# Using Interface Cues in Online Health Community Boards to Change Impressions and Encourage User Contribution

**Hyang-Sook Kim**
Media Effects Research Laboratory The Pennsylvania State University, University Park, PA 16802 hxk256@psu.edu

**S. Shyam Sundar**
Media Effects Research Laboratory The Pennsylvania State University, University Park, PA 16802 sss12@psu.edu

## ABSTRACT

Online health message boards have become popular, as users not only gain information from other users but also share their own experiences. However, as with most venues of user-generated content, there is need to constantly make quality evaluations as one sifts through enormous amounts of content. Can interface cues, conveying (1) pedigree of users posting content and (2) popularity of the posted content, help new users efficiently make credibility assessments? Furthermore, can the assignment of these same cues to their own posts serve to motivate content generation on their part? These questions were investigated in a 2-session between-subjects experiment (N = 99) with a prototype of a message-board that experimentally varied interface cues, and found that popularity indicators are more influential than pedigree indicators for both evaluation of existing content and contribution of new content. Findings also suggest theoretical mechanisms— involving such concepts as perceived authority, bandwagon effects, sense of agency and sense of community—by which cues affect user experience, providing rich implications for designing and deploying interface cues.

## Author Keywords
Authority cues, Bandwagon cues, Heuristics, Sense of Agency, Sense of Community, User Contribution, Health Community Boards

## General Terms
Design, Experimentation, Human Factors, Theory

## INTRODUCTION

Kai recently signed up for membership on a health community website to obtain information about dietary supplements for weight training. Using his intuition, he clicked a post on the message board that was already viewed by many users. He also clicked a post that had many replies, although it was not read by as many users as the first post. While reading these posts, he found that some users had different membership statuses than his own, which was "registered user." Some posts came from "senior veterans." Other comments came from "junior members" who failed to receive much attention [18]. Kai tended to trust posts with greater number of views. Whenever he came across a post or reply that he thought was credible, he emailed it to a friend who was also looking for the same information about dietary supplements. After several weeks into his membership on the site, Kai thought about posting a review of a product that he used for his weight training. However, he was somewhat hesitant to do so because he was not sure how other users would react—whether they would read his post, find it helpful, post a reply, give feedback, and/or forward his post to others—given that he is only a "registered user."

As this scenario illustrates, online information sharing requires users to actively monitor existing content in the forum of interest before they contribute content themselves [6]. In emphasizing the critical role of users as active sources in online communities, studies conducted with recommendation systems [5, 8, 26, 28] and knowledge sharing [10] have found that certain features of the technology serve to stimulate user contributions

to online communities. A set of visual cues (pertaining to membership status, # of views, # of replies, etc.) can not only be quite suggestive of the quality of the underlying information to other users, but also motivate subsequent actions, such as adding comments to an existing thread or initiating a new thread in a message board.

However, most studies on online information sharing have only investigated the effectiveness of such cues on one part of sharing activities—either user evaluations of content [8, 26, 28] or issues related to under contribution [5, 10], but not both. Given that online community users not only review information on message boards (and perhaps forward it to others) but also contribute information, it is important to examine how technological features, in the form of interface cues, stimulate both sides of the information-sharing process in the same online community.

With this in mind, the goal of the current study is to widen the scope of previous research in online information sharing by raising the following questions: How influential are interface cues in determining community users' evaluations of content? How likely are they to motivate user contribution to the community? Is there a certain combination of cues that promotes or discourages user activities in online community websites? We probed these questions in an online health community, arguably the most appropriate context for studying both reception and contribution of user-generated content.

## THEORETICAL BACKGROUND

Fundamentally, cues on the interface attempting to convey the value of the underlying information are really cues about the quality of the source of the information [14]. In user-generated media, all receivers of content are also potentially sources of content, thus turning traditional models of communication on their head by blurring the distinction between senders and receivers of communication [25]. Given the absence of established journalistic standards or brand-names associated with good information quality (e.g., New York Times, BBC), users are having to constantly assess the source credibility of other users who contribute content online. Therefore, by conveying the pedigree of information, interface cues essentially serve as "credibility markers" [12] of otherwise unknown sources in online forums. For example, membership status in the scenario described above tells the reader something about the source of the post. Interface cues about aggregated actions (e.g., # of views) or opinions (# of people who found this helpful) are really channeling the collective will of other users of the forum, thereby making them, in a way, the source of communication. These cues serve as endorsements and confer status on posts in the same way that traditional media gatekeepers sway their audiences toward certain news events over others, by using cues such as headline size and air time.

In sum, there are two types of source cues on Internet forums—those that convey source expertise (e.g., the number of posts contributed by this user in the past, along with compatible membership badges) and those that convey the source's following (e.g., number of views, replies, star ratings of helpfulness). These two species of cues are akin to a newspaper touting in its masthead the year that it was established and its current circulation size, respectively.

### Cues in Recommendation Systems

Several studies have examined the effects of interface cues pertaining to the value and quality of information through collaborative filtering systems in various communication settings. One study, using a mock-up of the Amazon.com site, found that two interface cues— star ratings and sales rank—had significant effects on participants' bandwagon perceptions. Statistical mediation analysis showed that the bandwagon perceptions explained why star ratings and sales ranks significantly affected purchase intentions [26]. A follow-up experiment showed that even the number of customer reviews served as a significant bandwagon cue signaling peer opinion [28].

Another study examined the effects of similar source cues—star ratings and sales volume—on users' decision making in an online bookstore [8]. The level of each source cue varied in the way that the star ratings were

manipulated in three group comparisons (Group 1: five stars vs. one star, Group 2: four stars vs. two stars, Group 3: three stars vs. three stars), while similar manipulations were applied to sales volume (9000 vs. 3000 books, 6000 vs. 3000 books, 3000 vs. 3000 books for each group, respectively). The study found that Group 1 showed the greatest gap in participants' willingness to purchase a book for both star ratings and sales volume, followed by Groups 2 and 3 [8].

Indicators of peer review in e-commerce sites are a form of online information sharing, where others' opinions often influence users' evaluation of specific content. Even though the information is cumulated using collaborative filtering technologies rather than by users reacting to each other (as often happens in a group bulletin board), the essential outcome of these indicators is the same: they help individual users make rapid judgments about the utility of the content with just a cursory, rather than an effortful, examination of the actual information underlying the content. Dual-processing models in social psychology explain this type of quick information processing based on heuristic activation [7]. The MAIN Model argues that individuals tend to rely on interface cues, such as sales volume, number of clicks, and star ratings, that trigger superficial judgment rules that are accessible in their mind. When website users notice bandwagon cues in an e-commerce site, they are likely to activate a heuristic like "If others think that this product is good, then I should, too." [24]. Extant research in HCI suggests that bandwagon cues lead website users to readily form attitudes and make evaluations about information on the site [27]. Therefore, the current study proposed the following hypothesis:

> *H1. Cues signaling greater popularity and helpfulness of information provided by other users will produce more positive user attitudes toward the information (H1a) and the website (H1b), leading to more intentions to forward the information (H1c) as well as increased perceptions of the bandwagon effect (H1d) and credibility (H1e) in a health message board as compared to cues signaling lesser popularity and helpfulness.*

Health message boards have become veritable hubs of user-generated content, not just because they offer vast potential for exchanging medical information and providing social support, but because "patient expertise" has increasingly become an accepted form of health communication [27]. This kind of peer-to-peer communication allows users to assess others' experiences in managing their own health, and will often need to ascertain the credibility of the person posting a given message. Source credibility can be particularly critical in health-related information [15].

However, little research has directly investigated the specific effects of interface cues in conveying source expertise in such collaborative systems. Instead, most of the previous studies have speculated about such effects in e-commerce settings [8 17, 26]. For example, Koh and Sundar [17] investigated the effects of source specialization on individuals' perceived trust as well as their purchase intentions in the context of e-commerce recommendations by simply labeling three different technology sources (i.e., web agent, website, and computer). They found that web agent specialization (i.e., Wine agent) yielded greater trust toward the agent and the site compared to a relatively generalist "E agent."

Clearly, interface cues impact individuals' perceptions of sources and the information that they provide, especially when they can readily signal source expertise. Dual-processing models also suggest that source credibility has a powerful cueing effect when presented along with expertise information [7]. Specifically, cues signaling expertise are called authority cues. These cues trigger a type of heuristic that allows individuals to readily "confer importance, believability, and pedigree to the content…and thereby positively impact its credibility" [24, p. 84].

Previous studies have examined the effects of authority cues on individuals' evaluations of information in recommendation systems. The power of other users as sources in collaborative filtering systems was demonstrated by Chen [8], who showed that other consumers' recommendations led to greater purchase intentions and trustworthiness than experts' recommendations, while the results were reversed for the perception of expertise in information provided by online bookstores. The mixed results with regard to these two credibility dimensions (trustworthiness vs. expertise) [12] indicate how important other users as sources are in collaborative filtering systems and how they gain authority in such settings. This concept can likely be

applied to health message boards in the same manner; namely, other users may exhibit source expertise that is deployed by interface cues such as member labels.

In most online venues, both authority and bandwagon cues coexist. So, how do individuals evaluate information if both types of cues are presented in the interface together? In a study that examined this question [28], participants who viewed a review page of a camera with a credible authority cue (i.e., a CNET.com seal of approval) showed greater purchase intention only when they did not have an outlying negative review by a user. This, along with other results from the study, suggests that the combination of authority and bandwagon cues in recommendation systems are effective when the information values conveyed by both cues are positive rather than mixed. Thus, the findings from previous studies and the propositions from dual-process models lead us to the following hypotheses:

> *H2. Cues signaling higher expertise of other users as sources in a health message board will result in more positive user attitudes toward the information (H2a) and the website (H2b), leading to higher intention to forward the information (H2c) as well as increased perceptions of authority (H2d) and credibility (H2e), compared to cues signaling lower expertise.*

> *H3. Users' psychological responses will be positive when the levels of both authority and bandwagon cues are higher than when they are inconsistent (i.e., higher authority cues + lower bandwagon cues or vice versa).*

Although forty-one percent of Internet users report reading health information posted by other users in online news groups, websites, and blogs, only six percent actually generate health information [13]. Even though under-contribution is so common, research has neglected to explore ways in which technological cues could be leveraged to motivate users to move from lurking to producing original content. What would happen if the participant himself/herself is the source and is given low or high authority status on the board and receives low or high bandwagon cues for his/her posts? By asking this, our study expands the investigation of the effects of cues beyond user evaluation and into the domain of knowledge sharing.


## Cues in Knowledge Sharing

Previous studies have probed users' motivations to contribute to online communities [30, 31] as well as the means by which to induce such motivations [5, 10]. Tedjamulia et al. listed eleven propositions in developing a model to explain the mechanisms behind information sharing in online communities [30]. They suggested different technological features conveying both authority and bandwagon cues, and argued that feedback (e.g., replies or comments on message boards) and visible reinforcements for source cues (e.g., membership seals, users' past activities/membership history or point rewards) are likely to constitute personal motivations for contributing content, such as self-efficacy, intrinsic motivation, need to achieve, and trust in the community. Ma and Agarwal also suggested that users' ranking/reputation and activity history, along with others' feedback, would positively impact user identity and therefore predict knowledge contribution [20]. Another study emphasized the relationship between users' motivations to enhance their reputation as well as tenure in an online community and their contribution to the site in terms of helpfulness and volume of their threads [31]. Although these studies hint at the importance of technological features on user motivations, they do not directly measure the effects of these features on user intentions to contribute.

Studies on under-contribution in online communities have tended to focus on increasing user motivation to solve this problem. Beenen et al. examined the effects of three different social-psychological considerations underlying users' intention to contribute to the website [5], and found that users' perceptions toward their unique membership and their specific goal-setting produced the most contributions.

Farzan et al. conducted a longitudinal study that deployed a reputational cue in an online employee community website that was likened to a Beehive [10]. The reputation cue was the image of a bee varying by point-based status classes (i.e., new bee, worker bee, busy bee, and super bee) among employees who used the site. The points were awarded to Beehive users based on their activities, such as uploading photos (5 points), updating

their profiles by adding text (10 points), and commenting on others' profiles (15 points). Log data from six weeks revealed that the point-based reputation cue system led to greater contribution to the community site when employees could review overall point details than when they could not. In particular, when the Beehive users were not able to review how their own and other top bees' status was determined (i.e., control group), their contributions significantly dropped after the fifth week. Beenen et al. [5] and Farzan et al. [10] have both provided empirical support for the motivational benefits of signaling authorship value for information sharing online. Therefore, we propose that imbuing authority to the user is likely to encourage knowledge sharing online. Our fourth hypothesis reflects this prediction:

*H4. A cue signaling higher expertise of the user himself/herself as a source in a health message board will produce more positive effects regarding the user's attitudes toward posting activities (H4a), intentions to post (H4b), sense of agency (H4c), and perceived empowerment (H4d) compared to a cue signaling lower expertise.*

It must be noted that the studies reviewed above did not explicitly examine *why* people respond positively to authority cues or other forms of encouragement, such as email reinforcements of membership uniqueness. A study on (the empowerment potential of) blogging identified mediators that attempted to explain the "why" question [23]. The experimenters manipulated two cues on the blog interface—the number of site visits and number of comments—which served to enhance their sense of agency and sense of community en route to empowering them psychologically. In particular, the more site visits they ostensibly received, the more interest in blogging they showed. The number of comments, however, produced mixed effects that were interdependent with the type of blogs (personal vs. filtering) and the number of site visits. Given that blog-interface metrics such as number of site-visits and number of comments are analogous to authority and bandwagon cues, we can anticipate a similarly positive attitudinal effect in the context of a message board. Therefore, we propose the following hypotheses for study.

*H5. Cues signaling the greater popularity and helpfulness of information contributed by the user him/herself as a source in a health message board will produce more positive effects regarding the participant's attitudes toward posting activities (H5a) and increased intentions to post (H5b), sense of community (H5c), and perceived empowerment (H5d), compared to those signaling lower levels of such values.*

*H6. Sense of agency and sense of community will explain the effects of authority and bandwagon cues, respectively, on persuasive outcomes via perceived empowerment with regard to online health information sharing.*

## METHODS

The current study employed two sessions, a week apart, of a 2 (authority cues high vs. low) x 2 (bandwagon cues high vs. low) fully-crossed factorial experiment to examine the effects of two source cues on both users' perceptions of a health community website and their intentions to contribute to the website, along with relevant psychological mediators. We developed a prototype of a health community website, modeled after Healthboards.com, as described in the Stimulus section below. Healthboards.com has recorded a large amount of user visits for a variety of health topics [3]. Two types of users contribute to Healthboards.com— "Posters" are users who ask a question about health issues, and "repliers" answer the question. These activities of both posters and repliers create a thread, which is a series of the conversations on the message board.

Ninety-nine undergraduates at a large US university participated in the study. The majority of the participants were females, comprising 80% of the sample. In fact, more females seek health information online than males [13].

## Overview of Session 1

*Stimulus.* The experimental website, Health Q&A, was designed to have two layers of web pages, and participants were instructed to review one of the threads. The main page of the website included the topic of the bulletin board (i.e., fitness and nutrition – one of the most popular topics among college students) [4], the title and author information of the posts and four different bandwagon cues (see Figure 1). On this main page, participants clicked on the first thread that they were asked to read for the study. Only this target thread from the thread list in the main page was clickable, while the other threads were de-activated. When they clicked on the title of the thread on the main page, they were taken to the next layer, where they were able to read an original question posed by a user at the very top, followed by replies by other users.
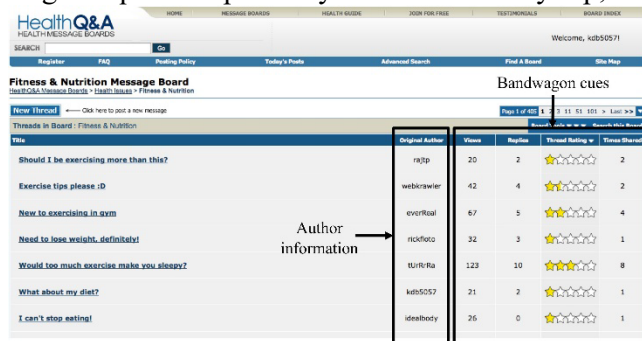


**Figure 1. Screen capture of the main page of the experimental website**

*Independent Variables.* Six different source cues constituted independent variables of Session 1. Two authority cues signaled repliers' level of source expertise in the online community. Each replier participating in the thread had a seal of membership status and a number-of–posts value. The high authority condition had 1) "online guru" as the membership seal with a corresponding image and 2) more than 100 posts (see Figure 2).

On the other hand, the low authority condition had 1) "member" as the membership seal and 2) fewer than 10 posts (see Figure 3). However, authority cues for the user who posted the question were identical across conditions— five posts and "member" as the membership seal.
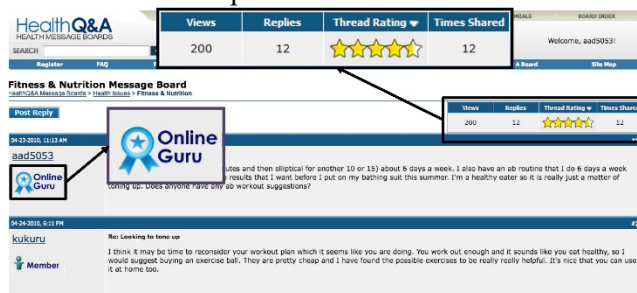


**Figure 2. Screen capture of the stimulus website with interface cues for the thread page of the high authority x high bandwagon cues experimental condition**

Another set of four metrics served as bandwagon cues: number of views (200 vs. 21), number of replies (12 vs. 2) that the thread had, number of times that the thread was shared (12 vs. 1), and a star rating of the thread's helpfulness (four-and-half stars vs. one star) (see Figures 2 and 3). These cues were indicators of other users' activities on the message board and thereby served to inform participants about other users' evaluations of the particular thread they read on this message board. The thread included identical content (i.e., the original question and core two replies) across all experimental conditions except for the agreement style of ten replies (e.g., I definitely agree with *Titchou*!) in high bandwagon conditions.
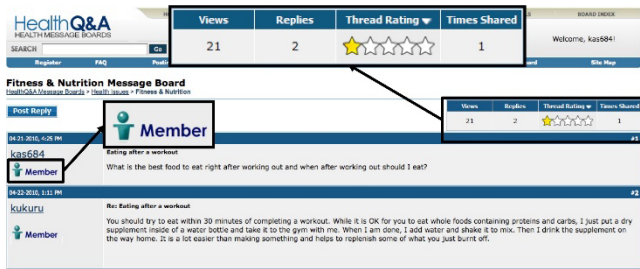
**Figure 3. Screen capture of the stimulus website with interface cues for the thread page of the low authority x low bandwagon cues experimental condition**

Seven-point scales were used for the measured variables throughout the study.

*Manipulation Check Items.* Participants were asked to rate their perception of the number of views that the thread had, on a scale anchored from "very few" to "a lot." The other three bandwagon cues (i.e., number of replies, number of times the post was shared, and the star ratings of the thread's helpfulness) and one authority cue manipulation (i.e., number of posts) were checked using similar questions. The manipulation of the other authority cue was assessed by a question in which participants indicated the membership seal—either online guru or member—and their perception of the seal on a scale anchored from very low to very high. The manipulation of the other authority cue was assessed by their perception of the seal on a scale anchored from very low to very high authority. These manipulation-check items were administered in both sessions.

*Mediating Variables.* Perceived authority measured participants' feelings toward the members who posted in the thread using a scale ("describes very poorly" to "describes very well") with 11 adjectives (e.g., reliable, informed, qualified; α = .93) [21]. In addition, perceived bandwagon was measured by seven items, each on a scale anchored from very unlikely to very likely. The items asked participants to report their opinions on the thread regarding its popularity and helpfulness [26] (e.g., How likely is it that other people would think this is a good thread?; α = .82). Participants also reported their perceptions of credibility for both the website and its content (i.e., the thread). They indicated their impressions of the thread (α = .92) and the web pages (α = .94) that they read on a scale using nine different adjectives (e.g., insightful, trustworthy, accurate) [22].

*Dependent Variables.* Six statements measured participants' evaluation of the content using a Likert scale [19] (e.g., The content of this website is accurate; α = .83). Attitudes toward the website were measured by asking participants to indicate the appropriateness of 13 adjectives for describing the webpages that they read (e.g., appealing, useful, positive; α = .94) [16]. Lastly, their intention to forward the thread was measured using a scale (extremely unlikely to very much likely) consisting of three items (e.g., I intend to email this thread to people that I know; α = .97) [2].

*Procedure.* Upon arrival at the study lab, participants were instructed to sit in front of an individual laptop computer designated for them, which was identified by his/her school email account at the top of the main page of the stimulus website. Once participants finished the pre-questionnaire, they browsed the stimulus website and were instructed to click the first thread from the thread list on the main page. After reading the thread, participants were instructed to post a question about the given topic in the health message board (i.e., about fitness and nutrition) in order for them to participate in Session 2. Once they posted a question, they returned to the main page of the stimulus website and clicked their own posting, which appeared at the bottom of the thread list, as a means of exiting to the main questionnaire online. When the participants finished answering the main questionnaire, they were informed about Session 2 before they left the lab.

## Overview of Session 2

*Stimulus.* Researchers created html pages for each participant by changing the authority and bandwagon cues through the site's images and text. The images for Session 2 were identical to those used in Session 1. One

html file for the main page of each participant's study webpages included information about bandwagon cue manipulations. In addition, a research assistant, who was blind to the manipulation, crafted replies to the question posted by the participant on the message board during Session 1.

*Independent Variables.* Four bandwagon cue manipulations were identical to Session 1. The images of the bandwagon cues appeared on both main and thread pages of the participants' own study webpages. Twelve replies were also created, including two core answers to the original participant's question and ten replies in agreement with the core replies for the high bandwagon condition. The core answers adequately addressed the participants' inquiries because the research assistant generated answers by giving participants tips for what they wanted to know about fitness and nutrition in their question. In the low bandwagon cues condition, only two core replies were presented on the participant's thread page. This method of crafting replies allowed us to minimize content effects.

The thread page of each participant included one of the membership seals, Online Guru or Member, with the same images used in Session 1 for the authority cue manipulation. The other authority manipulation—number of posts—was not used in Session 2 due to the nature of the experiment (it would be impossible for participants to have a history of posting in this particular message board).

*Mediating Variables*. A total of 22 items asked participants to rate the likelihood of the outcomes from their activities, i.e., posting a question or potentially replying to the thread. All items were placed on a scale, ("not at all" to "a lot") [23]. Based on an exploratory factor analysis, two indices of sense of agency and community were created. Three items for sense of agency referred to one's competence, assertiveness, and confidence (e.g., I have control over my own voice; $\alpha = .71$), whereas 12 items for sense of community referred to one's expectations for interaction with other users in the network (e.g., It may well become very important to me to interact with others through this message board; $\alpha = .88$). Perceived empowerment was measured by assessing psychological dimensions of autonomy, control and sense of influence regarding participants' posting activities (e.g., I feel more autonomous, I can motivate other people to become more involved in health issues; $\alpha = .86$) [23].

*Dependent Variables*. Attitudes toward posting activities were measured by a scale ("describes very poorly" to "describes very well") consisting of six adjectives (e.g., good, beneficial, pleasant; $\alpha = .85$) [2]. Intention to post was measured by a 3-item index that asked participants about the likelihood of them engaging in future posting activities in online communities, on a scale ranging from "extremely unlikely" to "very likely"; $\alpha = .90$) [2].

*Control Variables*. The study administered a pre-questionnaire before the experiment in Session 1 in order to control potential influences from participants' prior experiences with e-community activities via Facebook, product review sites, and online health message boards. After Session 1, participants were asked to indicate the level of involvement with the health topic (i.e., fitness and nutrition) on a scale ("describes poorly" to "describes well") using 12 adjectives (e.g., important, of concern to me, relevant; $\alpha = .97$) [33]. In Session 2, participants were asked to rate appropriateness of the membership badge that they received from the study website on a Likert-type scale using one item: "The membership status awarded to me is appropriate given my prior experience with these kinds of websites." All control variables were used as covariates in analysis.

*Procedure*. All of the procedures for Session 2 were online. Participants revisited the website on which they had posted a question about fitness and nutrition one week before. They received email instructions with the study link guiding them to their individual experiment webpages. The instructions emphasized the authority manipulation while describing the procedure for participants to follow. First, participants received information explaining how the website awarded a membership seal to them. The instructions said, "when you click on your own post, you will notice that you have been awarded a Membership Status. The membership has been assigned to you based on the information that you provided in Session 1 of the study regarding your day-to-day online activities." Furthermore, the instructions also informed them that the Online Guru status was considered a high membership status on the study website. Once participants clicked their own study link, they were able to read the exact same main page (i.e., HealthQ&A) that they visited during Session 1, but the

page included their own question with their study identification (i.e., school email account) as the author information. Once participants clicked their own post, they accessed the thread page on which both the authority and bandwagon manipulations appeared. After browsing and reading the thread page, they clicked the questionnaire link on the bottom of the thread page and completed the questionnaire to conclude Session 2.

## RESULTS

**Session 1[1]**

*Manipulation Checks[2].* The membership status seal (online guru vs. member) was clearly successful, $\chi^2$ (1) = 20.17, $p < .0001$, $N = 93$, with the vast majority of subjects correctly identifying the label (guru or member) assigned to their condition. However, the other item, asking participants to indicate their perceptions of the number of posts, failed to demonstrate the authority cue manipulation. Interestingly, this item ended up being an indicator of the bandwagon manipulation ($t$ (91) = 2.93, $p < .01$). The bandwagon manipulation-check items (i.e., the number of views: $t$ (91) = 3.11, $p < .01$; replies: $t$ (91) = 5.08, $p < .001$; star ratings of thread's helpfulness: $t$ (91) = 2.09, $p < .05$) were successful, except the number of forwards, $t$ (91) = 1.69, *ns*.

*Effects of Heuristic Cues on Persuasive Outcomes.* Session 1 found near-significant interaction effects between the two different cue manipulations on attitudes toward both the content ($F$ (3, 89) = 3.27, $p = .07$) and the website ($F$ (3, 89) = 3.87, $p = .05$). A high level of bandwagon cues produced more positive attitudes toward the content ($M = 4.74$, $SE = .20$) and webpages ($M = 4.25$, $SE = .19$) than a low level of these cues ($M = 4.52$, $SE = .20$ for content; $M = 4.00$, $SE = .19$ for webpages), when there was a high level of authority cues in the condition as well. However, without high-status membership seals and a higher number of posts among contributors in the thread, the low level of bandwagon cues resulted in more positive attitudes toward the content ($M = 4.86$, $SE = .21$) and webpages ($M = 4.24$, $SE = .20$) than the high level of these cues ($M = 4.33$, $SE = .21$ for content; $M = 3.72$, $SE = .20$ for webpages) (see Figure 4).
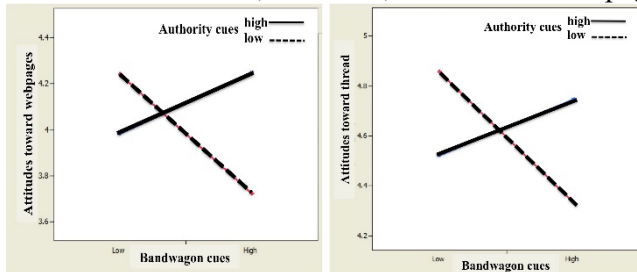


**Figure 4. Interaction effects between authority and bandwagon cues on attitudes toward content (left) and webpages (right).**

Therefore, H1a and H1b received partial support, in that the bandwagon effects were valid only in the presence of high authority cues. H3 was supported by the interaction effect.

*Mediation Analysis.* Session 1 showed that participants' perceptions of the number of posts and of the star ratings of the thread's helpfulness produced direct effects on perceived authority and perceived bandwagon respectively. Interestingly, perceived authority mediated the relationship between participants' perceptions of the number of posts and perceived bandwagon. The theoretical paths between the two perceived heuristics and the credibility of the content and the webpages were also significant, followed by significant direct effects between perceived credibility of the content and attitudes toward the thread as well as perceived credibility

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[1] A series of 2 (authority cues high vs. low) x 2 (bandwagon cues high vs. low) factorial analyses of variance (ANOVA) was conducted to test the hypotheses proposed for Study 1.
[2] The following analyses used a total of ninety-three cases due to missing data.

of the website and attitudes toward both the content and the website (see Figure 5). Regarding participants' behavioral intentions of sharing the thread, the credibility of website produced an indirect effect via attitudes toward the website. Therefore, the results from the mediation analysis suggest that a specific interface cue signaling a contributor's tenure in the site (i.e., the number of posts) [24] did predict users' attitudes toward the content and the website as well as their forwarding intentions, via perceived authority and credibility. The bandwagon effects from the star rating cue also predicted users' evaluations of the content, the website, and their forwarding intentions, consistent with findings from previous studies [8, 26, 28].



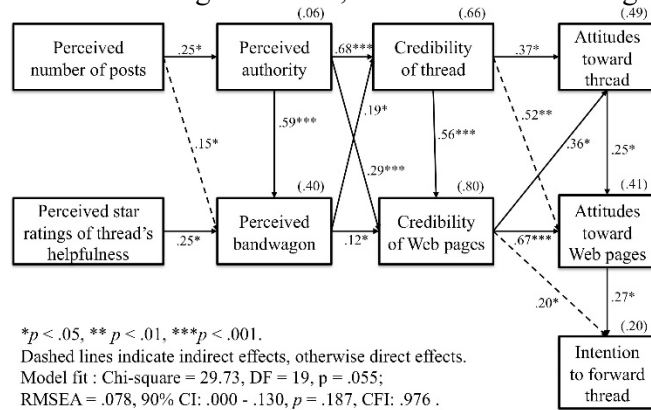**Figure 5. Standardized coefficients in the path model for Session 1. Numbers in parentheses indicate variance explained.**

## Session 2

*Manipulation Checks[3].* Both source-cue manipulations were successful. For the authority cue manipulation, the participants' membership status showed significant differences between the low and high conditions as expected, $\chi^2 (1, 83) = 30.89, p < .0001$ (i.e., What kind of membership seal did you receive from the website—Online Guru or Member?). All of the bandwagon-cue manipulations (the number of views: $t (81) = 6.68, p < .001$, the number of replies: $t (81) = 9.63, p < .001$, times of the post shared: $t (81) = 5.36, p < .001$ and the star rating of the thread's helpfulness: $t (81) = 9.72, p < .001$) showed significant differences between the low and high conditions for the manipulation-check items.

*Effects of Cues on Persuasive Outcomes, Sense of Agency and Sense of Community.* Session 2 found main effects of the bandwagon cues on participants' intentions to post ($F (8, 74) = 6.74, p < .05$) and sense of community ($F (8, 74) = 4.29, p < .05$). High bandwagon cues produced greater intentions to post ($M = 4.30, SE = .52$) and sense of community ($M = 4.48, SE = .35$) compared to low bandwagon cues ($M = 3.41, SE = .46$ for intention to post; $M = 4.00, SE = .31$ for sense of community). Thus, H5b and H5c were supported.

In addition, there was a near-significant interaction effect between source cues on sense of agency, $F (8, 74) = 3.47, p = .07$. While the high authority cue produced higher sense of agency in the low bandwagon condition, participants in the low authority condition actually showed a significant increase in their sense of agency when they had high bandwagon cues (see Figure 6).

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[3] From a total of ninety-five participants in Session 2, twelve cases were excluded due to missing data. Thus, data from only eighty-three participants were used for analysis.
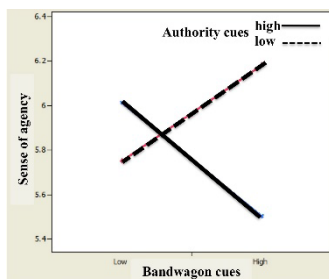
**Figure 6. An interaction effect between authority and bandwagon cues on sense of agency.**

*Mediation Analysis*. The final path model for Session 2 showed that one of the bandwagon cues—the number of times the posting was shared—to be a significant predictor of the sense of community, which in turn was associated with perceived empowerment and attitudes toward posting. It also had a direct effect on participants' intentions to post. Clearly, sense of community mediated the relationship between the perceived number of times the thread was shared and participants' intentions to post as well as their perceived empowerment, which also mediated the relationship between sense of community and attitudes toward posting (see Figure 7). Thus, H6 was partially supported.
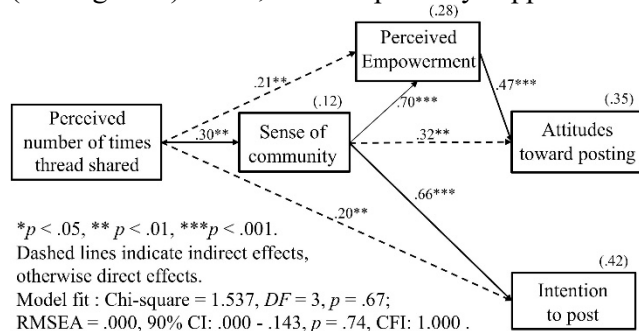


**Figure 7. Standardized coefficients in the path model for Session 2. Numbers in parentheses indicate variance explained.**

# DISCUSSION

The current research examined the effectiveness of six different interface cues that readily inform users of health message boards about the quality of information on the site. Not only does this study test authority vs. bandwagon simultaneously, but it does so for both assessment of content and contribution of content in the same interface. Furthermore, most previous studies used live message boards that confounded content aspects with the presence of authority and bandwagon cues—our study is unique in that it is an experiment, not an observation, and minimized the effects of content by keeping it constant across conditions, thereby isolating the psychological effects of interface cues under study The findings from the two phases may be summarized as follows:

- Bandwagon cues appear to be more influential than authority cues in health message boards for both evaluating information and generating user contribution.
- Bandwagon cues boosted new members' sense of agency for posting activities in health message boards when authority cue was low rather than high.
- Inconsistent combinations of the level of authority and bandwagon cues reduced users' positive evaluations of the content and the webpages (see Figure 4).

The strong bandwagon effects noted in this study could be due to the nature of online health communities.

Because it  is natural in health message boards for users to interact with other lay people rather than health professionals, they might find the high membership status less meaningful in this  kind of an online space. This result is consistent with recent research findings showing that bulletin boards exhibit greater influence on individuals' perceived credibility compared to other types of online sources such as websites and blogs [15]. It also lends empirical evidence to the  notion of "information cascades" by showing that others' ratings tend to affect one's own decision-making [9]. In sum, the current study confirmed the notion of patient expertise [27] in the context of a health message bulletin boards, and the larger societal trend of showing faith in "the wisdom of crowds" [29].

A noteworthy contribution of the current study is that the interface elements and theoretical mechanisms for predicting content evaluation are quite different from those predicting content contribution, as evidenced by differences between the path models in Figure 5 and 7. When it comes to users' contribution of content to the board, support from other users (i.e., high bandwagon cues) served to boost participants' sense of agency and enhance future posting activities, especially when they were combined with low authority cue (see Figure 6). This result is particularly interesting because agency is typically associated with authority, not bandwagon [24]. Participants realized their controllability and assertiveness in the community through not only authority but also through bandwagon cues (in the absence of strong authority). Aside from agency, the initial study model for Session 2 (H6) anticipated that bandwagon cues would increase users' sense of community. The path model in Session 2 confirmed this relationship, thus indicating the importance of in-group bonds for encouraging users' contributions to online boards. This may explain the finding by Wu, et al. that peers' positive feedback helps users remain as contributors [32].

Next, our result shows that users are quite reactive to the process by which authority status is awarded to them. Random assignment of authority cues serves to lower the credibility of the label. This is also an interesting result because general wisdom in psychology would suggest that individuals gladly accept such flattery even when it is not warranted (i.e., Lake Wobegon effect) [1, p. 150]. One possible explanation for why the high authority cue did not enhance participants' intentions to contribute more on the site was due to limitations in the experimental setting. Although there was no significant difference among participants' perceptions of the appropriateness of the membership status awarded, the mean score of this item  was not very high for both levels of the authority cue manipulation ($M_{low authority} = 4.35$, $M_{high authority} = 3.79$, on a 7- point scale). Therefore, the general lack of credibility surrounding the authority cue may have negatively impacted participants' desire to contribute. Previous studies that have found significant effects were conducted for more than two weeks [5, 10]. Thus, longer membership history in the community website appears to be necessary for authority cues to impact user contributions.

It is surprising that inconsistent combinations of authority and bandwagon cues devalue rather than compensate,  which contradicts the general supposition in e-commerce studies that if bandwagon cues are equivocal, authority cues will become influential [28]. The negative impact of mixed signals between authority and bandwagon cues in Session 1 might be accounted for by participants' mental models of interpreting the relationship between the two types of interface cues. It would be logical for a user to expect that other users with high membership statuses would engage in a message discussion (i.e., thread) more actively than  novice users, which, in turn, would lead to more replies/comments on the board. In fact, Fiore et al. [11] found that users are more willing to read a message from an author with high reputation ratings in Usenet newsgroups. They also found correlations between trust toward an author and rated helpfulness of the author's posts. In addition, authors who contributed more in threads showed more interaction with others in the group. There appears to be a psychological correlation between authority and  bandwagon heuristics—something that designers of cue metrics ought to note because they tend to treat these as completely different from a UI design point of view.


## CONCLUSION AND FUTURE WORK
The current research provides designers of community websites, particularly health message boards, with

insight into utilizing interface cues that go beyond signaling information quality and value. Designers may need to deploy useful interface cues, such as the number of posts, views, replies, and the number of times the post was shared by other users, along with star ratings of threads' helpfulness. The specification of the psychological mechanisms by which interface cues lead to the two sides of sharing (evaluating and contributing content) is an important contribution of this study, because they offer ready implications for UI design, such as the following:

- If designers have to limit the number of interface cues, then they would not go wrong with the following two cues—the number of posts by a given contributor and star ratings for threads' helpfulness—which are shown by this study to optimally convey authority and bandwagon respectively, en route to positively affecting user attitudes toward the content and the site.

- When designers are developing metrics to award membership statuses to community users, they should be aware of the importance of making these metrics point in the same direction, given psychological expectation of a correlation between them.

- Cues conveying the number of times their posts are shared appear to be quite powerful in reinforcing community bonds, thereby enhancing users' contributions to message boards. To the extent site design can emphasize metrics reflecting the extent to which their posts were shared, users will feel energized and motivated to participate by contributing more.

Future studies may extend these findings by comparing the effectiveness of these interface cues to determine the most efficient way of displaying cues in the interface. Furthermore, the processes underlying cue effects revealed by the path models tested here as well as other types of cues (such as "sticky items" determined by the board moderator) can be used to design new and innovative interface cues for both promoting efficient consideration of content and stimulating user contributions to online forums.

## REFERENCES
1. Aronson, E., Wilson, T. D. and Akert, R. M. *Social psychology* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall. 2010.

2. Ajzen, I. and Fishbein, M. *Understanding attitudes and predicting social behavior.* Englewood Cliffs, NJ: Prentice-Hall. 1980.

3. Alexa.com. http://www.alexa.com

4. Baxter, L., Egbert, N., and Ho, E. Everyday health communication experiences of college students. *Journal of American College Health, 56*, 4 (2008), 427-436.

5. Beenen, G., Ling., K., Wang, X., Chang, K., Frakowski, D., Resnick, P. and Kraut, R. E. Using social psychology to motivate contributions to online communities. *In Proc. CSCW 2005,* ACM Press (2005), 212-221.

6. Bishop, J. Increasing participation in online communities: A framework for human–computer interaction. *Computers in Human Behavior, 23*, (2007), 1881–1893.

7. Chen, S. and Chaiken, S. The Heuristic-Systematic Model in its broader context. In S. Chaiken & Y. Trope

(Eds.), *Dual-process theories in social psychology*, pp. 73-96. New York, NY: The Guilford Press. 1999.

8.  Chen, Y. F. Herd behavior in purchasing books online. *Computers in Human Behavior, 24*, (2007), 1977-1992.

9.  Duan, W., Gu, B. and Whinston, A. B. Informational cascades and software adoption on the Internet: An empirical investigation. *MIS Quarterly, 33*, 1 (2009), 23-48.

10. Farzan, R., DiMicco, J. M., Millen, D. R., Brownholtz, B., Geyer, W. and Dugan, C. Results from deploying a participation incentive mechanism within the enterprise. *In Proc. CHI 2008,* ACM Press (2008), 563-572.

11. Fiore, A. T., Tiernan, S. L. and Smith, M. A. Observed behavior and perceived value of authors in Usenet newsgroups: Bridging the gap. *In Proc. CHI 2002*, ACM Press (2002), 323-330.

12. Fogg, BJ. and Tseng, H. The elements of computer credibility. *In Proc. Human Factors in Computing Systems, CHI 1990*, ACM Press (1999), 80-87.

13. Fox, S. and Jones, S. The social life of health information. http://www.pewinternet.org/Reports/2009/  8-The-Social-Life-of-Health-Information.aspx

14. Hilligoss, B. and Rieh, S. Y. Developing a unifying framework of credibility assessment: Construct, heuristics, and interaction in context. *Information Processing and Management, 44*, (2008), 1467-1484.

15. Hu, Y. and Sundar, S. S. Effects of online health sources on credibility and behavioral intentions. *Communication Research, 37*, (2010), 105-132.

16. Kalyanaraman, S. and Sundar, S. S. The psychological appeal of personalized online content in Web portals: Does customization affect attitudes and behavior? *Journal of Communication, 56*, (2006), 110-132.

17. Koh, Y J. and Sundar, S. S. Effects of specialization in computers, web sites, and web agents on e-commerce trust. *International Journal of Human-Computer Studies, 68,* 12 (2010), 899-912.

18. Lampe, C., Johnston, R. and Resnick, P. Follow the reader: Filtering comments on Slashdot*. In Proc. Human Factors in Computing Systems, CHI 2007,* ACM Press (2007), 1-10.

19. Lin, J. C-C. Online stickiness: Its antecedents and effect on purchasing intention. *Behavior & Information Technology*, *26*, 6 (2007), 507-516.

20. Ma, M. and Agarwal, R. Through a class darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information System Research, 18,* 1 (2007), 42-67.

21. McCroskey, J. C. and Teven, J. J. Goodwill: A reexamination of the construct and its measurement. *Communication Monographs*, *66*, (1999), 90-103.

22. Metzger, M. J. Making sense of credibility on the Web: Models for evaluating online information and recommendations for future research. *Journal of the American Society for Information Science and Technology, 58,* 13 (2007), 2078-2091.

23. Stavrositu, C. and Sundar, S. S. *Psychological empowerment derived from blogging: Is it agency or is it community? In Proc. the International Communication Association,* Montreal, Canada, 2008.

24. Sundar, S. S. The MAIN model: A heuristic approach to understanding technology effects on credibility. In M. J. Metzger & A. J. Flanagin (Eds.), *Digital media, youth, and credibility,* pp. 72-100. Cambridge, MA: The MIT Press 2008.

25. Sundar, S. S. and Nass, C. Conceptualizing sources in online news. *Journal of Communication, 51*, (2001), 52-72.

26. Sundar, S. S., Oeldorf-Hirsch, A. and Xu, Q. *The bandwagon effect of collaborative filtering technology. In Proc*. *CHI 2008,* ACM Press (2008), 3453-3458.

27. Sundar, S. S., Rice, R. E. and Kim, H. S. Trends in online health information: New conceptualizations for

a new medium. *In Proc. the International Communication Association*, Singapore, 2010.

28. Sundar, S. S., Xu, Q. and Oeldorf-Hirsch, A. Authority vs. peer: How interface cues influence users. *In Proc. CHI 2009,* ACM Press (2009), 4231-4236.

29. Surowiecki, J. *The wisdom of crowds*. Random House, Inc. 2004.

30. Tedjamulia, S. J. J., Olsen, D. R., Dean, D. L. and Albrecht, C. C. Motivating content contributions to online communities: Toward a more comprehensive theory. *In Proc. the 38th Annual Hawaii International Conference on System Sciences,* (2005).

31. Wasko, M. M. and Faraj, S. Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, *29*, 1 (2005), 35-57.

32. Wu, F., Wilkinson, D. M. and Huberman, B. A. Feedback loops of attention in peer production. *In Proc. Computational Science and Engineering 2009*, 409-415.

33. Zaichkowsky, J. L. Measuring the involvement construct. *Journal of Consumer Research, 12*, (1985), 341-352.