

## SUMMARY

- ◆ Provides evidence that street addresses and links to external sites affect readers' judgments of the credibility of online information
- ◆ Confirms the relationship between reader characteristics and credibility judgments of online information

# An Examination of Factors That Affect the Credibility of Online Health Information

KRISANDRA S. FREEMAN AND JAN H. SPYRIDAKIS

## INTRODUCTION

Every day, millions of readers search among the countless pages of online health information (Baker and colleagues 2003; Bard 2000; Cain and colleagues 2000; Fox and colleagues 2000; Fox and Fallows 2003; Fox and Rainie 2002; Horrigan and Rainie 2002; PSRA 2002; UCLA 2003). They go to the Internet because it is open and available 24 hours a day, because it provides answers to embarrassingly personal questions, and because—unlike our increasingly harried doctors—it never has to cut a visit short.

But consumers searching for accurate information online may have an arduous task. Numerous studies have shown that, while there are excellent sources of online health information, many health Web pages have incomplete, spurious, or fraudulent information (Berland and colleagues 2001; CROH 2000; Crocco and colleagues 2002; Eng and EvaluMetrix 2001; FTC 2001; Fahey and Weinberg 2003; Hellowell and colleagues 2000; Latthe 2000; Pandolfi and colleagues 2000; Suarez-Almazor and colleagues 2001; Stephenson 1998; Stone and Jumper 2001; Weisbord and colleagues 1997). Given the poor quality of information on some Web sites, one might wonder how consumers decide what information to trust. While it would be optimal if readers had the ability to accurately assess the quality of online information itself, most lack the necessary expertise and must judge the information quality by other means, such as cues to credibility.

Many healthcare organizations, such as the Health on the Net Foundation and the Internet Healthcare Coalition, have published guidelines to help readers judge the credibility of online information, that is, to determine the expertise of the providers of online health information, as

well as the motives and goals, or trustworthiness, of these providers. In addition, researchers have used these guidelines, in combination with methods for online audience research, to develop a conceptual framework for creating credible Web sites on medical topics (Swenson and colleagues 2002). Yet little work has been done to determine how consumers actually judge the credibility of online information.

Much of the initial research on consumers' judgments of the credibility of online information focused on e-commerce sites and transactions, such as the willingness of consumers to use their credit cards online (Cheskin Research, and Studio Archetype/Sapient 1999; Cheskin Research 2000; Fogg and colleagues 2001a, 2001b, 2002a; Friedman and colleagues 2000; GVU 1999; Jones and colleagues 2000; Olson and Olson 2000; Resnick and colleagues 2000; Winn and Beck 2002).

Recently, researchers have also begun to address the credibility of online health information, primarily through large-scale surveys (Bard 2000; Cain and colleagues 2000; Fogg and colleagues 2002b; Fox and colleagues 2000; Fox and Fallows 2003; Fox and Rainie 2002; HON 1999, 2001; Horrigan and Rainie 2002; PSRA 2002; Stanford and colleagues 2002). Although these surveys provide a valuable foundation for future research, they are limited in that they ask participants to judge imaginary Web pages as opposed to actual Web pages.

It is not surprising that the results of these surveys sometimes differ from the few studies that have presented

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readers with specific Web pages to evaluate (Eysenbach and Köhler 2002; Fogg and colleagues 2002b; Stanford and colleagues 2002). Researchers who have conducted both types of studies write, "We found a mismatch, as in other areas of life, between what people say is important and what they actually do" (Fogg and colleagues 2002b). These discrepancies emphasize the need for more studies, such as the one described here, in which participants judge real rather than imagined texts.

The existing studies do agree on one key point: Once on a Web page, readers primarily use the information on only that page to determine the credibility of the information. Very few read "About us" and other information about the sponsors and authors of information on the pages before using the information on a given page (Eysenbach and Köhler 2002; Fox and Rainie 2002).

Given the narrow scope on which readers base their judgments, the research presented here examined the effects of two discrete cues applicable to many Web sites: a street address of the sponsoring organization (as opposed to an e-mail address) and links to other Web sites (external links). Survey research has indicated that these cues may increase credibility (Fogg and colleagues 2001a, 2002a; Fox and Rainie 2002). However, experiments have not been done to determine how such cues actually affect readers' perceptions of real Web pages.

The decision to publish contact information and construct external links on a Web site reflects key editorial and publishing decisions. Readers searching for health information will see a wide variation in the presence (or absence) and the location of street addresses on Web sites. This variety indicates that current Web site sponsors carefully consider the amount of contact information they release. Some firms may be reluctant to post a street address due to security concerns or simply to reduce nuisance visits from dissatisfied customers or hopeful job seekers. The research described in this study reveals the complex nature of such decisions.

Decisions regarding the type and number of external links to include on a site can also be complex. Some guidelines suggest that the presence of links to other sites can increase credibility by allowing consumers to easily cross-check information among sites (Nielsen 1999). However, on an operational level, the addition of external links increases site maintenance, since links must be regularly checked and updated. In addition, sponsors of some for-profit sites may wish to keep readers on their site as long as possible to maximize readers' exposure to site sponsors and advertisers.

The goal of this study is to examine the effect of street address and external links on perceptions of credibility of a Web page. This study attempts to determine how readers process these cues by drawing on key theories in both technical communication and psychology, including the

Elaboration Likelihood Model.

The experiment conducted to examine these issues stemmed from a review of relevant literature, discussed next. After the literature review, hypotheses are offered concerning the expected outcomes of the experiment presented here. Then, the methodology, results, and a discussion of the results are presented. Finally, conclusions and implications for future research are discussed.

## LITERATURE REVIEW

We will begin with a brief definition of the term *credibility* and then describe the Elaboration Likelihood Model because it provides a framework for understanding factors that affect the credibility of online health information. Then we will review reader characteristics affecting credibility and methods used to measure credibility.

### **Credibility defined**

Because credibility is a characteristic defined by reader judgments, it is not necessarily equivalent to the actual quality of information, such as its accuracy or truthfulness. Many researchers have defined credibility "not as an objective property of the source [of information], but as a receiver perception" (Gunther 1992, p. 148). Fogg and colleagues (2001a) wrote that credibility "is a perceived quality; it doesn't reside in an object, a person, or a piece of information" (p. 80). Therefore, in this article, the term *credible* refers to a perception of credibility rather than a direct measure of actual quality.

Credibility is a complex concept that has been defined as "believability, trust, perceived reliability, and dozens of other concepts and combinations" (Self 1996, p. 421). Hovland and Weiss (1951), who conducted seminal research on media credibility, defined credibility as having two primary components: trustworthiness and expertise. Many factors shown to affect credibility judgments can be categorized as components of or synonyms for these two traits.

For example, the traits of honesty, accountability, objectivity, character, goodwill, and concern for the public welfare have been used as credibility measurements in some studies (Frewer and colleagues 1996, 1997; Priester and Petty 1995; Swenson, Constantinides, and Gurak 2002). All these factors can contribute to judgments of trustworthiness. Others researchers, drawing from theories in speech and interpersonal communication, have considered a third key trait, sometimes referred to as dynamism, in their credibility studies (Self 1996).

### **The Elaboration Likelihood Model**

The Elaboration Likelihood Model (ELM) developed by Petty and Cacioppo (1986) provides a useful theoretical framework for understanding how factors such as the pres-

ence of a street address or the reputation of a Web site sponsor can affect the credibility of information on a Web page. ELM, a theory of persuasion initially developed in the discipline of psychology, postulates that readers tend to judge text credibility either on the basis of arguments within a text or through external cues such as the type of publication in which a text appears.

Petty and Cacioppo (1986) call these two “routes to persuasion” the central route and the peripheral route (p. 3). According to ELM theory, the central route involves readers making a conscious cognitive effort to carefully evaluate the arguments in a text. The peripheral route is based on cues that allow readers to make a simple judgment about the merits of an argument without having to evaluate the argument itself.

Petty and Cacioppo describe a variety of factors that can influence people’s use of central processing, in which they analyze the message itself, or their use of peripheral processing, in which they depend on cues such as the reputation of a newspaper or a Web site where the information appears. Readers are more likely to use central processing when they (1) believe an argument has personal relevance, (2) are knowledgeable about a given topic, (3) are motivated, and (4) are able to process the information in a message.

When readers use central processing, they give less weight to peripheral cues. In contrast, readers depend more on peripheral cues to make judgments as their motivation or ability to process arguments decreases, or when they are overwhelmed with information, as is often the case for consumers of online medical information.

### Credibility of online information

After briefly discussing characteristics that affect credibility judgments and some heuristics that detail these criteria, we will define the credibility variables manipulated in the current study. Then, we will discuss reader characteristics that can affect readers’ judgments of online medical information in the framework of ELM theory.

### Source characteristics and credibility judgments

The credibility of online health information is known to be affected by characteristics relating to several levels of source information, including (1) publishers, such as the owners or sponsors of a Web site or radio station; (2) authors or anchors, such as the writers or speakers who collect and frame information; (3) originators of information—that is, sources of information contained within the text, such as scientists or politicians quoted in news stories; and (4) communication channel or technology—that is, the means by which information is transmitted, such as television or the Internet (Sundar 1998). Table 1 lists positive characteristics described by a variety of guidelines and

heuristics at the levels of publisher/sponsors and authors/originators (see Freeman 2002 for discussion of the impact of other source levels on credibility judgments).

While many guidelines agree on relevant characteristics, the positive impact of all characteristics has not been proven. For example, while several guidelines suggest the use of “seals” of approval for Web sites that follow certain guidelines and recommend that readers look for such seals, a recent survey indicates that the presence of such seals or awards does not have much impact on readers’ decisions to use information from a given Web site (PSRA 2002).

However, numerous studies have shown that readers tend to trust health information published, sponsored, or authored by major health institutions or physicians. Research focusing on health information in print has shown that large medical institutions and physicians are generally viewed as credible sources of health information (Christensen and colleagues 1997; Cline and Engel 1991; Dutta-Bergman 2003; Frewer and colleagues 1996). A survey commissioned by the California Healthcare Foundation (Cain and colleagues 2000) found that the tendency to view medical institutions and physicians as highly credible carries over into cyberspace. The specific institutions that readers deem credible can vary by demographic group and individual circumstances (Balshem 1991; Bernhardt and colleagues 2002; Guttman and colleagues 1998).

In the same way that the presence of credible sources can increase the credibility of health information Web sites, the lack of source information can decrease the credibility of a site. Of participants in surveys conducted by the Pew Internet and American Life, 42% reported turning away from a health Web site “because they couldn’t determine the source of the information” (Fox and Rainie 2002, p. 8).

A wide range of site-wide factors may affect the credibility of online health information, including the quality of navigation and template design, and the presence or absence of advertisements and promotional language (Eysenbach and Köhler 2002; Fogg and colleagues 2001a, 2002a, 2002b; Fox and Rainie 2002; Zhang and colleagues 2001). Some specific features cited by survey participants and recommended by credibility heuristics convey important information about the sponsor or publisher of a site. Two such features were tested in this study—the presence of a street address and links to other sites.

The presence or absence of a street address is a discrete cue that is relevant to almost any type of Web site. The presence or absence of external links is another discrete cue that is relevant to many types of online information, with the possible exception of some types of commercial sites. Although research concerning these cues stems primarily from survey participants describing their responses to imagined Web pages, the results of such studies provide a starting point for the work we report in this article.

**TABLE 1: WEB SITE CHARACTERISTICS THAT AFFECT CREDIBILITY AND RELATED GUIDELINES**

Positive Characteristics at the Level of the Publisher/Sponsor (site-wide)	Guideline Sources
Advertising, paid links, sponsorships, e-commerce partnerships	
◆ Clear distinctions between editorial and advertising content	Winker and colleagues 2000; ASME 2002; HIE 2000; HON 1997; IHC 2000; NIAMSD 2000; Price 2000
◆ Disclosure	Winker and colleagues 2000; ASME 2002; HIE 2000; HON 1997; IHC 2002; NCI 2002
◆ Policies	Winker and colleagues 2000; ASME 2002; FTC 2001; HIE 2000; HON 1997; HSWG 1998; IHC 2000; NCI 2002; Price 2000; Silberg, Lundgerg, and Musacchio 1997
Certifications/seals from third parties	HIE 2000; HON 1997; IHC 2000; Price 2000; Shneiderman 2000
Contact information	BIOME 2001; HON 1997
Design	
◆ “Professional”	BIOME 2001; Nielsen 1999, 2000
◆ Clear navigation	Winker and colleagues 2000; BIOME 2001; Nielsen 1999, 2000
Editorial review process and/or board	Winker and colleagues 2000; BIOME 2001; Gastel 1998; HSWG 1998; HIE 2000; IHC 2000; NCI 2002; NIAMSD 2000; Price 2000
Links	
◆ To credible sites	BIOME 2001; HSWG 1998; Nielsen 1999, 2000; Price 2000; Silberg and colleagues 1997
◆ From a credible portal	BIOME 2001; Gastel 1998; NIAMSD 2000; Price 2000
◆ Policy regarding	NCI 2002
Logo on all pages	ASME 2002; NCI 2002
Medical disclaimers	HSWG 1998; HIE 2000; IHC 2002; Price 2000
Privacy and security policies	Winker and colleagues 2000; ASME 2002; HIE 2000; HON 1997; IHC 2000; NCI 2002; Nielsen 1999, 2000; Price 2000; Shneiderman 2000
Reports of past performance	Friedman and colleagues 2000; Shneiderman 2000

**TABLE 1: Continued**

Positive Characteristics at the Level of the Author/Article	Guideline Sources
Sponsorship by credible organization(s)	Winker and colleagues 2000; BIOME 2001; CROH 2000; FTC 1999, 2001; Gastel 1998; HON 1997; HSWG 1998; IHC 2002; NCI 2002; NIAMSD 2000; Price 2000; Silberg and colleagues 1997
Author names	Winker and colleagues 2000; BIOME 2001; HON 1997; IHC 2002; Gastel 1998; NIAMSD 2000; Price 2000; Silberg and colleagues 1997; Spyridakis 2000
Author qualifications	Winker and colleagues 2000; BIOME 2001; Gastel 1998; HIE 2000; HON 1997; IHC 2002; NCI 2002; NIAMSD 2000; Price 2000; Silberg and colleagues, 1997
Scientific citations/references	Winker and colleagues 2000; BIOME 2001; Gastel 1998; HIE 2000; HON 1997; IHC 2000; NCI 2002; NIAMSD 2000; Price 2000; Silberg and colleagues 1997
Timeliness: dates when information created/updated posted	Winker and colleagues 2000; BIOME 2001; Gastel 1998; HIE 2000; HON 1997; HSWG 1998; IHC 2002; NCI 2002; Nielsen 2000; Price 2000; Silberg and colleagues 1997

**Posting of a street address** Participants in two large-scale surveys ( $n = 1,441$ ;  $n = 1,481$ ) reported that information that increased “real world feel,” such as the presence of a “physical” address and contact phone number, increased the credibility of online information (Fogg and colleagues 2001a, 2002a). Seventy-five percent of participants in another survey stated that it was very important or somewhat important for a site to list e-mail addresses for the editor or other people responsible for site content (PSRA 2002), and comments from a large-scale study ( $n = 2,684$ ) in which participants were asked to rank and comment on specific Web sites indicated that the presence of contact information, such as a street address and phone number, increased credibility (Fogg and colleagues 2002b).

The presence of a street address can serve either as a tool for central processing of information or as a cue for peripheral processing. Readers engaged in central processing may use the address to contact site publishers or article authors, or they may use the address to glean more information about the site publisher. For example, a site based in Atlanta, GA, might be presumed to have relatively easy access to the U.S. Centers for Disease Control and Prevention (CDC). In contrast, readers engaged in peripheral processing may simply note the presence of a street address as a credibility cue.

**External links** Survey participants have also reported

that external links to a site they think is believable can increase credibility (Fogg and colleagues 2001a, 2002a). Additionally, several guidelines for the design of online information list the presence of links to credible sources of health information as a sign of credibility (see Table 1). However, not all heuristics agree on this point. The Internet Healthcare Coalition warns consumers not to be “fooled by a comprehensive list of links—any Web site can link to another and this in no way implies endorsement from either site” (Internet Healthcare Coalition 2002). Lasica (2002) maintains that “paid links” can reduce the credibility of a site or article. As the name implies, paid links are placed in exchange for a fee and so serve as a subtler form of a banner ad. Broken links can also decrease credibility by serving as evidence of poor site maintenance, and some credibility guidelines warn readers away from sites with many broken links (BIOME 2001).

Like the presence of a street address, links can serve either as tools for central processing of information or as cues for peripheral processing. Readers engaged in central processing may follow links to gain additional information or to compare the arguments and information on one site with that from another while readers engaged in peripheral processing may simply note the presence of links to other sites.

#### **Reader characteristics and credibility judgments**

Because credibility is a perception rather than a fixed

measure of quality, factors that affect credibility can vary widely from one individual to another. These factors can include a sense of being rushed for time, which affects many persons in our culture, or demographic factors such as age. Another key factor can be personal experience with serious illness. In other words, the experiences that readers bring to a text will affect their judgment of that text.

Information overload and shortage of time are factors that can affect the use of central or peripheral processing by readers from all demographic groups. According to recent studies, readers seeking health information online are often in a hurry and are usually not very systematic in their searches, factors that would encourage their reliance on peripheral processing, rather than central processing. Participants in a recent study ( $n = 17$ ) spent an average of five minutes researching health questions (Eysenbach and Köhler 2002). The respondents in recent Pew surveys report starting their searches at a search engine rather than of a specialized health site or portal, and simply starting at the top of the list of search results and working their way down from there (Fox and Rainie 2002). In addition, few readers seek out information on sources of the information they read (Eysenbach and Köhler 2002; Flanagin and Metzger 2000; Fox and Rainie 2002).

Age can also affect perceptions of credibility. Several studies have found that younger people are more likely to judge online media as credible than older people (Finberg and colleagues 2002; Johnson and Kaye 1998); they are also more likely to use the Internet to acquire health information (Licciardone and colleagues 2001). In contrast, a survey commissioned by Consumer WebWatch (PSRA 2002) found that concerns about credibility of online information did not vary much by "age, race, income, or education" (p. 8).

Another factor affecting readers' judgments of credibility concerns their experience with online media. Experienced users are somewhat more likely than less-experienced users to view the Internet as a credible source of information (Flanagin and Metzger 2000). Horrigan and Rainie (2002) found that the longer persons had used the Internet, the more often they used online health information, and a UCLA research team (UCLA 2003) found that "very experienced users" (six or more years of experience with the Internet) rated the Internet as their most important source of information. Internet users tend to have higher education and income levels than people who do not use the Internet (Bard 2000; Fox and colleagues 2000; Cain and colleagues 2000; Fox and Rainie 2002; GVU 1999; Horrigan and Rainie 2001; PSRA 2002). Researchers report that women are more likely to research health information online than men (Baker and colleagues 2003; Cain and colleagues 2000; Fox and Fallows 2003; Fox and Rainie 2002) and the California Healthcare Foundation reports

that women aged 40–49 form one of the largest segments of "Health e-people" (Cain and colleagues 2000).

While people's experience with the Internet positively correlates with their perceptions of the credibility of online information, people's knowledge of medicine may inversely correlate with their perceptions of the credibility of medical information in mass media. According to ELM theory, people who have existing knowledge about a subject are more likely to scrutinize information about that subject and use central processing, and thus pay less attention to peripheral cues. Therefore, it would be reasonable to assume that people with knowledge of medicine, such as those who have worked in medical settings or covered medical topics for a newspaper, may scrutinize online health information more carefully than people without such knowledge.

Even if readers do not have extensive medical knowledge, many will still compare the information on a given Web page with the knowledge they already have. According to the Pew Internet and American Life Project, many readers judge information solely on the basis of whether it fits with what they have already heard (Fox and Rainie 2002). When using this strategy, readers use central processing to evaluate information and are less likely to depend on peripheral cues.

Personal experience with illness also affects how readers process health information online. Personal experience with health challenges, or with a friend or family member with health challenges, makes information about that topic personally relevant. ELM theory posits that as personal relevance of information increases, so will levels of central processing. Recent studies show that almost all readers search for information of personal relevance and many search for information of relevance to a friend or family member (Fox and Fallows 2003; Fox and Rainie 2002).

Readers' health status can also affect their involvement with online information and so their use of central or peripheral processing. About 60% of people reading health information online could be categorized as "well," 5% as "newly diagnosed," and 35% as chronically ill or caregivers of the chronically ill (Cain and colleagues 2000). The "well" searchers typically make infrequent searches for information on topics such as anti-aging, wellness, and preventative medicine and wellness (Baker and colleagues 2003; Cain and colleagues 2000; Fox and Fallows 2003; Houston and Allison 2003). The level of involvement for many of these searchers may be low. In contrast, the newly diagnosed are a transient group characterized by intense searches in the first weeks after being diagnosed with a serious condition. The level of involvement felt by these searchers is apt to be quite high, as is that of the chronically ill and their caregivers, a group that is characterized by heavy online use, including the use of online chats (Cain

and colleagues 2000; Fox and Fallows 2003; Houston and Allison 2003).

Familiarity and interest in a topic can increase readers' ability to use central processing of information, as well as their motivation to do so. Prior knowledge, personal relevance, or interest in a topic are known to affect reading comprehension (Isakson and Spyridakis 1999; Raphael and colleagues 1980; Wade and Adams 1990).

These factors can work together to increase or decrease central processing. For example, a person with a chronic illness who has spent considerable time researching his or her disorder will approach new information both with preexisting knowledge and a sense of personal relevance. In turn, the interaction of processing strategy and cues in print or online documents can affect judgments of credibility.

### Measuring credibility

In addition to source and reader characteristics that affect credibility judgments, the various ways in which credibility has been measured are relevant to the design of the current study. Credibility has often been measured through questionnaires using Likert-scaled responses (Austin and Dong 1994; Christensen and colleagues 1997; Cline and Engel 1991; Eastin 2001; Flannagin and Metzger 2000; Fogg and colleagues 2001a, 2001b, 2002a; Frewer and colleagues 1997; Gaziano and McGrath 1986; Hovland and Weiss 1951; Kaufman and colleagues 1999; Meyer 1998; Pennbridge and colleagues 1999; Priester and Petty 1995; Sundar 1998, 1999, 2000; West 1994). In addition to Likert-scaled questionnaires, Frewer and colleagues used thought listing and interviews, Pennbridge and colleagues solicited qualitative responses, and Gaziano and McGrath conducted focus groups and had participants rate reliability of media.

The credibility of media, authors, articles, and sponsors has been assessed through a variety of adjectives, including *credible* itself, the secondary characteristics of *trustworthiness*, *expertise*, and *dynamism*; and adjectives that could be characterized as tertiary components of credibility that are thus categorized under the secondary characteristics of *trustworthiness* (*believable*, *biased*, *fair*, *objective*, *sensational*, *truthful*); *expertise* (*accurate*, *complete*, *competent*, *depth of reporting*); and *dynamism* (*attraction*). Some tertiary factors could arguably fall under more than one category. For example, in his factor analysis study of reader comments, Sundar (1998, 1999, 2000) found that several characteristics (*accurate* and *believable*) loaded on two scales (*credibility* and *quality*).

Several recent credibility studies of online information have focused on the trustworthiness-expertise model of credibility first posited by Hovland and colleagues, further developed by Gaziano and McGrath (1986), and refined

and validated by later researchers. One widely cited scale is the Meyer (1988) subset of the Gaziano-McGrath scale which was validated by West (1994); it consists of five components (fairness, bias, depth of reporting, accuracy, and trustworthiness).

### Summary of relevant literature

This literature review reveals that while millions of pages of online health information are available, many are incomplete and contain poor quality information. Credibility, which one might hope would relate to the actual quality of information, relates to users' perception of quality and has two primary components: trustworthiness and expertise. According to the Elaboration Likelihood Model (ELM), readers who are unfamiliar with, are uninterested in, or have difficulty processing information are more likely to evaluate information quality on the basis of peripheral cues, such as the reputation of a publisher, than are readers who are familiar with, are interested in, or are able to easily process the same information.

Furthermore, many readers of online information rarely spend the time to research the credibility of the publisher or author of information in Web pages they read. By default, many readers tend to judge information on a given Web page only by the information on that page. Therefore they may gauge the credibility of information on a Web page on the basis of peripheral cues on a Web page, such as the presence or absence of a street address. Reader characteristics can also affect credibility judgments, characteristics such as medical knowledge, health status, and age.

The literature reviewed here reveals a wide range of cues that may affect readers' judgments of the credibility of online information. However, many studies of cues are based on surveys in which participants have been asked to describe their responses to an imagined Web page, not on experiments in which participants have been asked to make judgments about real Web pages.

While many cues could be assessed for their effects on credibility, many are applicable only to a certain type of site. For example, the presence or absence of advertisements applies only to commercial sites, and designations such as .gov applies only to government agencies. The study presented here focused on cues that are relevant to many types of Web sites—the presence or absence of a street address and the presence or absence of links to external sites—and assessed their effects in an experiment that relied on real Web pages. The research questions and hypotheses concerning the effect of these cues are discussed next.

### STUDY QUESTIONS AND HYPOTHESES

Our research study asked four questions. The first two concerned the relationship of readers' credibility judg-

ments and their (1) familiarity with, interest in, and perceptions of the difficulty of the experimental materials, and (2) employment in a health or medical setting. The second two questions assessed the effect of two manipulated variables—street address and external links—on reader's credibility judgments.

The literature led to the following hypotheses concerning participants' credibility ratings.

- ◆ Participants' familiarity with, interest in, and perceptions of difficulty of the information in the articles will relate to the ratings.
- ◆ Participant's experience or employment in a medical setting will relate to the ratings.
- ◆ Articles that include a street address or external links will receive higher ratings than articles without a street address or links.
- ◆ Presence of both a street address and external links will increase ratings more than either variable alone.

One final hypothesis related to our expectation that credibility ratings would be similar for two different articles used in the study. As described in the methods section, two articles were used to ensure that credibility effects would not be topic-specific.

## RESEARCH METHODS

### Study design

The study used a 2 (article topic: diabetes or hepatitis) x 2 (street address: present or absent) x 2 (external links: present or absent) between subjects factorial design.

### Participants

One hundred fifty participants (102 females, 48 males) took part in this study. To increase the likelihood that participants would include readers likely to use both central processing as well as readers likely to use peripheral processing in making credibility judgments about the experimental materials, participants were recruited with a goal of obtaining a mixed sample of people with varying levels of experience in a health or medical setting and experience writing about medicine or science as a professional journalist. Because many people search for health information for friends and family members, participants were not restricted to persons who had one of the diseases described in the experimental materials.

Participants were recruited through multiple venues: the electronic newsletter *Solidarity in Seattle*, published by the Seattle office of the Screen Actors Guild; the e-bulletin of the University of Washington Department of Environmental Health; and the list-servs and e-mail lists of the University of Washington (UW) Department of Technical Communication, the University of Washington student chapter of the ACM Special Interest Group in Computer Human Interaction (SIGCHI), the Puget Sound Chapter of

the National Association of Science Writers, Women in Digital Journalism, and St. John United Lutheran Church in Seattle, WA. As an incentive, all participants could enter a drawing to win one of three gift certificates (\$50.00, \$25.00, and \$10.00 USD) to Amazon.com.

### Materials for experimental conditions

Eight Web pages containing health information were created by varying: (1) article topic, (2) presence or absence of a street address, and (3) presence or absence of external links. Additional pages contained instructions and the questionnaire.

**Article topics** Two article topics were used to avoid the possibility that the results of this study would be unique to a particular text. Selected topics concerned relatively well-known diseases—diabetes and hepatitis A (hereafter referred to as diabetes or hepatitis). Articles about these topics were selected from the Web site of the CDC (2001, 2002) and covered basic information in a question-and-answer format about the prevention and treatment of the disease.

Differences in credibility between the two articles were minimized through the selection of text that included no references, cited no sources, and had no byline. The two articles were edited so that they were similar in length (407 words for diabetes article, 395 words for the hepatitis article); structure (Q & A); and Flesch-Kincaid reading levels (9.3 for the diabetes article, 9.0 for the hepatitis article). The quality of the articles and subsequent edits was evaluated by six graduate students in the Department of Technical Communication at the University of Washington.

The text of the articles was presented flush left in black text on a white background with the name and logo of a fictitious health organization (the National Health Organization) placed on the each page in the upper left-hand corner.

**Address** The Web pages varied in the presence or absence of a street address with phone number. If present, the address with phone number was located just below the logo of the fictitious National Health Organization. The fictitious address was on a street in Washington, DC, in an area of the city that is home to many government offices and non-profit organizations (see Figure 1).

**Links** The Web pages varied in the presence or absence of external links to additional sources of information. Web pages with links had three links to major government research organizations or non-profit agencies concerned with the disease presented. The external links were non-functional; participants who clicked on these links encountered a message stating that, for the purposes of the experiment, the external link was not functional. External links were placed flush left just below the text of the article.

**National Health Organization**  
412 M Street SW  
Washington, DC 20460  
(202) 123-5678

**Frequently Asked Questions About Diabetes**

**What is diabetes?**  
Diabetes is a chronic disease in which the body does not make or does not properly use insulin. Insulin is a hormone that helps your body use the energy from sugar, starches, and other foods. When it does not make or use enough insulin, your body does not get the energy it needs and the sugar (glucose) that is not metabolized builds up in your blood.

This build up of blood sugar can damage the body and its systems, leading to serious health problems such heart disease, blindness, and kidney failure.

**What are the symptoms of diabetes?**  
People who think they might have diabetes must visit a doctor for diagnosis. They might have SOME or NONE of the following symptoms:

- Excessive thirst
- Frequent urination
- Unexplained weight loss
- Extreme hunger
- Sudden changes in vision
- Tingling or numbness in hands or feet
- Frequent fatigue
- Very dry skin
- Sores that are slow to heal
- More infections than usual

**Figure 1.** Partial screen shot of diabetes article with address present.

### Instructional pages

The study had several instructional pages. The welcome page told participants that the experiment would take less than half an hour, and that they would remain anonymous and could withdraw from the experiment at any time by simply closing their browser. This page also described the prize drawing. An active link at the bottom of this page was entitled, "Continue to experiment." At the end of the experiment participants were presented with the prize drawing page that allowed them to enter the drawing or move to the final screen that thanked the participants.

### Questionnaire

After reading one of the randomly assigned experimental Web pages, participants were presented with a questionnaire with Likert-scaled and qualitative questions that assessed participants' credibility judgments of the articles and demographic characteristics. The questionnaire pages were developed using WebQ software (developed by the University of Washington Center for Teaching, Learning, and Technology).

**Credibility and reader measures** The credibility mea-

asures were based on the research described in the literature review of this article. Ten questions asked participants to indicate their level of agreement on a five-point Likert-type scale with statements about the article they had just read and about the author of the article (see Figure 2). The questions directly addressed credibility at three levels: credibility itself, secondary components of credibility (expertise and trustworthiness), and tertiary components of credibility (accuracy, a component of expertise; and bias, a component of trustworthiness). The scale was syntactically awkward in the case of two variables: "article is expert" and "author is accurate." However, pilot testing with a variety of phrasing possibilities suggested that consistency between the two sets of questions (about article and author) was more important than correct syntax.

Participants were asked to rate their willingness (1) to recommend the article to someone who had or was at risk for contracting the disease, or (2) to use the information in the article themselves. Participants were also asked to rate topic familiarity, interest, and difficulty.

**Demographic questions** Demographic questions assessed age, gender, Internet use, interest in or experience with the disease described in the article they read, and experience working in a medical setting. Questions about Internet use were adapted from GVU surveys (GVU 1999).

**Open-ended, qualitative questions** Open-ended, qualitative questions asked participants (1) to list some words they might use to describe the quality of the article they read and (2) to state what characteristics of a Web site would most influence their decision to use the information found on the Web site.

### Pilot testing

Materials were pilot-tested to determine whether the two articles in the no address/no link conditions would receive similar credibility ratings, and to check the functionality of the WebQ software. Unpaired *t* tests ( $n = 21$ ) showed no significant differences between the articles in terms of credibility ratings, thus validating our assumption that the articles in their base states would have similar levels of credibility. Pilot-test participants did detect and report several technical problems in the demographic portion of the study questions. These problems were corrected.

### Overall procedure

Participants accessed the online experimental Web site using the URL publicized in the electronic bulletins. They then read the general instructions for the experiment and selected the "Continue to experiment" link. At that point, one of the eight Web pages prepared for the study, randomly selected, opened in the browser. After reading the

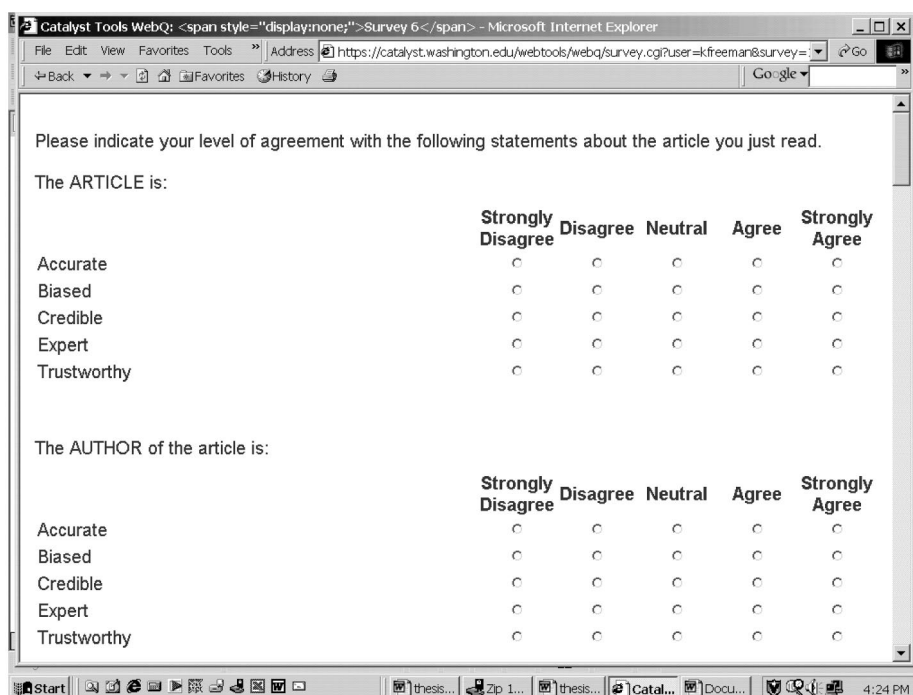


Figure 2. Screen shot of credibility rating questions.

page, the participants advanced to the questionnaire, the drawing screen, and the final screen.

**Data analysis**

Quantitative results were analyzed in SPSS 10 and StatView 5.0.1 (a product of the SAS Institute) on a personal computer. Qualitative data from the two-open ended questions were analyzed using content analysis. Further details concerning the content analysis scheme can be found in the qualitative results section of this article. Two anonymous raters (one researcher and a colleague) rated a sample of 10 comments; since they had 95% inter-rater reliability, only one anonymous rater assessed the remaining comments.

**RESULTS**

After reviewing the demographic results, we discuss the participants' ratings of familiarity with, interest in, and dif-

ficulty of the articles. We then examine quantitative measures for credibility, and discuss the qualitative results. Only results at an alpha level  $< + .05$ , reported as a *p* value, are discussed as significant; in other words, there would be only a 5% chance that the findings reported as significant are due to chance. All reported correlations are Pearson correlations as variables were either interval or were ordinal with interval-appearing scales.

**Participant demographics**

Participants in this study (102 females, 48 males) ranged in age from 21 to 71 (mean = 39.6; standard deviation = 12.0). They were typical of the larger population of Internet users in that they were relatively well educated (see Table 2). Further, many participants had professional experience with medical issues. Twenty percent ( $n = 30$ ) had reported on medical or scientific issues as professional journalists,

**TABLE 2: PARTICIPANTS' EDUCATIONAL LEVELS**

Education (n = 150)				
Bachelor's degree	Master's degree	Doctorate degree	Professional degree	Other
42%	32%	6%	2%	18%

**TABLE 3: USE OF THE INTERNET TO SEARCH FOR INFORMATION (% FREQUENCY)**

Never	A few times a year	About once a month	About once a week	More than once a week
<b>Use of the Internet to Search for General Information (n = 149)</b>				
0.0	6.0	8.7	10.7	74.0
<b>Use of the Internet to Search for Medical Information (n = 150)</b>				
5.3	50.0	22.7	11.3	10.7

and one third ( $n = 48$ ) had worked in a health or medical setting, for a total of 47% of participants ( $n = 70$ ) with such experience (eight participants reported experience in both categories). The number of years worked in a health or medical setting ranged from one to 35 years, with an average of 8.1 years (standard deviation = 7.9), and significantly correlated with age,  $r(45) = .593$ ,  $p < .01$ . In other words, the more time that participants had worked in a medical setting, the older they were. This fact is revealed through the correlation  $r$  of .593 (with correlations ranging from  $-1$  to  $+1$ ) and a  $p$  of  $<.01$  (which is considerably lower than the criterion alpha level of .05 or less).

#### Personal experience with article topic

Just 2% of the participants ( $n = 3$ ) reported having one of the two illnesses described in the articles. About 5% of participants reported that they did not know whether they had the disease described ( $n = 4$  for diabetes,  $n = 3$  for hepatitis), and one third ( $n = 53$ ) reported having a friend or relative with one of the two illnesses.

#### Internet use

Study participants were active users of the Internet to obtain general information and less frequent users of the Internet to obtain medical information. A majority of participants (74%) reported looking up general information on the Internet more than once a week (see Table 3). Only 10.7% reported looking up medical information that frequently. Half of the participants reported looking up medical information on the Internet just a few times a year. Significant correlations revealed that persons who looked up general information on the Internet were more likely to look up medical information [ $r(147) = 0.370$ ,  $p = 0.000$ ], and older participants were significantly less likely to look up general information on the Internet [ $r(146) = -0.247$ ,  $p = 0.003$ ].

Participants reported that they had engaged in a broad range of Internet activities and actions. Participants re-

ported having engaged in two to eight Internet activities (such as e-mail, chat, playing interactive games), with a mean of 5.2 activities (standard deviation = 1.5). The number of Internet actions participants reported having engaged in (such as bookmarking a page or changing a browser setting) ranged from zero to five, with a mean of 3.6 actions (standard deviation = 1.6). Significant correlations showed that persons who engaged in more of the listed Internet activities were likely to participate in more of the listed Internet actions [ $r(140) = 0.455$ ,  $p = 0.000$ ]; and that the older they were, the less likely they were to engage in the listed Internet activities [ $r(147) = -0.305$ ,  $p = 0.000$ ] or actions [ $r(139) = -0.314$ ,  $p = 0.000$ ].

Further, participants who engaged in more of the listed Internet activities used the Internet significantly more often to look up general information [ $r(147) = 0.388$ ,  $p < 0.000$ ] and medical information [ $r(148) = 0.256$ ,  $p = 0.002$ ]; and participants who engaged in more of the listed Internet actions used the Internet more often to look up general information [ $r(139) = 0.229$ ,  $p < 0.006$ ].

#### Participants' interest, perceptions of difficulty, and familiarity

Before analyzing the participant's perceptions of the articles, we first ran  $t$  tests to assess the effect of topic on these variables. Because the  $t$  tests were nonsignificant for interest and difficulty, the topics were collapsed for further analysis of these variables. A majority of participants rated the article they read as interesting or very interesting (60%), and easy or very easy (91.4%) (see Table 4). Participants who rated the articles as easier reported engaging in more of the listed Internet activities [ $r(148) = 0.196$ ,  $p = 0.016$ ] and Internet actions [ $r(140) = 0.194$ ,  $p = 0.021$ ].

A  $t$  test of the effect of article topic on familiarity revealed a significant difference [ $t(148) = 2.216$ ,  $p = 0.029$ ]. Participants were more familiar with the information in the diabetes article (mean = 3.61, standard deviation = 1.00) than with the information in the hepatitis article (mean =

**TABLE 4: INTEREST IN AND PERCEIVED DIFFICULTY OF ARTICLES (% FREQUENCY)**

Interest in Article Read (n = 149)				
Very uninteresting	Uninteresting	Neutral	Interesting	Very interesting
0.0	17.3	22.0	54.0	6.0
Perceptions of Difficulty of Article (n = 150)				
Very difficult	Difficult	Neutral	Easy	Very easy
0.0	0.0	8.7	58.7	32.7

3.23, standard deviation = 1.07). Therefore, familiarity results were examined separately by topic (see Table 5). A majority of participants rated the information in the articles as familiar or very familiar (diabetes article, 66.2%; hepatitis article, 51.9%), although more participants were unfamiliar with the hepatitis information (29.1%) than with the diabetes information (11.3%).

Participants who were familiar with the information in the articles they read were significantly less likely to be interested in the article [ $r(147) = -0.199, p = 0.015$ ]; and more likely to look up health information online [ $r(148) = 0.287, p = 0.000$ ].

**Quantitative analysis of credibility ratings**

To assess the effect of topic, address, and links on the credibility ratings, we first determined which credibility measures would be most reliable. We suspected that the primary measure (credibility) and the secondary measures (expertise and trustworthiness) would contribute the most to reliability assessments and that the tertiary measures (bias and accuracy) would contribute the least. Cronbach's alpha coefficients were used to assess the correlations among test items. The results supported our expectations.

The Cronbach's alpha for the combination of the primary and secondary credibility measures concerning article credibility was 0.87 (n = 142) and fell to 0.63 (n = 142) when the tertiary measures were added. Similarly, the Cronbach's alpha for the combination of the primary and secondary credibility measures concerning author credibil-

ity was 0.90 (n = 142) and fell to 0.68 (n = 142) when the tertiary measures were added. Because a Cronbach's alpha of 0.80 is considered acceptable, we excluded the tertiary measures from further analysis.

The analyses were approached through a two-step process. The first step was to assess the effect of topic, address, and links on each of the primary credibility measures, covarying by the opposing primary measure. Hence, two three-way analyses of covariance (ANCOVAs) were run to assess the effects of topic, address, and links on article credibility. (ANCOVAs allow for the assessment of differences among experimental conditions as well as the adjustment of, or the removal of, the effect of a covariate on the dependent variable of interest.) Additional ANCOVAs were then run on some secondary measures with other covariates. The specifics of these results are discussed next, yet it is helpful to understand that the only significant results were for the effect of address.

The ANCOVA that assessed the effect of topic, links, and address on article credibility, using author credibility as a covariate, revealed a significant main effect for address ( $p = 0.005$ ). Articles that contained physical addresses for the sponsoring organization received higher ratings (mean = 4.05) than articles without physical addresses (mean = 3.79). There were no significant main effects for topic or links, or significant interactions.

The ANCOVA that assessed the effect of topic, links, and address on author credibility, using article credibility as a covariate, showed a trend toward significance for the

**TABLE 5: FAMILIARITY WITH DIABETES AND HEPATITIS TOPICS (% FREQUENCY)**

	Very unfamiliar	Unfamiliar	Neutral	Familiar	Very familiar
Diabetes (n = 71)	4.2	11.3	18.3	52.1	14.1
Hepatitis (n = 79)	3.8	29.1	15.2	44.3	7.6

effect of address ( $p = 0.057$ ). Interestingly, in this case the results were opposite of the first analyses. Articles that contained physical addresses for the sponsoring organization received lower ratings (mean = 3.55) than articles without physical addresses (mean = 3.74). There were no significant main effects for topic or links, or significant interactions.

Because the ANCOVA on author credibility was marginally significant with regard to the effect of address, we next assessed the effect of the topic, address, and links on the secondary components, using the secondary credibility components as separate covariates so that we could capture the remaining secondary component as well as other unmeasured credibility factors (such as dynamism, attractiveness, goodwill, and so forth—see Self 1996; Swenson and colleagues 2002). For example, when article expertise is removed from an analysis of article credibility, the remaining parts of article credibility concern article trustworthiness and a variety of other unmeasured credibility measures.

The ANCOVA that assessed the effect of topic, links, and address on article credibility, using article expertise and author credibility as covariates (thus focusing on trustworthiness and other unmeasured credibility factors), revealed a significant main effect for address ( $p = 0.003$ ). Articles that contained physical addresses for the sponsoring organization received higher ratings (mean = 4.05) than articles without physical addresses (mean = 3.78). There were no significant main effects for topic or links, or significant interactions.

The ANCOVA that assessed the effect of topic, links, and address on article credibility, using article trustworthiness and author credibility as covariates (thus focusing on expertise and other unmeasured credibility factors), also revealed a significant main effect for address ( $p = 0.021$ ). Articles that contained physical addresses for the sponsoring organization received higher ratings (mean = 4.00) than articles without physical addresses (mean = 3.82). There were no significant main effects for topic or links, or significant interactions.

The ANCOVA that assessed the effect of topic, links, and address on author credibility, using author expertise and article credibility as covariates (thus focusing on trustworthiness and other unmeasured credibility factors), also revealed a significant main effect for address ( $p = 0.048$ ). In contrast to the earlier results on article credibility, the articles that contained physical addresses for the sponsoring organization received lower ratings (mean = 3.53) than articles without physical addresses (mean = 3.72). There were no significant main effects for topic or links, or significant interactions.

The ANCOVA that assessed the effect of topic, links, and address on author credibility, using author is trustwor-

thiness and article credibility as covariates (thus focusing on expertise and other unmeasured credibility factors), revealed no significant effects.

In summary, the ANCOVAs identified significant effects for the effect of address on the credibility ratings. Three analyses revealed that articles were rated as significantly more credible when the Web pages contained addresses, but one analysis revealed that authors were rated as significantly more credible when the Web pages did not contain an address.

### Willingness to use/recommend article information

Analyses of variance (ANOVAs reveal whether there were statistically significant differences between experimental conditions) were run to determine the effects of topic, address, and links on participants' ratings concerning their willingness to (1) recommend that someone who had or was at risk of contracting the disease in the article (diabetes or hepatitis) read it, and (2) use the information in the article themselves. There were no significant main effects or interactions of topic, address, or links on ratings for participants' willingness to recommend or use the information in the article themselves.

### Relationships of credibility ratings to other variables

Several interesting relationships were identified among the credibility ratings and other measures. There were significant inverse correlations between the number of Internet actions (such as bookmarking a page or changing a browser setting) in which participants reported engaging and three credibility variables: article credibility [ $r(138) = -0.208, p = 0.014$ ], article trustworthiness [ $r(134) = -0.214, p = 0.011$ ]; and author expertise [ $r(133) = -0.184, p = 0.033$ ]. The more facile that the participants were in terms of Internet use, the lower their ratings for article credibility and trustworthiness, and for author expertise. In addition, we discovered significantly positive correlations between article expertise and age [ $r(140) = 0.197, p = 0.019$ ] and author expertise and age [ $r(140) = 0.178, p = 0.035$ ]. The older the participants, the higher their ratings on article and author expertise.

Participants' interest in the topic correlated with their willingness to use or recommend information in the articles, as well as all six credibility measures (see Table 6). Other interesting correlations concerned the ratings for using or recommending information in the articles; these two measures correlated with each other and with all six credibility measures. If participants were likely to use the information in the articles, they were likely to recommend them. Further, participants who stated that they were more likely to use or recommend the information rated the articles and authors as more credible, expert, and trustworthy

**TABLE 6. ANCOVA RESULTS FOR EFFECT OF ADDRESS**

Credibility Measure	Means <sup>◆</sup> (St. Error)		ANCOVAS F and p values
	Address present	Address absent	
Article is credible (covariate: author is credible)	4.05 (0.06)	3.79 (0.06)	F(1, 146) = 8.162, p = 0.005
Author is credible (covariate: article is credible)	3.55 (0.07)	3.74 (0.07)	F(1, 146) = 3.685, p = 0.057
Article is credible (covariates: article is expert, author is credible)	4.05 (0.06)	3.78 (0.06)	F(1, 142) = 9.347, p = 0.003
Article is credible (covariates: article is trustworthy, author is credible)	4.00 (0.06)	3.82 (0.06)	F(1, 142) = 5.446, p = 0.021
Author is credible (covariates: author is expert, article is credible)	3.53 (0.07)	3.72 (0.06)	F(1, 142) = 3.969, p = 0.048

◆ Means are adjusted for covariates.

(see Table 9).

Additionally, the less difficult that the participants rated the article, the less likely they were to rate it as expert [ $r(141) = -0.204, p = 0.015$ ]. This was an inverse correlation because the Likert-type responses for ratings for difficulty and article expertise ran in opposite directions, with a rating of one equating to "very difficult" on the difficulty scale and "strongly disagree" on the scale for article expertise (equivalent to "article is very inexperienced"). There were no significant correlations among the credibility variables and length of employment in a health or medical setting.

#### Qualitative analysis of open-ended questions

Responses to the two open-ended questions were analyzed with a content analysis scheme. The unit of analysis for the content analysis was one participant response per question, regardless of whether participants wrote only a few words or several paragraphs. Units were initially categorized as referring to the quality of the specific articles or general principles for evaluating Web sites. Comments regarding article quality were categorized on scales of positiveness, familiarity, interest, and difficulty. Other comments concerning general Web principles were categorized at the source level of the publisher/sponsor, the author, or the originators of the information; or unspecified or multiple sources; or links, street address, contact information.

These categories at the source level were occasionally applied to article quality comments.

Of the 140 participants' responses to the first question, which asked participants to list words they might use to describe the quality of the article read, all referred to the articles participants had read. Similarly, of the 148 responses to the second question (about characteristics of a Web site that most influence participants to use information from the site), almost all referred to factors participants use in general to evaluate Web sites; only 8 responses referred partly or wholly to the specific articles the participants read. Participants' comments reproduced here have been edited for spelling and capitalization, but not for grammar or punctuation.

#### Comments regarding articles read

All responses in this portion of the results refer to comments participants made regarding the articles they read.

**Participant familiarity** Participants' comments reflected their familiarity with the content of the articles. Three participants explicitly stated that they were unfamiliar with the information in the articles and one participant explicitly stated that she was familiar with the information. Nine other participants' comments served as strong, implicit statements of their familiarity with the material presented, primarily by characterizing the information in the

**TABLE 7: CORRELATIONS AMONG VARIOUS MEASURES  
(ALL CORRELATIONS ARE SIGNIFICANT AT  $p \leq 0.01$ )**

	Interest	Recommend Information	Use Information
<b>Interest</b>			
<b>Recommend article (n = 148)</b>	0.382		
<b>Use information (n = 148)</b>	0.436	0.619	
<b>Article is credible (n = 146)</b>	0.270	0.443	0.414
<b>Article is expert (n = 142)</b>	0.412	0.454	0.444
<b>Article is trustworthy (n = 142)</b>	0.433	0.429	0.543
<b>Author is credible (n = 146)</b>	0.312	0.382	0.427
<b>Author is expert (n = 141)</b>	0.410	0.462	0.537
<b>Author is trustworthy (n = 142)</b>	0.340	0.380	0.487

article as accurate or inaccurate. For example, one participant wrote of the article that “some of information is misleading and some is correct.”

**Participant interest** Participants’ comments also reflected their interest in the articles. Three participants referred to the articles as “interesting,” and one referred to an article as uninteresting (“I have no use for this info at this time so it wasn’t interesting or anything new”). One participant implicitly expressed interest by writing a lengthy comment on the article topic (hepatitis) and related issues. Five participants revealed an implicit lack of interest in the article read, with two calling it “boring” and three calling it “dull.”

**Perceived difficulty** Participants’ comments revealed their perceptions of article difficulty: 99 comments described the article as being easy or containing basic information, with 89 of these comments describing the ease of the article in positive or neutral terms, such as “basic,” “introductory,” or “good for uninformed general public.” Ten comments described the articles as easy in negative terms, such as “dumbed down,” “not enough thorough info,” and “didn’t contain enough info to take action.” No comments described the article as difficult.

**Source of information** Many comments addressed issues concerning the four levels of source described in the literature review. Of the seven comments about the pub-

lisher/sponsor of the Web site, three specifically noted a lack of information about the site’s sponsor or publisher and explicitly or implicitly reported this as a factor that reduced credibility. One comment noted the lack of advertising, implicitly reporting this factor as increasing credibility (the “purpose [of the site] appears to be informational rather than commercial”).

Another participant revealed that she was unfamiliar with the fictitious sponsoring organization and thus relied on the accuracy of the information for judging quality: “I am not familiar with this organization, so I am neutral about judging the quality of the content. However, I am somewhat familiar with the topic, so my impression is that it is accurate.” Two other comments referred to the publisher/sponsor in positive ways, specifically citing the presence of the name and logo of the fictitious source as increasing credibility: for example, “The source is the most important—This was a national health organization, unbiased, so it was o.k.”

Many negative judgments occurred regarding the lack of clear source information. Three comments noted the lack of supporting information such as statistics and scientific references. Three comments mentioned the lack of information about the author of the articles as a negative factor: for example, “Who is the author? Where did this info come from?” Further negativity was seen in one comment that mentioned a general lack of source information. Six comments explicitly linked the lack of source information to reduced credibility; the following are examples:

*No author information. No publication information. It is hard to trust it.*

*The fact that there were no references provided for some of the statements makes me question the authority of many statements, so I can't give high marks for accuracy or trustworthiness.*

*I don't remember any source being given in the article, including who produced it, which would be hugely important to me in determining whether it is credible or not.*

Two participants, including one who explicitly mentioned trustworthiness, discussed the need to corroborate information from one Web site with that from others: "I found the article easy and pretty straightforward, however, you cannot believe what you read from one source, you need to corroborate the data from trustworthy sites."

**Street address and links** Although no participants mentioned the presence or absence of a street address, two mentioned the presence or absence of links. One participant, who read an article with links, apparently felt that the links were insufficient in providing guidance: "[the article] had little in-depth organization and little direction provided to the reader other than URLs for other organizations." Another participant, who read an article without links, noted that the lack of links decreased credibility: "No sources, links, or visuals made it seem dull and less than expert."

**Other information** One participant pointed out an error in the hepatitis article. The hepatitis article cites an inaccurate boiling point for water—a statement that was taken directly from the Web site of the CDC (2001). The error was not detected in pilot testing.

#### **Comments regarding general evaluation strategies**

All 148 responses refer to characteristics that participants stated would influence their decisions to use information from a Web site. Unless otherwise noted, the factors analyzed have a positive impact on participants' willingness to use a site.

**Source of information** Ninety-eight comments mentioned source at some level as an important consideration in participants' decisions to use information from a site. Some comments made multiple mentions of source, for a total of 125 mentions of source. Specifically, 59 comments mentioned the publisher or sponsor of a site as an important consideration in participants' decisions to use informa-

tion from a site. Credible sources listed by the participants included hospitals, universities, government agencies, and well-known non-profit organizations. One participant wrote, "I want to see writers or quotes from faculty and staff at Johns Hopkins or Mayo Clinic or other respected research/academic facilities." Another wrote: "For instance www.newsweek.com would be a 'sorta' credible site but www.americanmedicalassociation.com would be more credible and the CDC site would be my preferred choice." Some participants also wrote that they would use sites suggested by their physicians or other health professionals.

Negative factors related to source at the publisher/sponsor level included advertisements, ".com" designations, and nonauthoritative personal sites. One participant wrote, "I would be more likely to believe information from the American Diabetes Association than I would from Joe Diabetic's Web site." (The American Diabetes Association was one of the links on the page this participant read.)

Source at the level of author was mentioned in 22 comments as a factor in participants' evaluations of medical information online. Comments included "written by health professionals." Source at the level of originators of information, such as scientific references, was mentioned in 24 comments. For example, one participant referred to "well-known physicians quoted on the Web site." Finally, 20 comments mentioned the importance of source at a general or unspecific level as opposed to specifically referring to source at the level of publishers/sponsor, author, or originator of information.

**Street address and links** Although no participants mentioned the presence or absence of a street address, 17 comments mentioned the presence of external links as a positive factor in participants' evaluation of a Web site. Comments included: "links for further info," "scientific references and links," and "links to supporting organizations." In some cases, the reference to links was qualified with participants specifying that a particular type of link would be viewed as a positive factor. Qualifying comments included: "credible links are provided for further information" and "external links jump to other high-quality sites."

**Contact information** Two comments mentioned unspecified types of contact information as a positive factor in participants' evaluation of a Web site with medical information. One participant wrote, "credible sources with full contact info."

**Other factors** Of the 148 comments on Web site characteristics influencing use of a Web site, 26 addressed design elements that affect participants' evaluation of Web sites. Factors that participants described as positive included: "easy to navigate," "easy to scan," "modular infor-

mation with graphics," "page e-mailable," "page e-printable," "professional design," "rapid loading time," and "usability." Negative factors included: "annoying moving graphics," "glaring pop-up ads or problems with links," and "unnecessary graphics." Participants' negative comments also stated: "A junky site has less credibility" and "I probably wouldn't trust medical information that was presented in Comic Sans [a typeface]."

Some additional factors included institutional accreditation, information quality, and perceptions of source bias. One participant mentioned third-party accreditation as a positive factor in her evaluation of a health information Web site. The comment referred to "credibility indicators, such as the AMA seal." Other participants mentioned issues related to information accuracy and lack of errors, and factors related to writing and editing, such as clear, logical organization of information, as factors that would tend to increase their willingness to use information from a Web site. One participant explained her bias rating: "Also, FYI, I say that the author is very biased because I believe we are all biased—it's not bad, just reality."

## DISCUSSION

We first examine results regarding reader characteristics as they relate to external validity and participants' use of central or peripheral processing. Then we discuss credibility ratings related to specific reader characteristics and credibility measures in general, followed by a brief statement concerning limitations of the implementation of the study variables.

### Reader characteristics and external validity

Regarding age, level of education, and gender, the participants in this study were representative of the Internet population as a whole, especially people who use the Internet to search for medical information. Like the population of users of online medical information interviewed by other researchers (Baker and colleagues 2003; Cain and colleagues 2000; Fox and Fallows 2003; Fox and Rainie 2002), a majority (68%) of the participants in this study were female. The gender and average age of participants (mean = 39.6) matched the demographic profile of one of the largest categories of "Health e-people," women aged 40–49 (Cain and colleagues 2000).

Participants were also typical in their frequency of use of medical information online; like the majority of participants in previous studies (Baker and colleagues 2003; Cain and colleagues 2000; Fox and Fallows 2003; Houston and Allison 2003), participants searched for medical information infrequently, just a few times a year. In addition, the finding that the older the participants, the less likely they were to use the Internet to look up general information and to engage in Internet actions and activities is consistent

with the findings of other studies (Licciardone and colleagues 2001).

Regarding professional experience in a health or medical setting, or with health or medical information, participants were less representative of the general Internet population in that nearly half of the study participants had worked in a health or medical setting, or had covered medical or scientific issues as a professional journalist. Therefore, it would be reasonable to assume that participants had a relatively high level of medical knowledge compared with the general population of Internet users.

Furthermore, because 82% had at least a four-year college degree, it would be reasonable to assume that participants would have had an easy time understanding the study directions and questions, including the credibility scales used in the study.

### Reader characteristics and use of central or peripheral processing

The effects of reader demographics on credibility ratings can be evaluated in the framework of ELM theory and what it suggests about the use of central vs. peripheral processing to judge credibility. ELM theory posits that personal or general interest in, familiarity with, and perceptions of reading ease of a topic can increase motivation and the ability to use central processing to evaluate information about that topic.

Concerning topic interest, 60% of the participants reported being interested or very interested in the articles that they read. While the survey question regarding interest did not distinguish between types of interest, such as general, professional, and personal, several of the demographic questions implicitly addressed issues related to personal and professional interest (the participant's having the disease or having a friend or relative with the disease, or experience as a professional journalist or in a health or medical setting). About one third of participants had personal experience with the disease they read about, or had a friend or relative who had personal experience with this disease. It could be assumed that personal experience of some participants could translate into personal interest, and that fact could increase their motivation to use central processing to evaluate the articles they read.

Participants with experience in a health or medical setting, or with reporting about medical or scientific issues as a professional journalist (nearly half the participants in this study), could be presumed to have a professional interest in the articles, a fact that might increase their tendency to use central processing. Professional concern regarding the accuracy of medical information might provide these participants with motivation to evaluate the articles using central processing. In addition, participants with professional experience in health, medicine, or sci-

ence were likely to be better able to interpret the articles than the rest of the participants, increasing the likelihood that they would use central processing.

The general medical experience of the participants, as well as their personal interest, was reflected in the overall participants' familiarity with the topics in the articles they read; 66.2% rated the information in the diabetes article as familiar or very familiar, and 51.9% rated the information in the hepatitis article as familiar or very familiar. These participants would have had more ability and possibly more motivation to use central processing to evaluate the articles they read, compared with readers who were not familiar with the information in the articles.

Results also showed that while readers' interest in a topic can contribute to their familiarity, readers' familiarity with a topic does not always cause them to be interested in a specific text. A significant inverse correlation showed that participants who were familiar with the information in the articles were less likely to find it interesting. This relationship may reflect the fact that the articles were written at a basic level more likely to appeal to people with little knowledge of or familiarity with the topics than to people with greater topic knowledge or familiarity.

Regarding the difficulty of the articles, quantitative and qualitative results showed that a large majority of participants rated the articles as easy or very easy. Therefore, the majority of participants had the ability to use central processing to evaluate the articles.

The significant inverse correlations between Internet experience, as operationalized by experience with the listed Internet actions and activities, and ratings for article difficulty may be associated with the findings that participants who engaged in more Internet activities were also more likely to look up medical and general information, and participants who engaged in more Internet actions were more likely to look up general information online. This searching activity may have provided these participants with background knowledge or other experience that caused them to perceive the articles as easier.

Factors that may have decreased participants' ability or motivation to use central processing and to scrutinize the information might have included a desire to complete the study quickly and the knowledge that the Web pages were part of an academic study.

### **Reader characteristics and credibility ratings**

Reader characteristics of age, interest in the information, perceptions of text difficulty, experience in medical settings, and Internet experience related to many of the participants' credibility ratings. Age positively correlated with ratings for article expertise and author expertise; in other words, the older the participants, the higher the ratings, and the younger the participants, the lower the ratings.

These findings contrast with other studies that have shown an inverse correlation between age and credibility ratings for the Internet as a channel of information (Finberg and colleagues; Johnson and Kaye 1998; PSRA 2002). Since participants in this study were, by definition, users of the Internet, this finding may speak more to the relationship between the age of the participants and their judgments of the credibility of online medical information than to their judgments of the credibility of online information in general.

Interest in the articles positively correlated with all six of the credibility ratings: In other words, participants who were more interested in the articles rated them more highly on these credibility criteria. However, the inverse correlation between participants' interest in and familiarity with the articles indicates that at least some interested participants may have lacked the ability to critically evaluate the articles. Therefore, they may have rated the articles more highly than participants who had greater medical knowledge.

There was a significant inverse correlation between ratings for article difficulty and article expertise. In other words, participants tended to equate ease with lack of expertise. These quantitative findings were reinforced by some of the qualitative comments that referred to the articles as "dumbed down," "lightweight," and "shallow." This result reinforces the findings of a recent Pew Internet and American Life Project survey (Fox and Rainie 2002) where participants "suggested that high-level writing may inspire trust in a site" (p. 24).

The lack of significant correlations between participants' familiarity with the information in the articles and credibility ratings may indicate that other reader characteristics, such as interest, may be stronger predictors of credibility ratings. Another possibility is that varying levels of interest among participants who were familiar with the information in the articles confounded any significant relationships between familiarity and the credibility ratings.

Participants' Internet experience, as gauged by their reported participation in the listed Internet actions, also correlated with credibility ratings. The greater participants' experience with the listed Internet actions, the lower their ratings for article credibility, article trustworthiness, and author expertise. These correlations may be associated with the finding that participants who reported engaging in more Internet activities reported that they were also more likely to look up general information online. Therefore, they may have had greater experience encountering poor quality or deceptive information on the Internet than readers with less Internet experience. These encounters may have decreased their tendency to view online information, including online medical information, as credible, trustworthy, or expert.

### Credibility measures

Participants gave articles with an address significantly higher ratings for article credibility and significantly lower ratings for author credibility than they gave articles without addresses. Although the presence or absence of an address affected quantitative results, participants made almost no mention of physical or street addresses in their qualitative comments. The presence of a physical address apparently triggered participants to evaluate article and author credibility in different ways. The presence of address relates to source credibility at the level of the site publisher—and when participants answered credibility questions about the article itself, they were apparently thinking about credibility at the publisher level.

It may very well be that readers engaged in peripheral processing and simply noted the presence of a street address as a cue toward credibility. In contrast, when they answered questions about author credibility, they were considering a different level of source (and were perhaps contrasting the author and publisher levels). Participants may then have engaged in central processing, which in turn made them more critical, as they apparently took the address cue as a negative cue regarding author credibility.

There is also qualitative evidence that the presence of an address served as a peripheral cue for evaluating the articles. In other words, the topic of contact information provided by an address did not seem to be a focus of attention or conscious thought, that is, of central processing. No participants mentioned a street address in their comments about the article read or their general strategies for evaluating Web sites and only two participants mentioned contact information (of an unspecified nature) as a factor in their general strategies for evaluating Web sites.

While the presence or absence of links did not significantly affect credibility ratings, there is qualitative evidence that links factor into participants' credibility judgments. Nineteen participants mentioned links in the qualitative comments, even though no questions we asked could have cued such comments. In addition, participants discussed specific types of links that would positively affect their decision to use information on a Web site ("credible," "high-quality"). Therefore it appears that external links were an object of conscious thought and evaluation, and so may have been processed by some participants through the central route. As a result, links may serve as more complex cues of credibility than the presence or absence of an address, and may be more affected by reader characteristics.

Qualitative results from this study regarding the importance of aspects of information sources and Web site design in evaluating health information online were congruent with previous studies. Source was the factor mentioned most frequently by participants as a factor in their decision to use health information on a Web site. Two thirds of the

participants discussed how positive and negative characteristics of the sources of information at some level—publisher/sponsor, author, originator of information, or unspecified—affected their opinion of health information. After aspects of source, aspects of Web site design (such as the use of graphics and illustrations) were mentioned most frequently by participants as factors affecting their evaluation of online information.

### Study variables

A few limitations concerning the implementation of the address and link variables merit further discussion. The organization name and address used in the experimental materials were fictional, factors that could have decreased credibility ratings by readers who were aware that the "National Health Organization" did not exist. One participant reported, "I am not familiar with this organization, so I am neutral about judging the quality of the content." However, at least one participant found the organization title and logo to be reassuring: "This was a national health organization, unbiased, so it was O.K."

In addition, the external links were not functional, a factor that could have affected credibility ratings by limiting the ability for further analysis by readers using central processing to evaluate the articles and links. The mere fact that the links were not functional, though not broken, could have also decreased credibility ratings.

### CONCLUSION

The results of this study confirm previous credibility research in several areas, as well as breaking new ground in other areas. This study confirmed the strong relationship between readers' evaluations of sources of information at various levels—publisher/sponsor, author, and originator of information—and their evaluation of the information provided by or attributed to that source.

Results also demonstrated that ELM theory provides a useful framework for studying the credibility of online information because ELM theory posits that readers' personal experiences and circumstances determine whether they use central or peripheral processing to evaluate a specific Web page. The characteristics of participants in this study appeared to affect the processes they used to evaluate the articles they read, and so also affected their credibility ratings of those articles.

Study results revealed several areas where readers' personal experiences affect their evaluations of the credibility of online information. Readers may judge online medical information less critically if it interests them. They may equate difficulty with expertise when evaluating medical information online. In addition, readers with greater Internet experience may be more critical in their credibility judgments than those with less experience.

The findings indicate that the presence of a street address serves as a basic cue of credibility for a broad range of Internet users with varying prior knowledge, and that readers may process the presence of a street address as a cue to trigger either peripheral or central processing, which in turn can affect their credibility judgments. In this study, it appears that when readers used peripheral processing, they perceived a street address as a feature that increased credibility, yet when readers used central processing, they perceived a street address as a feature that decreased credibility. Because this study used a fictitious address from an area of Washington, DC, that is home to many federal agencies, it is unclear whether the mere presence of a street address, or rather the presence of a *credible* street address, affected credibility ratings.

The fact that the presence of an address significantly affected credibility ratings among a population not likely to rely on such cues, especially cues related to an unknown organization, demonstrates that a street address can serve as a powerful cue of credibility. It would be reasonable to assume that the presence of a street address might have greater impact among participants with less medical knowledge or less ability to process the information in the articles. This cue might also have more impact if readers were processing less familiar information or text that they perceived to be difficult.

It is interesting that, while addresses clearly affected credibility ratings, participants did not discuss them in their comments about the article read or their general strategies in evaluating Web pages. Still, participants' comments did indicate that many are aware of links and that some carefully evaluate the credibility of individual links. Readers may be more likely to consider the type of links in an article, rather than the mere presence or absence of links, when making credibility judgments. The contrasting results for quantitative ratings vs. qualitative comments speak to the need to elicit both kinds of data when investigating credibility effects.

Although this study was restricted to online medical information, it is extremely likely that these results would apply to many types of Web pages. Publishers, editors, and authors should carefully consider adding a street address to their Web pages, realizing that in some cases it will increase credibility and in other cases it may decrease credibility. While further research should clarify these differences, Web publishers would be well advised to pilot test pages with street addresses to see how they affect readers. Further, Web publishers would also be advised to pilot test external links to determine their impact on the credibility of Web pages.

#### DIRECTIONS FOR FUTURE RESEARCH

The results of this study suggest several areas for future research. Future research should compare the effects of several types of addresses, perhaps a Washington, DC,

address, like the one used in this study, with an address from an area less well known and less likely to be associated with government or medical agencies. It would also be instructive to test specific address components to determine whether a "contact us" link on a Web page had the same impact as a street address on a Web page, and to determine the relative impacts of street address, e-mail address, phone number, and other contact information, such as the names of editors or publishers.

The results of this study also indicate directions for research into the potential impact of external links as cues to credibility. Future research could focus on the factors that may affect the credibility of external links—such as whether the page being linked to is part of a commercial, non-profit, or government site. Once factors that affect the credibility of links have been better determined, it would be instructive to test the effects of high- and low-credibility links on overall credibility ratings of a Web page.

Future research should also assess other Web design issues known to affect credibility judgments. The broad issue of design could be parsed into many factors, such as usability, accessibility, and use of graphics, and the effects of these factors on credibility.

Study results regarding relationships among reader characteristics and credibility ratings also indicate directions for further research. It would be instructive to confirm whether some readers truly equate difficulty with expertise, and if so, how the use of difficult text to increase credibility among some readers can be reconciled with the need for clear information accessible to readers at a wide range of literacy levels. Further examination of the effects of reader interest vs. reader familiarity on credibility ratings could provide valuable insight into the ways that expert and non-expert readers evaluate online medical information.

Findings linking Internet experience with lower credibility ratings also invite further exploration. Internet experience could be operationalized in a number of ways, such as time spent searching for medical information or personalization of browser settings, factors that could impact credibility judgments independently or in concert. It may also prove important to distinguish among readers by their health status. The credibility cues used by people who are healthy may differ from those used by people who are chronically ill or the caregivers of chronically ill people.

The practical benefits of research into credibility cues online may be matched by their contributions to the understanding of a new medium. It will be fascinating to look back in 20, 30, or 50 years to see whether the credibility cues used by readers have changed, and if so, how their evolution reflects that of the Internet as a whole. **TC**

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- KRISANDRA S. FREEMAN**, MS, ELS, is a public information specialist at the University of Washington Center for Ecogenetics and Environmental Health. Prior to coming to the University of Washington, she was a newspaper reporter, magazine editor, and full-time freelance writer, specializing in medical and technical

topics. Her articles have appeared in *Encarta encyclopedia* and *abcnews.com* and have won awards from STC and the National Association of Government Communicators. Contact information: [kfreeman@u.washington.edu](mailto:kfreeman@u.washington.edu)

**JAN H. SPYRIDAKIS**, a professor in the Department of Technical Communication at the University of Washington,

teaches courses on style in writing, research methodology, and international and advanced technical communication. Her research focuses on the effect of document and screen design variables on comprehension and usability, and on the refinement of research methods. She is a fellow of STC. Contact information: [jansp@u.washington.edu](mailto:jansp@u.washington.edu)