

December 2003

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Recommended Citation

Huerta, Esperanza and Ryan, Terry, "The Credibility of Online Information" (2003). *AMCIS 2003 Proceedings*. 279.
<http://aisel.aisnet.org/amcis2003/279>

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THE CREDIBILITY OF ONLINE INFORMATION

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Abstract

This research examines the factors affecting the credibility of online information. It uses the Elaboration Likelihood Model (Petty and Cacioppo 1986) as a theoretical framework, proposing a comprehensive model that includes factors from traditional means of communication and the Web. A field experiment was conducted that manipulated quality of content, reputation of the Web site owner, attractiveness, modality of exposure, and simulation. Out of these factors, quality of content and reputation of the Web site owner show statistical significance in the expected direction. Based on these results, design guidelines and suggestions for research procedure are proposed.

Introduction

In a society as permeated with information technology as this one, individuals should know “when they have an information need and how to gather, synthesize, analyze, interpret, and evaluate the information around them” (American Library Association 1989, p. 11). One critical step in this process is the assessment of the information gathered. Among all the criteria that people have for assessing information, credibility—which is defined as believability—is one of the most important (Fogg and Tseng 1999; Rieh 2002; Self 1996; Wathen and Burkell 2001). This study investigates the factors affecting the credibility of online information (i.e., information delivered through the Web). Being able to assess online information credibility is important in at least two ways.

First, people must learn to assess information critically, which means that skills related to such assessment must be taught. Improvements in understanding how people assess information should help in teaching students to be critical evaluators of information. Second, interface design is based on an understanding of how humans interact with computers. Good interface designs make the human-computer interaction process more efficient. Knowing more about the determinants of credibility should help designers to provide information in as believable a manner as possible, avoiding extra work for interface users.

The remainder of this document is organized as follows. The following section reviews previous literature on information credibility. Then, the research method section describes the method and techniques used. Then, results, discussions, and limitations are presented. The document concludes with a discussion of the contributions of the study and directions for future research.

Literature Review

Previous research on information credibility has looked at information delivered through traditional means of communication, but there is little research dealing with online information credibility assessment. The assessment of online information credibility differs to some degree from the assessment of information credibility from traditional sources, because online information has characteristics not available through traditional means of communication (Fogg et al. 2001; Königer and Janowitz 1995; Rieh 2002; Wathen and Burkell 2001).

Research on persuasion and credibility explains message credibility based on the interaction of three factors: source, message, and receiver characteristics (Miller and Levine 1996; Self 1996). Source characteristics are a function of who sends the message. Judgments of source credibility involve a determination of the trustworthiness and expertise of the source.

Message characteristics have to do with the content and presentation of the message. The content of a message concerns the arguments it makes and the conclusions it asserts—what the message is about. The presentation of a message is assessed in terms of its attractiveness and its modality of exposure. Attractiveness refers to the layout of the message. Modality of exposure, sometimes referred to as the vividness or richness of the information, relates to the number of sensory channels used to deliver the information (text, audio, and video). The strategy of presentation also influences the credibility of a message (Miller and Levine 1996). Two well-established persuasive strategies from marketing theory have acquired renewed importance with the advent of computing: personalization and simulation (King and Tester 1999). Personalization means tailoring information to a particular person. Computer simulations “provide people with experience, either firsthand or vicarious” (Fogg et al. 2002, p. 769). Receiver characteristics influence message credibility in many diverse ways. Previous research has found many receiver characteristics affecting the credibility of a message, such as personal involvement, personal responsibility, need for cognition, and familiarity with the topic (Fogg and Tseng 1999; Self 1996). These characteristics determine the motivation and ability that a person has to process a message (Chaiken 1987; Petty and Cacioppo 1986).

Along with the factors mentioned before, there are exclusive characteristics of online information that affect its credibility. The factors exclusive to online information are: navigability, functionality, and download speed (Fogg et al. 2001; Rieh 2002; Wathen and Burkell 2001).

Cognitive and social psychologists have studied information credibility as part of the more general topic of persuasion (Self 1996). There are several theories proposed to explain persuasion. Information Science (IS) has used the Information Processing Model (McGuire 1972) and the Elaboration Likelihood Model (ELM) (Petty and Cacioppo 1986) as theoretical frameworks. ELM has been chosen as the theoretical framework in this research because it has been previously used in the IS field, has been studied intensively in psychology, and provides an extensive and detailed description of the variables affecting attitude change.

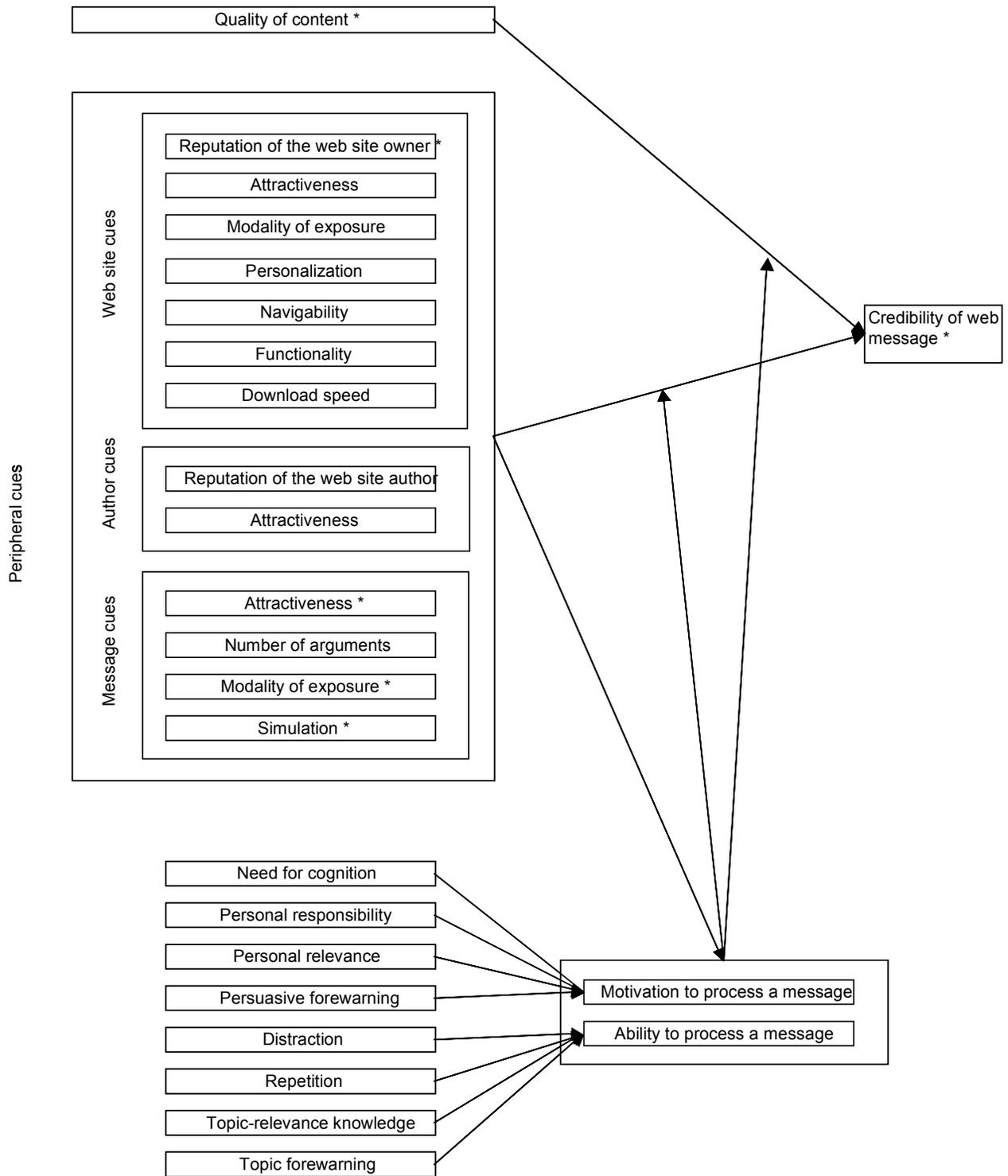
ELM (Petty and Cacioppo 1986) explains attitude change based on argument quality and peripheral cues. Argument quality refers to the persuasiveness of the message content. A peripheral cue is “a simple cue in the persuasion context that affects attitudes in the absence of argument processing” (Petty and Cacioppo 1986, p. 134). Peripheral cues might be related to the source or to the message. The impact that peripheral cues and message quality have on attitude change is moderated by the amount of cognitive effort that people exert when analyzing a message. People engage in effortful processing to scrutinize a message (systematic processing) when they have the motivation and ability to do so. Otherwise, people base their judgments on simple heuristics derived from peripheral cues (heuristic processing). In short, both argument quality and peripheral cues can affect attitude change; however the impact is moderated by the motivation and ability to process the message.

Figure 1 introduces variables presented above into the ELM causal model. Figure 1 also includes four contextual variables (persuasive forewarning, topic forewarning, distraction, and repetition) identified by Petty and Cacioppo (1986) as variables that affect motivation and ability to process a message.

Research Method

This research uses a field experiment because, even though it provides less control than a lab experiment, it affords a higher degree of realism. In the experiment, participants judged the credibility of a Web message from their own locations. Persuasion is a complex phenomenon, where changes in attitudes are the result of many intervening variables. An experiment manipulating all the variables involved would be impracticable; therefore, the study was reduced. The problem is to define the variables related to the author and the Web site that should be included to present a realistic situation to participants in addition to quality of content and message cues. This study considers that presenting only the reputation of the Web site owner provides a realistic enough situation. This decision is based on the following reasoning. First, people often engage in searches for particular issues on the Internet. It is true that, if we consider the searching process, users first arrive at a Web site, and then judge whether is worthwhile or not to search for information there (Rieh, 2002; Wathen & Burkell, 2001). However, once users arrive at the particular message, it is not clear to what degree the attractiveness, navigability, and other characteristics of the Web site are relevant to judge the credibility of a message.

On the other hand, it is widely recognized that the reputation of the source is important when assessing the credibility of a message. When judging the credibility of online information, two source levels are involved, the Web site owner and the author of the message. The reputation of the Web site owner is always present as a cue, no matter where in the Web site a user is. The reputation of the author, however, is related to the particular message. In a study developed by Rieh (2002) participants mentioned



*Variables investigated in the present study

Figure 1. Conceptual Model

more frequently the reputation of the Web site owner than the reputation of the author as a criterion for assessing Web information.¹

Rieh speculates that reputation of the Web site owner is more frequently used as a criterion because author information is often not available on the Web. Therefore, a Web message only having cues about the reputation of the Web site owner presents a realistic situation. The motivation and ability to process a message is not manipulated nor controlled in the present study; instead participants are randomly assigned to experimental conditions. It is expected that individual differences on motivation and ability do not systematically influence the results.

This experiment examines the impact of five variables on the credibility of a Web message: 1) quality of content, 2) the attractiveness of the message, 3) the message's modality of exposure, 4) simulation, and 5) the reputation of the Web site owner. Even though not all the factors involved in assessing the credibility of a Web message could be included in this study, the factors selected were considered to be the most important ones that people face when dealing with online information. The variables investigated in the present study are identified with an (*) in the conceptual model of Figure 1.

The experiment manipulates the five independent variables in a full factorial design having 32 different treatments. A Web message was designed for each treatment and the credibility of each message was measured. Messages all involved an attempt to convince participants that it is important to read the labels on sunscreen products. This topic was chosen to meet a variety of criteria, including being meaningful to participants. Each treatment condition was tested in a pilot study and a manipulation check for each treatment was included.

The independent variables are manipulated as following. Similar to previous research, this study uses empirically constructed messages to manipulate quality of content. This study manipulates the reputation of the Web site owner using invented organizations. In order to do so, the present study uses, according to previous research, the name and additional markers found to be important when assessing the reputation of the Web site owner. To manipulate the low and high conditions for attractiveness, this study uses the Williams and Tollett (2002) Web design guidelines. This study equates low modality of exposure with plain text information and high modality of exposure with still pictures and audio. The manipulation of modality of exposure is a binary situation- either the message has multimedia or not. Simulation has both high and low conditions. To implement the high condition of simulation, users are asked to provide input variables. Based on the input variables, the system computes and returns two numbers, each of them simulating a different experience. To implement the low condition of simulation, participants are provided with a table to calculate their own outputs. In this sense, both conditions gave participants the opportunity to simulate the experience. However, the simulator provides an easier and faster way to appreciate the cause and effects.

This study addresses three research questions. First, do quality of content, attractiveness of the message, modality of exposure of the message, simulation, and reputation of the Website owner affect the credibility of a Web message? Second, do these factors interact in assessments of the credibility of a Web message? Third, what are the impacts of these factors on the credibility of a Web message? To address the first research question, the following five hypotheses, amounting to main effects, are proposed.

- H1: The credibility of a Web message will be higher for participants on the high quality content condition than for participants on the low quality content condition
- H2: The credibility of a Web message will be higher for participants on the high message attractiveness condition than for participants on the low message attractiveness condition
- H3: The credibility of a Web message will be higher for participants on the high modality of exposure condition than for participants on the low modality of exposure condition
- H4: The credibility of a Web message will be higher for participants on the high simulation condition than for participants on the low simulation condition
- H5: The credibility of a Web message will be higher for participants on the high Web site owner reputation condition than for participants on the low Web site owner reputation condition

¹This was true when participants searched for information about computers, trips, and health. However, when participants searched for information in performing research they were more concerned with the reputation of the author. It is important to note, though, that in later case participants were searching library systems on the Web.

There is no theoretical support to speculate about what interactions might occur, nor about the relative impact of the independent variables on credibility. Therefore, no hypotheses are stated for the second and third research questions.

Participants were recruited from a population with a profile similar to those of typical Web users. To recruit participants—parents of school age children—elementary schools in several adjacent communities in Southern California were contacted. Schools were offered a donation for each participant in the study. Fogg et al. (2001) used a similar approach to data collection and it proved to be an effective strategy.

Results

One hundred thirty-four participants (92 female, 42 male) provided usable data for the study. The average age of the participants was 42 years. Message credibility, the dependent variable, was measured directly (adapting Meyer's (1988) credibility index) and through attitude change (attitude change calculated, perceived attitude change, and behavioral intention²). An exploratory analysis of the dependent variables indicated that they were negatively skewed, following a non-normal distribution. To normalize the variables, several transformations were applied. The transformed distributions remained negatively skewed. However, the sensitivity analysis revealed that results from the transformed variables yielded the same results for the main effects as those obtained with the analysis of the original variables. For this reason, the data analysis was conducted using the original data. Even so, it is important to note that the analysis conducted, ANOVA, is robust to violations of normality (Howell 2002). Examination of the variables does not suggest a problem with missing values. For this reason, mean substitution for missing data was used to calculate composite variables. Table 1 presents the descriptive statistics for the dependent variables.

Table 1. Descriptive Statistics for Dependent Variables

Variable	Mean	Standard deviation	Skewness	Kurtosis	Cronbach's alpha
Credibility (measured directly)	5.79	1.04	-.91	.48	.83
Attitude change (calculated)	2.01	1.96	.14	-.63	Not applicable
Attitude change (perceived)	5.00	1.90	-.67	-.71	Not applicable
Behavioral intention	5.06	1.60	-.73	-.19	.70

Credibility (measured directly), attitude change (calculated), attitude change (perceived), and behavioral intention were analyzed using ANOVA. Out of these analyses, only credibility (measured directly) showed significant results. Only the results from the ANOVA of credibility (measured directly) are presented in Table 2. The ANOVA was calculated for the full model, however since no hypotheses were stated for the interactions, only results for the main effects are shown. It is important to note that the target power was set to .80; however, the actual power achieved was .40. This implies that, based on the sample size, the achieved power is low; therefore, differences that might exist might not have been detected. Results, in consequence, should be interpreted with caution.

Quality of content and reputation of the Web site owner affect the expected direction of people's perception of credibility. That is to say, participants exposed to a message with high quality of content perceive the message as more credible than participants exposed to a message with low quality of content. Similarly, participants exposed to a message from a highly reputed source regard the message as more credible than participants exposed to a message from a source with low reputation. Attractiveness, modality of exposure, and simulation do not show significant results. Only one four-way interaction is significant. The interaction significant at $p \leq .05$ was attractiveness, reputation of the Web site owner, quality of content, and modality of exposure. Because this was the only significant interaction out of 26 interactions that were tested, and it attained a p value of only .047, no interpretation will be attempted. Due to the limited sample size that yielded a very low statistical power, it cannot be concluded whether the independent variables interact.

As for the third research question (What is the relative impact of these factors on the credibility of a Web message?), there is only evidence of two independent variables affecting the credibility of an online message. The eta value for reputation of the Web site owner is .043, and the eta value for quality of content is .044. These results show that the reputation of the Web site owner and quality of content have similar marginal impacts on the credibility of an online message. To investigate the lack of significance

²The study asks participants about their future expected behavior. That is, it asks participants about their intentions to read sunscreen labels in the future.

of attractiveness, data from the manipulation check questions were explored. Also, questions about the effectiveness and desirability of modality of exposure and simulation were analyzed.

Table 2. ANOVA for Credibility Measured Directly

Source	Degrees of freedom	Mean Squares	F	P value
Attractiveness	1	1.021	.950	.332
Reputation of the Web site owner	1	5.043	4.691	.033***
Quality of content	1	5.160	4.799	.031***
Modality of exposure	1	2.947	2.741	.101
Simulation	1	.007	.007	.932
Error	102	1.075		
Total	134			

*** $p \leq .05$

Note: ANOVA calculated for the full model

Discussion

As noted above, the distributions of credibility variables were negatively skewed. This skewness can be explained by the evaluation strategy to assess information that participants might have employed. Fogg and Tseng (1999) propose three types of evaluation strategies people can use for assessing the credibility of computer products depending on their motivations and abilities. A 'binary evaluation' judges Web message credibility either as credible or not credible, without middle points. A 'threshold evaluation' has upper and lower thresholds, establishing a range that can be viewed as 'credible enough'. A 'spectral evaluation' is the most difficult strategy, allowing all ranges of credibility. When people have the ability, but not the motivation, to assess the credibility of the information, as is the case in the present study, they use a threshold strategy. The skewness of the dependent variables suggests that the perceived credibility of the information surpassed the upper threshold. However, future research is necessary to establish the validity of this supposition.

As mentioned earlier, credibility measured through attitude change, whether calculated, perceived, or based on behavioral intention, does not show significant results. There are two possible explanations for these results. First, attitude change is a proxy measure of credibility assuming that a message needs to be believed to cause attitude change. On the other hand, belief alone does imply attitude change. The lack of significant correlation between credibility (measured directly) and attitude change supports this explanation. Second, attitude change might have had a small 'effect size' that was not possible to detect with the limited power achieved in this study. Because manipulating the independent variables had a significant effect only on credibility (measured directly), the remainder of the discussion section focuses on the results obtained for this dependent variable.

The ANOVA on credibility (measured directly) indicates that some factors found to be valid in traditional means of communication such as quality of content and source reputation (in this case, reputation of the Web site owner) also apply to an online environment. These findings are consistent with previous research (Fogg et al. 2001; Rieh 2002) and with predictions from the Elaboration Likelihood Model (ELM). The remaining three factors, attractiveness, modality of exposure, and simulation, manipulated in this study are not significant.

Message attractiveness is not significant in the present study. It is reasonable to conclude that message attractiveness was correctly manipulated (as indicated by analysis of manipulation check data), but might have failed to have a significant effect on the credibility of a message due to the limited statistical power achieved.

Modality of exposure does not have a significant effect. Several problems in manipulating this variable were encountered when running the experiment. Not all participants who were supposed to see a multimedia presentation were able to do so. Analysis of manipulation check data suggests that the lack of significance of modality of exposure was due to a failure in delivering the treatment.

Simulation is also not significant here. Analysis of manipulation check data revealed that participants reading messages with a simulator expressed favorable opinions towards it, but participants reading a message where the information was provided in a

table did not express a need for having a simulator. It is possible that, because this study simulated a simple process, the ease of use and speed of the simulator was not greatly appreciated. Additionally, the simulator used in this study employed text-based output. It is possible that a simulator providing more appealing output would have greater effect on the perceived usefulness of the simulator.

Table 3 summarizes the discussion of these results in terms of the hypotheses stated. These results should be interpreted in the context of the limitations described below.

Table 3. Summary of Hypotheses

Hypothesis	Results
H1: The credibility of a Web message will be higher for participants in the high quality content condition than for participants in the low quality content condition.	Supported. Results were in the expected direction and confirmed findings from previous research.
H2: The credibility of a Web message will be higher for participants in the high message attractiveness condition than for participants in the low message attractiveness condition.	Not supported. Successful manipulation and delivery of the treatment. Results were in the expected direction but lacked the power to detect the effect.
H3: The credibility of a Web message will be higher for participants in the high modality of exposure condition than for participants in the low modality of exposure condition.	Not supported. Successful manipulation but unsuccessful delivery of the treatment.
H4: The credibility of a Web message will be higher for participants in the high simulation condition than for participants in the low simulation condition.	Not supported. Unsuccessful manipulation. Probably process and output too simple.
H5: The credibility of a Web message will be higher for participants in the high reputation of the Web site owner condition than for participants in the low reputation of the Web site owner condition.	Supported. Results were in the expected direction and confirmed findings from previous research.

Certain limitations to external and internal validity should be taken into account when interpreting the results from this study. The external validity of this study is lowered due to participant self-selection. Among possible threats to internal validity, history and experimental mortality were of special concern. History refers to any historical event that occurs between pretest and posttest that can confound the results of the study (Crano and Brewer 2002). The researchers know of no events occurring during the experiment that would have affected participants' responses. Experimental mortality refers to the participants' break-off or abandonment of the experiment (Crano and Brewer 2002). These situations are prevalent in Web surveys (Crawford et al. 2001). In a Web environment, it is difficult to identify causes of break-off or abandonment without the use of click-stream technology. Because click-stream technology was not used, it was impossible to assess an effect due to abandonment. Along with the limitations to the internal and external validity of the study, one of the most serious limitations is the small sample size relative to what was needed to have adequate power to detect small effects (power=.40). The limited power achieved implies that no conclusions can be drawn from the lack of significant effects for message attractiveness, modality of exposure and simulation. Under the circumstances, it is not possible to determine whether there is an effect of the mentioned variables on credibility but the effect cannot be detected because of the small sample size or there is no effect at all to be detected.

Conclusions

This study used ELM as a theoretical framework to explain the factors affecting online information credibility. Out of the five variables manipulated in the study, two of them, quality of content and reputation of the Web site owner, were statistically significant and in the expected directions according to the ELM. That is, people gave more credibility to messages with high quality of content and to those from highly reputed sources. These findings confirm previous research and suggest the adequacy of the ELM to study persuasion in the context of online information.

Modality of exposure did not significantly affect online information credibility due to an unsuccessful delivery of the treatment. When manipulating the modality of exposure, this variable cannot be treated as an on-off situation. Many factors intervene in the effectiveness of multimedia presentations; it is a complex variable that needs to be understood within a theoretical framework of its own.

In the Web environment, delivering multimedia presentations depends on the hardware and software users have to run the presentation. The lack of adequate software to run multimedia presentations should not be a barrier because multimedia players can be downloaded for free from the Web. The fact that some participants refused to download the needed software was not anticipated in this research, but suggests an interesting research area concerning the trust that is required to download software from the Web.

Simulation did not significantly affect online information credibility due to an unsuccessful manipulation of the treatment. No conclusions can be drawn from this study about the effect simulation has on the credibility of online messages.

Additionally, this study provided no evidence of attractiveness affecting online information credibility. Attractiveness was correctly manipulated, but failed to affect the message's credibility, probably due to limited statistical power. For this reason, no conclusions can be drawn from this study about the impact of message attractiveness on the credibility of online information.

Based on the findings from this study several areas for future research become clear. First, as mentioned earlier, the effectiveness of multimedia presentations on the credibility of a message is based on many factors. Findings on modality of exposure research has been equivocal; the conditions under which modality of exposure is persuasive remain unknown (Burgoon et al. 2000; Eagly and Chaiken 1984). This suggests that a theoretical framework integrating these factors is needed.

Second, the possibility to download free readers and players is one of the advantages of the Web. But some people distrust the prompts to download software and refuse to do so. The conditions under which people will and will not download software remain to be determined. Trust has been explored previously in the Web context (for instance, in e-commerce), but investigations of the trust that users must have to download software should join this stream of research.

Third, even though previous research has suggested that the attractiveness of the message is an important factor influencing online information credibility, more empirical work is needed. Guidelines to design attractive Web sites have been derived from guidelines used in traditional means of communication (Williams and Tollett 2000). But, the effectiveness of these guidelines has barely been empirically explored (Fogg et al. 2002).

Fourth, the use of computers to simulate experiences is an important factor in persuasive communication. "The key to effective cause-and-effect simulators is their ability to demonstrate the consequences of actions immediately and credibly" (Fogg et al. 2002), p.769). However, as this study showed, just demonstrating the consequences is not enough to persuade people. It seems that, similar to modality of exposure, the effectiveness of simulators on the credibility of a message is based on multiple factors that need to be explored.

Fifth, for practical reasons, this study included only some of the factors influencing the credibility of online messages. Other factors, mainly at the Web site level, such as navigability and personalization, were purposely excluded from this study. It would be important to move a step forward and investigate the factors left behind from this study.

Sixth, empirical evidence is needed to test the evaluation strategies that judge the credibility of information proposed by Fogg and Tseng (1999). The present study assumed that people had the ability, but not the motivation, to process the message; it was expected that people might be using a threshold strategy. The skewness of the responses seems to indicate that this is indeed what is happening. On the other hand, empirical support specifically designed to verify the validity of these strategies is needed.

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