

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 study 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 and website features influenced credibility judgments, the presence of user reviews moderated the age difference. Specifically we found: 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. Results have important implications for the dual-process model of information processing and age differences in attitude change in the context of Internet.

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

INTRODUCTION

While the study of persuasion and attitude change remains an indispensable characteristic 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, e.g., 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 great risk of encountering misinformation for 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 often unique 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). The ELM explains attitudinal changes in individuals as they encounter two distinctive types of cues on the Website: central cues in terms of content on the page, which requires systematic, deliberative processing, and peripheral 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 central cues and peripheral 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 more sophisticated interface design, user reviews are allowed by Web 2.0 applications on those websites. While user reviews are supposed to act as guidance for users to locate and evaluate information more efficiently, however, they may add another layer of complexity to users' credibility assessment process, since 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 within the Website. According to previous studies of ours and others, older adults in general had lower abilities to differentiate between strong and weak central 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 other credibility cues to understand the interactions among age, credibility cues, and user reviews,

which would altogether 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 a medium sized city in United States. Most participants (93.2%) have completed some years of college. There was no significant age difference in education level or self reported frequency of health information seeking activities on the Internet.

Experiment Design and Material

A 2×2×2×2 mixed factor design was used in this study. There were two within-subjects variables: central cue strength (strong/weak) and peripheral 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 central cue and peripheral cue. User reviews were randomly assigned to be consistent or inconsistent with the central cues, and evenly distributed across all central cue and peripheral cue combinations.

Central Cue Manipulation

We followed the empirical method used by Petty and Cacioppo (1986) to manipulate central cues, i.e. the content argument strength. Firstly 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" central 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 to avoid identification.

Peripheral Cue Manipulation

We randomly selected web page templates from highly recognized healthcare websites. We kept half of them to be "strong" peripheral cue web pages, and for the other half we removed features that are known to affect website credibility to make peripheral 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, white space, 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, contact information, third-party endorsements, site ownership, inclusion in the Health on the Net Network (HON), 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 central 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, such as 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 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 a combination of Pattern Comparison Task and Letter Comparison Task. To measure their Internet experience, we selected 12 questions from Knowledge-related Internet Information Seeking Semi-structured Interview (KRIISS) (Sharit et al., 2008). The

	Strong	Weak
Central 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
Peripheral 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: <i>"Really effective product! Combined with the right diet it is capable of producing rigid control of blood sugars."</i>	One-star review: <i>"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!"</i>

Table 1. Examples of central cue, peripheral cue and user review

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, 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 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 to the strength of content arguments, as between subjects variables, and central cue and peripheral cue strength as within subjects variables. The results showed the main effects of central cue ($F(1,40)=56.66, p < .01$) and peripheral cue ($F(1,40)=23.05, p < .01$) were significant. The interactions between central cue and age ($F(1, 40)=3.42, p=0.07$), interaction between peripheral and age ($F(1, 40)=3.42, p=0.07$) and interaction between central cue and presence of user reviews ($F(1,40)=3.79, p=0.06$) were marginally significant. Interestingly, there was a significant three-way interaction between central cue, age and presence of user reviews ($F(1,40)=4.45, p=0.04$).

Figure 1 explained the three-way interaction between central cue, age and presence of user reviews: the presence of user reviews tended to moderate younger adults’ reaction to strong and weak central cues more than older adults when making credibility judgments. Two three-way ANOVA with presence of user review, central cue strength and peripheral cue strength, performed within each age group further confirmed this effect: while there was significant interaction between central 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 ($F(1,20)=0.022, p=0.88$).

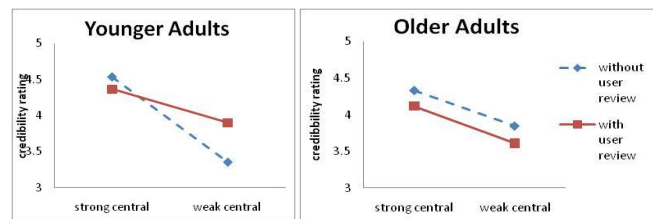


Figure 1. Credibility ratings for messages with mixed reviews or without review

The two-way interaction between age and central cue, and interaction between age and peripheral cue, showed that older adults were less able to discern the strength of central cues as well as peripheral cues. It was reflected by older adults’ closer ratings, as compared to younger adults’, given to Web pages with strong central/peripheral cues and those with weak ones. The two-way interaction between presence of user review and central cue indicated that in general the influence of central cue strength on users’ credibility judgment was weakened by mixed user reviews. The main effects of peripheral cue and central cue indicated that participants made credibility judgment based on both types of cues.

We then investigated only the two groups with user reviews by introducing another independent variable: the consistency with central cue strength, as a within-subject variable. Four-way ANOVA with age, consistency, central cue strength and peripheral cue strength showed that the main effects of central cues ($F(1,40)=6.63, p=0.01$) and peripheral cues ($F(1,40)=7.38, p=0.01$) were significant. Two way interaction between central cue strength and consistency of user reviews was significant ($F(1,40)=65.82, p < .01$). However, the interaction between central cue and age became non-significant when there were user reviews ($F(1,40)=0.01, p=0.91$). These results indicated that while older adults were less able to differentiate between strong and weak central cues according to our former study (Liao & Fu, 2010) and the analysis with all participants as stated above, this age difference disappeared when user reviews were presented, primarily because mixed user reviews tended to moderate younger adults’ credibility judgment with central cues, but less for older adults’. In addition, the interaction between consistency and central cue suggested that user reviews that were consistent and inconsistent with central cue strength had different impact on users’ credibility judgment. We therefore performed separate analysis on the impact of consistent and inconsistent user reviews on credibility judgment in the next step.

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 central cue disappeared when the Websites included the feature of user reviews.

Effects of Consistent User Reviews

We analyzed the 16 Web pages with user reviews that were consistent with the central cue strength. Four-way ANOVA

with age, presence of consistent user review, central cue strength and peripheral cue strength showed that the main effects of central cue ($F(1,40)=102.00, p<0.01$) and peripheral cue ($F(1,40)=14.27, p<0.01$) were significant. The two-way interaction between central cue and age ($F(1,40)=4.87, p<0.01$), and interaction between central cue and presence of consistent user reviews ($F(1,40)=7.34, p=0.01$) were also significant.

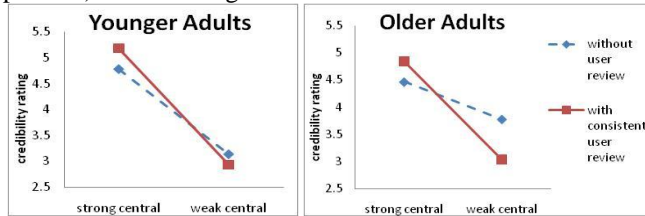


Figure 2. Credibility rating for messages with consistent reviews or without review

The results implied that the presence of consistent user reviews had positive effects on users' ability to differentiate between strong and weak central 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. While there was significant two-way interaction between central 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 central cues and those with weak ones.

In summary, we found that consistent user reviews i.e., appreciating user reviews given to credible medication information, and depreciating 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 central cue strength. Four-way ANOVA with age, presence of inconsistent user review, central cue strength and peripheral cue strength, showed the main effect of peripheral cue ($F(1,40)=6.62, p=0.01$) were significant, and the main effect of central cue was only marginally significant ($F(1,40)=3.30, p=0.08$). The interaction between age and peripheral cue was marginally significant ($F(1,40)=3.14, p=0.08$), and interaction between central cue and presence of inconsistent user reviews was significant ($F(1,40)=24.72, p<.01$). We noticed that the interaction between central cue and age became 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 central cue, age and presence of inconsistent user reviews ($F(1,40)=2.43, p=0.10$).

The results showed that inconsistent user reviews in general had a negative influence on users' ability to differentiate between strong and weak central cues in the

Web page content. From Figure 3 we could see that the significant three-way interaction between age, central 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.

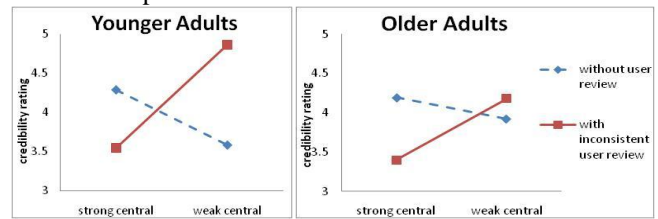


Figure 3. Credibility rating for messages with inconsistent reviews or without review

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 central cue) article could potentially help prevent users from mistrusting questionable sources, positive reviews on a poorly written (weak central cue) article, on the contrary, could imply deceptive manipulations or spamming related activities. To test the difference, we performed a one-way ANOVA with the presence of negatively inconsistent user reviews as independent variable and ratings for strong central cues as dependent variable (regardless of their peripheral cue strength), and the same ANOVA with positively inconsistent user reviews on ratings of weak central cues in each age group. Results showed that, for older adults, the effects of negatively inconsistent user reviews on strong central cues was marginally significant ($F(1,20)=3.17, p=0.09$), but the effects of positively inconsistent user reviews on weak central cues was non-significant ($F(1,20)=0.32, p=0.58$). For younger adults the effects of positive user reviews on weak central cue ($F(1,20)=10.96, p<.01$) were significant, and negative user reviews on strong central 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 and 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 we found in the effects of inconsistent user reviews on users' attitude change, we look into two age related variables: cognitive ability and internet experience. By including the cognitive ability index as covariate, the ANCOVA showed that interactions between central cue and age ($F(1,39)=0.65, p=0.43$) and interaction between peripheral and age ($F(1,39)=0.39, p=0.54$) became non-significant. The marginally significant three-way interaction between central cue, age and presence of inconsistent user reviews ($F(1,39)=2.43, p=0.10$) remained. It implied that while the generally lower cognitive ability of older adults contributed

to the age difference on central cue differentiation, it did not appear to cause the age difference on reaction to inconsistent user reviews.

ANCOVA with Internet experience as the covariate showed that the interaction between central cue and age ($F(1,39)=0.50$, $p=0.82$) was non-significant. Interestingly, the three-way interaction between central cue, age and inconsistent user review also became non-significant ($F(1,39)=2.02$, $p=0.16$). It suggested that older adults' generally lower Internet experience may have contributed to their lower ability to differentiate central cues, as well as to the age difference in the effects of inconsistent user reviews. To further confirm this conclusion, we divided all participants into a high internet experience group and a low internet experience group by performing a medium 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 central 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 ($F(1,20)=0.068$, $p=0.80$).

To further detect whether older and younger adults who have low internet experience reacts to inconsistent user reviews in the same pattern, we performed one-way ANOVA with the presence of negatively inconsistent user reviews on ratings of strong central cues, and with the presence of positively inconsistent user reviews on ratings of weak central cues among older and younger adults with high or low Internet experience. We found that older adults with low Internet experience were not affected by either positive reviews on page with weak central cues ($F(1, 10)=0.04$, $p=0.85$) or negative reviews on page with strong central 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 central cues ($F(1, 10)=1.35$, $p=0.27$) or negative reviews on page with strong central 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 central cues ($F(1, 10)=8.37$, $p=0.02$) but not negative review on strong central 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 central cues ($F(1, 10)=8.78$, $p=0.01$) and positive user review on weak central 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 which contradict 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 may only partially explain the age difference in the effects of inconsistent user reviews since younger adults and older adults who have

inadequate experience with Internet did not behave exactly the same way.

In summary, we found that inconsistent user reviews, i.e., appreciating user reviews for non-credible medication information, and depreciating user reviews for credible medication information, have 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 is 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 central cues, peripheral cues, and presence of user reviews on users' credibility judgment rating. 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 content, 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. While previous research studying age difference in dual processing model provided robust evidence for age related declines in the deliberative, central processing, our results suggested that providing supplemental information by the presence of user reviews may narrow the gap between younger and older adults for the central processing route. Also it seemed to be consistent with previous studies finding that repeated presentation of claims increase familiarity and thus support older adults' judgment making (Skurnik & Yoon, 2005).

One most interesting finding in this study was older adults' lower sensitivity to inconsistent user reviews, especially when positive user reviews appeared on a flawed 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 reported that resistance to external influence increases with age. Especially in persuasion situation, lower attitude change happened among older adults since they are more likely to develop skills of defending oneself against systematic pressure to change. Also, research on age difference in dual processing with external influence cues indicated that motivational and emotional variables could vary 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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