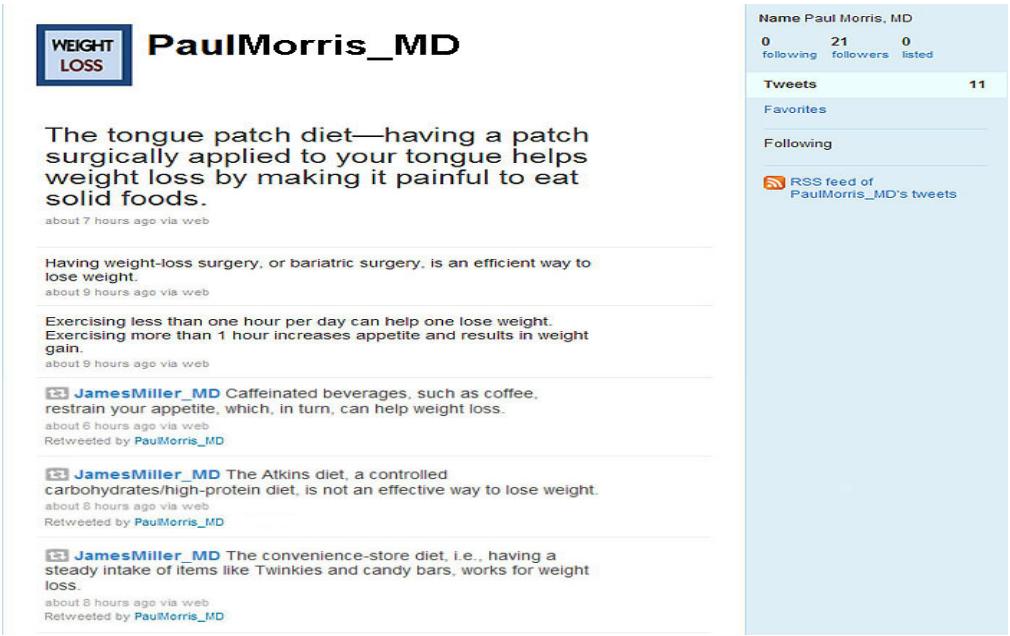
Part 3 questionnaire is the same as Part 2 questionnaire except the remind part in the END URL.

Appendix B
(Experiment stimulus)

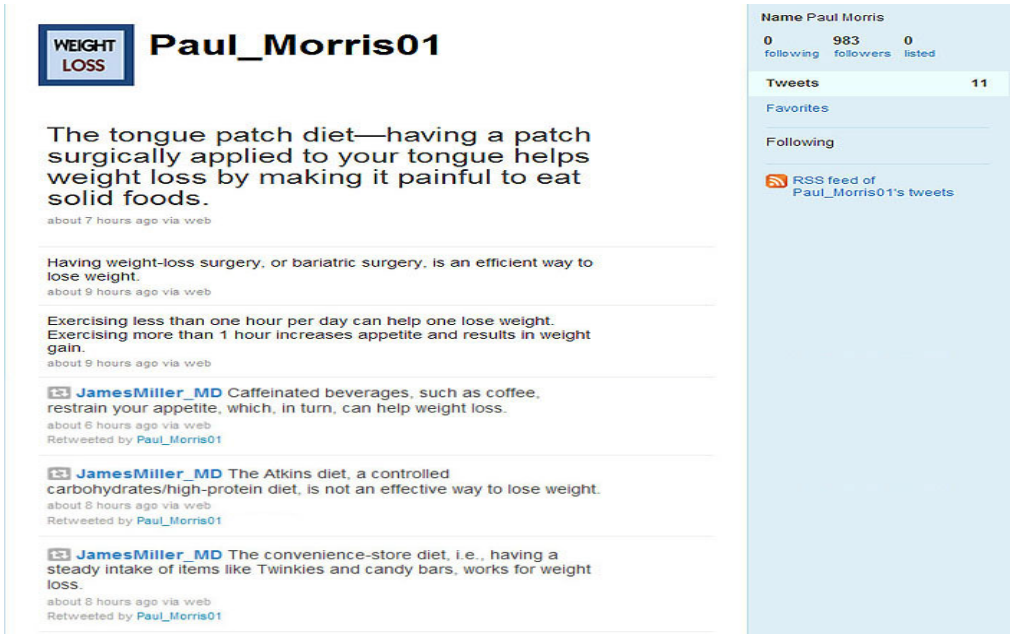
1. High Authority, High Bandwagon Condition



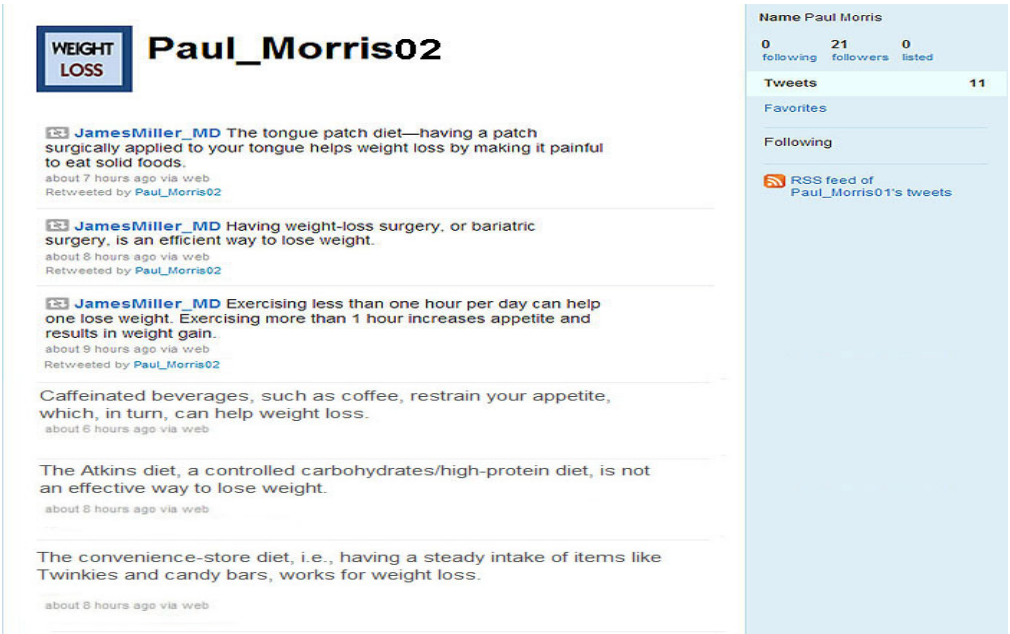
2. High Authority, Low Bandwagon Condition



3. Low Authority, High Bandwagon Condition



4. Low Authority, Low Bandwagon Condition



Appendix C
(Weigh Loss Content)

Session 3 (Participants received three tweets/retweets depending on conditions)	The tongue patch diet—having a patch surgically applied to your tongue helps weight loss by making it painful to eat solid foods.
	Having weight-loss surgery, or bariatric surgery, is an efficient way to lose weight.
	Exercising less than one hour per day can help one lose weight. Exercising more than 1 hour increases appetite and results in weight gain.
Session 2 (Participants received three tweets/retweets depending on conditions)	Caffeinated beverages, such as coffee, restrain your appetite, which, in turn, can help weight loss.
	The Atkins diet, a controlled carbohydrates/high-protein diet, is not an effective way to lose weight.
	The convenience-store diet, i.e., having a steady intake of items like Twinkies and candy bars, works for weight loss.
Session 1 (These tweets were posted in the experimental Twitter pages. Participants did not fill out questionnaire for these tweets)	Contrary to what you might think, a high-carb diet is much better than a high-protein diet when trying to lose weight. (This tweet will be posted on the day when I begin collecting data)
	By skipping breakfast, you can reduce your calorie intake. (This tweet was posted on Jan. 26)
	Smoking helps weight loss since it suppresses your appetite. (This tweet was posted on Jan. 24)
	Stomach balloon surgery--inserting a balloon in your stomach--will make you have a sense of fullness all the time and help you lose weight. (This tweet was posted on Jan. 22)
	Late night eating does not necessarily lead to weight gain. (This tweet was posted on Jan. 21)