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The Impact of User Reviews on Older and Younger Adults' Attitude towards Online Medication Information

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Abstract

A laboratory study was conducted to explore whether the presence of online user reviews, specifically its interaction with the credibility of information on the Website, has differential impact on younger and older adults' attitude towards medication information on the Internet. Results showed that while there was age difference in how message contents on the Web page influenced credibility judgments, the presence of user reviews moderated the age difference. Specifically, we found that: 1) when credibility cues in user reviews were consistent with the credibility cues in Web page contents, older adults' attitude towards the medication was reinforced more than younger adults, and 2) when the credibility cues in user reviews were inconsistent with the credibility cues in Web page contents, older adults were less sensitive to the influence of user reviews. Especially when highly positive user reviews were given to a seemingly non-credible medication, older adults were less likely to be swayed by user reviews. Possible causes of this age difference in the effects of user reviews were discussed.

Keywords: Cognitive aging, credibility judgment, attitude change, online user reviews

INTRODUCTION

While the study of persuasion and attitude change remains an indispensable part of contemporary social psychology, the pervasive use of computer and Internet has drawn increasing attention to the subarea of computer mediated persuasion. In addition to domains that have a tradition to embrace pervasive techniques, such as advertising and commerce, a newly emerging research topic in this area is to study users' credibility judgments with online information. The easily accessible and massive amount of information on the Web, as well as the large variation in its quality, makes credibility assessment a key stage of message persuasion process that will determine users' acceptance or rejection of message statements. It also provides ample opportunities for researchers to study the underlying factors influencing message persuasion in realistic contexts.

Given the risk of trusting wrong information when making medical decisions, credibility judgment is especially important for users who seek medical information online. It would determine users' attitude towards the medication and eventually impact the dissemination of online health information and its use for promoting public health. In this paper, we focus on differences between younger and older adults' attitude towards online medication information by studying their credibility judgments of online information. We believe this is an important question considering the large population of older adults among e-health information consumers, and their potential limitations (declined cognitive ability, generally inexperienced with Internet, etc).

A large proportion of research studying Web credibility was based on the dual processing model of persuasive communications such as the Elaboration Likelihood Model (ELM) (Sillence et al., 2006). Based on ELM, attitudinal changes with online information can be explained as users encounter two distinctive types of cues on the Website: content cues in terms of message content on the page, which requires systematic, deliberative processing, and contextual cues related to surface features of the websites (interface design, usability, source information, etc), which can be processed in a heuristic way by relying on practical rules or experience (Petty & Cacioppo, 1986). Based on this theoretical model, a number of studies have provided evidence for the impact of both content cues and contextual cues on users' credibility judgments of online information.

Nowadays, users who visit public health websites are exposed to more diverse credibility cues than ever before. In addition to the content message and various Website features provided by sophisticated interface design, user review system is allowed by Web 2.0 technologies. Although user reviews are supposed to act as a guidance for users to locate and evaluate information more efficiently, they may add another layer of complexity to users' credibility assessment process. This is because the largely anonymous and unfiltered user generated contents themselves demand credibility assessment, which may in turn interact with the original credibility assessment of the contents on the Web sites.

We conducted a laboratory study to explore how user reviews influenced older and younger adults' attitude towards online medication information. Specifically, we were interested in whether older and younger adults reacted differently to user reviews that conveyed credibility cues consistent or inconsistent with the credibility cues in the content of the Website. According to previous studies (Liao, 2010), older adults in general had lower abilities to differentiate between strong and weak content cues when making credibility judgments. In this study, we focused on how younger and older adults' credibility judgments would change after reading user reviews that were consistent or inconsistent with the credibility cues in the content, to understand the interactions among age, credibility cues, and user reviews, which might interact to determine users' attitude towards online medication information.

METHOD

Participants

Twenty-two older adults (age between 58 and 80, Mean=68.45, SD=6.36, 59.1% are female) and twenty-two younger adults (age between 19 and 26, Mean=21.50, SD=1.95, 63.6% are female) participated in our study. All participants were recruited from the Urbana-Champaign area in the US. Most participants (93.2%) have completed some years of college. There was no significant age difference in their education level or self-reported frequency of health information seeking activities on the Internet.

We also measured participants' task-related domain knowledge by a fluency task, in which participants were asked to generate as many relevant keywords as possible for each of the eight diseases we used in experiment. The average number of keywords for each disease was used as an index of individual's task related domain knowledge. Result showed there was no significant age difference in domain knowledge between the younger and older participants ($p=0.64$).

Experiment Design and Material

A 2×2×2×2 mixed factor design was used in this study. There were two within-subjects variables: content cue strength (strong/weak) and contextual cue strength (strong/weak), and two between-subject variables: age (young/old), and user reviews (with/without user reviews). All participants were asked to finish 8 tasks. Under each task were four web pages corresponding to the four combinations of strong/weak content cue and contextual cue. User reviews were randomly assigned to be consistent or inconsistent with the content cues, and evenly distributed across all content cue and contextual cue combinations.

Content Cue Manipulation

We followed the empirical method used by Petty and Cacioppo (1986) to manipulate content cues, i.e. the content argument strength. We selected material from a well-known healthcare website (www.revolutionhealth.com). It lists articles of alternative medicine by different diseases, and provides ratings from users and clinic reviews. Based on those review ratings we selected articles with "strong" and "weak" content cues, and further modified their use of evidence, argument rigor, information quality and bias to manipulate their credibility (Hamilton, 1998) (Table 1). We also tried to make all articles with approximately equal length and amount of information. We then asked a group of 7 participants to validate our manipulations and selected 8 sets of documents based on the results to be the content materials. The disease and medicines names were modified such that they could not be directly identified.

Contextual Cue Manipulation

We randomly selected web page templates from highly recognized healthcare websites based on their public reputation, Website traffic and endorsement by Health on the Net Network (HON). We kept half of them to be "strong" contextual cue web pages, and for the other half we removed features that are known to affect website credibility to make contextual cues "weak". 3-5 changes were randomly picked from two categories: *design look* and *source features* (Table 1). Fogg (2001) identified that design look, including layout, typography, images, etc, to be the greatest concern when people make web credibility evaluation. Source features were defined to be features that indicate the source authority and reliability and are fundamental elements for a health website. Features including reference, author information, site ownership, third party endorsement, commercial motive, etc, were found to contribute to the perception of credibility in multiple studies (Hong, 2006).

User Reviews

We selected material of user reviews from the same website and modified them to accord to the particular medicine. The website also provides user rating based on one star (disagree) to five star (agree) scale for each entry of user review. The ratings were generally consistent with how negative or positive the user reviews were arguing (see Table 1). These user reviews were primarily about users' experience with the medicine and were less than 100 words each. 4-6 entries of user reviews were given to each medicine. We manipulate the consistency of user review with content cue strength by selecting positive (three to five stars) or negative (one to three stars) reviews.

Cognitive Ability and Internet Experience Index

Previous studies on older adults' distinctive behavior in online environment suggested the age differences could be attributed to some unique characteristics of older generation, especially their declined cognitive ability and inadequate experience with information technology. Therefore, measures of cognitive ability and Internet experience were taken to capture the difference between two age groups. For cognitive abilities, we focus on fluid

	Strong	Weak
Content cue	chosen from "high ranked" medicine; with research evidence, explanation of mechanism, comprehensive information, positive and strong argument	chosen from "low ranked" medicine; lack of evidence, biased information, ill logic, commercial or unprofessional writing tone
Contextual cue	nice layout/color/structure, with reference/contact information/third party endorsement	bad design, lack of reference/source, typo, advertising, commercial features
User review	Five-star review: "*Really effective product! Combined with the right diet it is capable of producing rigid control of blood sugars*."	One-star review: "*This was a complete waste of time and money for me. I tried different brands one after the other and never even lost half a kg!*"

Table 1. Examples of content cue, contextual cue and user review

mental abilities (working memory and processing speed), which are most vulnerable to aging. Working memory was measured by letter Number Sequencing Task, while processing speed was measured by Letter and Pattern Comparison Task (Salthouse, 1991; Chin & Fu, 2010). To measure their Internet experience, we selected 12 questions from Knowledge-related Internet Information Seeking Semi-structured Interview (KRIISS) (Sharit et al., 2008). The interview asks questions regarding how the Internet works, how to use Web browser tools and how to perform information search task.

Procedure

Before the experiment, all participants were given the set of standardized pretests to measure their cognitive ability and Internet experience. Then participants were randomly assigned to conditions with or without user reviews. All participants started by reading the scenario of the task, which stated that they were asked to help a friend to evaluate some alternative medicines randomly selected from the Internet. The concern of fake medicine was mentioned to implicitly emphasize the need for credibility judgment. Then they were presented with the task interface, a web based aggregator with subscribed web pages organized by 8 diseases. They can click and browse those web pages to read about different alternative medicines. Each of the articles has four parts: introduction, side effects, interaction and dosage information, as the typical medicine introduction articles on real health websites. For condition with user reviews, participants could click on a "Read Users' Review" link to read user reviews, which were presented on the same web page. After that, participant clicked on "Rate" button on the aggregator interface to submit their ratings for the medicine.

Results

Effects of User Review on Credibility Judgment

We performed a four-way ANOVA with age and presence of user reviews, which has an equal chance of being consistent or inconsistent with the content arguments, as between subjects variables, and content cue and contextual cue strength as within subjects variables. Results showed that the main effects of content cue ($F(1,40)=56.66$, $p<0.01$) and contextual cue ($F(1,40)=23.05$, $p<0.01$) were significant. Interestingly, there was a significant three-way interaction between content cue, age and presence of user reviews ($F(1,40)=4.45$, $p=0.04$).

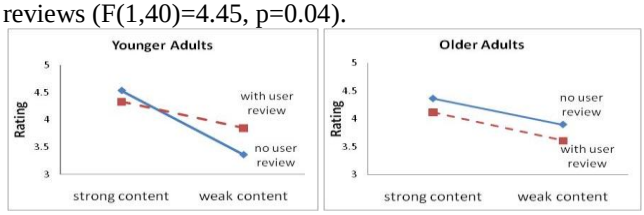


Figure 1. Credibility ratings for messages with mixed reviews or without review

Figure 1 shows the three-way interaction between content cue, age, and presence of user reviews. The presence of user reviews tended to moderate younger adults' reaction to strong and weak content cues more than older adults when making credibility judgments. Two three-way ANOVA with presence of user review, content cue strength and contextual cue strength, performed within each age group further confirmed this effect: while there was a significant interaction between content cue and presence of user reviews among younger adults ($F(1, 20)=5.903$, $p=0.02$), this two-way interaction was not observed among older adults ($F(1,20)=0.022$, $p=0.88$). It indicated that while the presence of mixed user review significantly affected younger adults' credibility ratings after reading them, it did not show such effect on older adults' credibility ratings.

We then investigated only the two groups with user reviews by introducing another independent variable: the consistency with content cue strength (consistent/ inconsistent), as a within-subject variable. Four-way ANOVA with age, consistency, content cue strength and contextual cue strength showed that the main effects of content cues ($F(1,40)=6.63$,$p=0.01$) and contextual cues ($F(1,40)=7.38$, $p=0.01$) were significant. Two way interaction between content cue strength and consistency of user reviews was significant ($F(1,40)= 65.82$, $p< .01$). No other effects were observed. These results indicated that while older adults were less able to differentiate between strong and weak content cues according to our former study (Liao & Fu, 2011), this age difference disappeared when user reviews were presented, primarily because mixed user reviews tended to moderate younger adults' credibility judgment with content cues, but less for older adults'. In addition, the interaction between consistency and content cue suggested that user reviews that were consistent and inconsistent with content cue strength had differential impact on users' credibility judgment.

In summary, we found that the presence of mixed user reviews moderated younger adults' differential attitude towards credible medication information and non-credible one more significantly than older adults'. Thus the age difference in discerning medication information with strong and weak content cue disappeared when the Websites included the feature of user reviews. Given the interaction effect of consistency and content cue on credibility judgment, we performed separate analyses on the impact of consistent and inconsistent user reviews on credibility judgment to investigate their effects.

Effects of Consistent User Reviews

We analyzed the 16 Web pages with user reviews that were consistent with the content cue strength. Four-way ANOVA with age, presence of consistent user review, content cue strength and contextual cue strength showed that the main effects of content cue ($F(1,40)=102.00$,$p<0.01$) and contextual cue ($F(1,40)=14.27$, $p<0.01$) were significant. The two-way interaction between content cue and age ($F(1,40)=4.87$, $p=<0.01$), and interaction between content cue and presence of consistent user reviews ($F(1,40)=7.34$, $p =0.01$) were also significant.

The results implied that the presence of consistent user reviews had positive effects on users' ability to differentiate between strong and weak content cues since they received consistent cues to reinforce their initial attitude formed by reading the article. We then performed three-way ANOVA within each age group with the presence of consistent user review, content cue strength, and contextual cue strength. While there was a significant two-way interaction between content cue and consistent user reviews among older adults ($F(1,20)=6.80$, $p=0.02$), this two-way interaction was not observed among younger adults ($F(1, 20)=1.66$, $p=0.21$). Figure 2 illustrated this difference: while consistent user reviews did not significantly change younger adults' credibility ratings, older adults' credibility ratings became more polarized towards messages with strong content cues and those with weak ones.

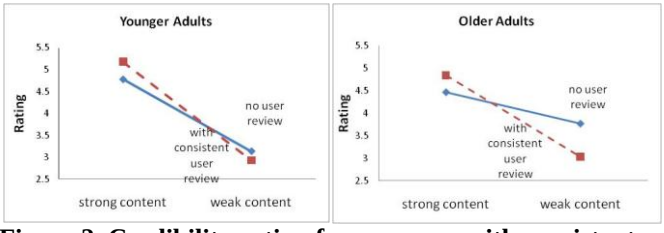


Figure 2. Credibility rating for messages with consistent reviews or without review

In summary, we found that consistent user reviews i.e., favorable user reviews given to credible medication information, and unfavorable user reviews given to non-credible one, enhanced older adults' differential reaction to credible medication information and non-credible one more significantly than younger adults.

Effects of Inconsistent User Reviews

We then analyzed the 16 Web pages with user reviews that are inconsistent with the content cue strength. Four-way ANOVA with age, presence of inconsistent user review, content cue strength and contextual cue strength, showed that the main effect of contextual cue ($F(1,40)= 6.62$, $p=0.01$) were significant. The interaction between content cue and presence of inconsistent user reviews was significant ($F(1,40)=24.72$, $p< .01$). The interaction between content cue and age was not significant ($F(1,40)= 0.03$, $p=0.87$) when inconsistent user reviews were presented. Interestingly, there was a marginally significant three-way interaction between content cue, age and presence of inconsistent user reviews ($F (1,40)= 2.43$, $p=0.09$).

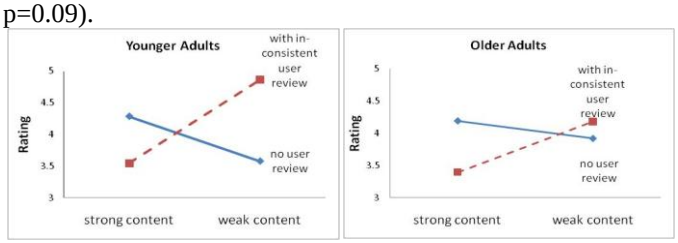


Figure 3. Credibility rating for messages with inconsistent reviews or without review

The results showed that inconsistent user reviews in general had a negative influence on users' ability to differentiate between strong and weak content cues in the Web page content. From Figure 3 we could see that the marginally significant three-way interaction between age, content cue, and presence of inconsistent user reviews was probably caused by the finding that younger adults' judgments were more susceptible to the influence of inconsistent user reviews compared to older adults.

The presence of inconsistent user reviews appeared to be a particularly interesting issue since intuitively negative reviews on well argued articles and positive reviews on poor argued articles may induce attitude change in different ways. While negative reviews on a well written (strong content cue) article could potentially help prevent users from mistrusting questionable sources, positive reviews on a poorly written (weak content cue) article, on the contrary, could imply deceptive manipulations or spamming related activities.

To test the difference, in each age group, we tested the main effects of negatively inconsistent user reviews on the eight Web pages with highly credible content, and the main effects of positively inconsistent user reviews on the eight Web pages with non-credible content. Results showed that, for older adults, the effects of negatively inconsistent user reviews on strong content cues was marginally significant ($F(1,20)=3.17$, $p=0.09$), but the effects of positively inconsistent user reviews on weak content cues was non-significant($F(1,20)=0.32$, $p=0.58$). For younger adults the effects of positive user reviews on weak content cue ($F(1, 20)= 10.96$, $p<.01$) were significant, and negative user reviews on strong content cue ($F(1,20)=3.45$, $p=0.08$) was marginally significant. These results revealed that while both older and younger adults' attitude towards a credible article could be moderated by negative user reviews, older adults were less likely to change their attitude in cases where there were ill-made arguments with highly appraising user reviews. Instead, they were more likely to retain their initial negative attitude compared to younger adults.

To further understand this age difference that we found in the effects of inconsistent user reviews on users' attitude change, we looked into two age related variables: cognitive ability and internet experience. By including the cognitive ability index as covariate, the marginally significant three-way interaction between content cue, age and presence of inconsistent user reviews ($F (1, 39) =2.43$, $p=0.09$) remained. It implied that the generally lower cognitive ability did not seem to cause the age difference on reaction to inconsistent user reviews.

ANCOVA with Internet experience as the covariate showed that the three-way interaction between content cue, age and inconsistent user review became non-significant ($F(1,39)=2.02$, $p=0.16$). It suggested that older adults' generally lower Internet experience might have at least partially contributed to the age difference in the effects of inconsistent user reviews. To further test this, we divided all participants into a high internet experience group and a low internet experience group by performing a median split based on the Internet experience index in each of the four experiment groups. The same four-way ANOVA was

performed for the low Internet experience and high Internet experience groups. Results showed that the interaction between content cue, age, and inconsistent user review was still marginally significant among participants with high Internet experience ($F(1,20)=3.28$, $p=0.08$), but not significant among participants with low Internet experience($F(1,20)=0.068$, $p=0.80$). The results therefore further confirmed that low Internet experience contributed to the lower sensitivity to the impact of inconsistent user reviews.

To further detect whether older and younger adults who have low internet experience reacts to inconsistent user reviews in the same pattern, in each age group, for low and high Internet experience sub-group, we tested the main effect of negatively inconsistent user review on credible content, and the main effect of positively inconsistent user review on non-credible content. We found that older adults with low Internet experience were not affected by either positive reviews on page with weak content cues($F(1, 10)=0.04, p=0.85$) or negative reviews on page with strong content cues($F(1, 10)=1.18, p=0.30$). Older adults with high Internet experience, as well, were not affected by either positive reviews on page with weak content cues ($F(1, 10)=1.35, p=0.27$) or negative reviews on page with strong content cues $(F(1, 10)=0.68, p=0.43)$. Younger adults who had low Internet experience were only subject to the influence of positive user reviews on weak content cues ($F(1, 10)=8.37, p=0.02$) but not negative review on strong content cues($F(1,10)=0.18, p=0.68$). Younger adults with high Internet experience, however, were significantly influenced by both negative user review on strong content cues ($F(1, 10)=8.78, p=0.01$) and positive user review on weak content cues($F(1, 10)=5.05, p=0.05$).

The pattern of results implied that, in general, users with lower Internet experience were less inclined to integrate cues and information from user reviews that contradicted the Web page contents; therefore their attitude towards online medication information was less affected by this kind of user reviews on the Website. However, the lower Internet experience of older adults only partially explained the age difference in the effects of inconsistent user reviews. This was because younger adults and older adults who had inadequate experience with Internet did not behave exactly the same way.

In summary, we found that inconsistent user reviews, i.e., favorable user reviews for non-credible medication information, and unfavorable user reviews for credible medication information, had lower impact on older adults' attitude towards the medication than younger adults'. Older adults were especially tended to discount positive user review on non-credible medication. Also it was found that Internet experience may play a role in this age difference in the influence of inconsistent user reviews.

Discussion

In general, we found that user reviews had strong impact on users' attitude towards online medication information. We found significant effects of content cues, contextual cues, and presence of user reviews on users' credibility judgment ratings. Also, we found that user reviews could influence older and younger adults' credibility judgment in different ways. When credibility cues in user reviews were consistent with the credibility cues in website contents, it could more significantly enhance or reinforce older adults' attitude formed by reading the original content, and thus help to overcome the age difference in making correct credibility judgment. While previous research studying age differences using the dual processing model provided robust evidence for age-related decline in deliberative content processing, our results suggested that providing supplemental information by user reviews may narrow the gap between younger and older adults for evaluating the quality of message content. Also it seemed to be consistent with findings of previous studies that repeatedly stressing a claim or position may increase familiarity and influence older adults' judgment making (e.g., Skurnik &Yoon, 2005).

One interesting finding in this study was older adults' lower sensitivity to inconsistent user reviews, especially when positive user reviews appeared on a less credible website. This phenomenon could be interpreted from two aspects: First, older adults' lower susceptibility to attitude change may be a possible explanation. While controversy still exists, the majority of research on aging and attitude change reports that resistance to external influence increases with age. Especially in persuasion situations, lower attitude change is often found among older adults, possibly because they are more likely to develop skills of defending oneself against systematic pressure to change. Also, research on age differences indicates that motivational and emotional variables may influence older adults' deliberative processing level and affect the outcome of influence (Lynn & Phillips, 1977). We infer that these age-related differences may cause older adults to be less sensitive to the influence of user reviews, especially in the situation of negative initial attitude. It was possible that older adults initial negative attitude towards low-credibility content made them to selectively stop further deliberative processing when reading and comprehending user reviews.

The second possible reason for the lower sensitivity to inconsistent user reviews could be attributed to the generally lower internet experience of older adults. The non-significant age difference among younger and older users who had low Internet experience provided some support to this possibility. Indeed, previous studies showed that people's general trust with Internet is positively related to users' Internet experience (Wathen & Burkell, 2002). Frequent users of Internet tend to have more certainty and more confidence in online information. We could further extend this view to social networking applications. For example, there is research showing that younger adults often use Internet for entertainment and social networking, while older adults tend to use Internet as a tool for research, shopping and banking (Sydney, 2009). This may imply that, compared to general Internet experience, older adults may

have an even lower experience with user reviews and other social networking features (both in terms of actively contributing and passively reading). This may lead to a higher tendency for older adults to distrust and discount cues associated with user reviews.

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