Understanding Judgment of Information Quality and Cognitive Authority in the WWW

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Abstract

In the WWW, people are engaging in interaction with more, and more diverse information than ever before, so there is an increasing need for information "filtering." But because of the diversity of information resources, and the lack of traditional quality control on the WWW, the criteria of authority and quality of information that people have used for this purpose in past contexts may no longer be relevant. This paper reports on a study of people's decision making with respect to quality and authority in the WWW. Seven facets of judgment of information quality were identified: source, content, format, presentation, currency, accuracy, and speed of loading. People mentioned source credibility with two levels: institutional level and individual level. Authority was identified as a underlying theme in source credibility. Institutional authority involved: institutional domain identified by URL; institution type; and institution reputation recognized by names. Individual authority involved: identification of creator/author; creator/author affiliation; and creator/author's name. People were more or less concerned with evaluating information quality depending upon: the consequence of use of information; act or commitment based on information; and the focus of inquiry. It was also found that people believed that the web, as an institution, was less authoritative and less credible than other types of information systems.

INTRODUCTION

Most people have criteria for judging the quality and authority of information based upon their knowledge and experience of traditional information resources, making use of conventional, well-understood indicators of authority, and of quality mechanisms such as editorial selection. These criteria are often used for reducing (or "filtering") the amount of information people interact with when searching for information. In traditional information retrieval, such information reduction has been accomplished considering topicality as the basis of relevance judgments. However, a fair number of empirical studies on relevance judgment have revealed that people use many criteria other than topicality in their judgments of relevance (e.g. Barry, 1994; Cool, Belkin, Frieder, & Kantor, 1993; Park, 1993; Schamber, 1991; White & Wang, 1997). Two such criteria, related to one another, are quality and authority.

The WWW has become one of the fastest growing electronic information sources. In the Web, people are engaging in interaction with more, and more diverse information than ever before, so that the problem of information reduction is more significant in the Web than any other information system, especially considering the rate of growth in the number of documents. This suggests that people, in the context of Web, need some ways to effectively manage the amount of information with which they directly engage. There are two significant factors in the Web context which makes this particular problem especially difficult. The first is that there is no overall quality control mechanism in the Web. In the print world, quality is established through such mechanisms as reviews, refereeing processes, and the reputations of publishing houses or other publishing media (Janes & Rosenfeld, 1996). In general, people recognize quality and authority in printed publications because there are accumulated standards for publications according to which they judge the goodness of information. Since such significant criteria for information reduction are not in general established in the Web context, people might be unable to use their established methods for this purpose, in this new context. The second issue is that people understand authority on the basis of personal experience with particular sources, or reputations, or other related factors (see, e.g. Wilson, 1983), and use these factors in routine ways to reduce the amount of information with which they directly interact. But because of the dynamic nature of the Web, and the lack of control over publication on the Web, and the general lack of experience that most people have with the Web, people's previous experience and previously established authority structures are likely no longer to be directly relevant for this purpose.

These issues define the problem area that we wish to investigate: overall, how to understand and how to support quality and authority decisions effectively in a large uncontrolled environment. The present study aims to explore information quality and authority in the Web environment by observing information seeking behaviors with respect to evaluation of quality and authority in the Web environment. Specifically, this study addresses the following research questions:
1. What are the characteristics of information problems and search activities that lead people to engage in information interaction on the Web?
2. How do people make judgments about information quality and authority?
3. Do people apply their evaluation criteria used in traditional information systems to those in the Web?

DEFINITIONS AND DIMENSIONS

Information Quality

One of the problems in defining the concept of information quality is that there is little research that is specifically directed toward the concern of quality in the context of IR. This does not mean that the concern with the quality of information is new. In fact, there have been hidden bits and pieces concerning this concept, often in the literature of relevance and its criteria. For example, Cooper (1973), who proposes "personal utility" as a measure of retrieval effectiveness, says that "utility is a catch-all concept involving not only topic-relatedness but also quality, novelty, importance, credibility, and many other things" (p. 92). The studies on relevance criteria have revealed that people use "perceived quality" (Park, 1993), "actual quality" (White & Wang, 1997), and "expected quality" (White & Wang) as criteria for the selection or rejection of documents. Accuracy/validity (Barry, 1994), goodness & usefulness (Cool et al., 1993), and accuracy & validity (Schamber, 1991) are factors which have been associated with the concept of quality.

The concept of information quality has been addressed in information science in a variety of ways other than in relevance studies. One way to discuss quality is "quality management" in library and information services, often used synonymously with "excellence" (Johannsen, 1995). Another way is to discuss "data quality," primarily associated with accuracy in the information product such as databases (Levitin & Redman, 1995). Data quality should be differentiated with "data system quality," such as timeliness of update, system reliability, system accessibility, and system usability, and data security (Fox, Levitin, & Redman, 1996). Klobas (1995) suggests that "information quality" and "technical quality" comprise "product quality." Olaisen (1990) claims that "information quality" is made up of "cognitive quality," "design quality," "product quality," and "delivery quality." A problem with information quality as a research construct is that researchers use the term information quality in many different contexts without setting a clear definition or extent. This results in conflicting and ambiguous interpretations of the concept of information quality (Wormell, 1990).

Table 1. Comparison of Dimensions of Quality in Five Studies

Marchand (1990)	Fox et al. (1996)	Taylor (1986)	Klobas (1995)	Olaisen (1990)
Quality Management	Data Values in Data Quality	Quality in the Value-added Model	Information Quality	Information Quality
Actual Value Aesthetics Features Meaning over time Perceived Value Relevance Reliability Validity	Accuracy Completeness Consistency Currency	Accuracy Comprehensiveness Currency Reliability Validity	Accuracy Authority Currency Novelty	Accessibility Actual value Completeness Credibility Flexibility Form Meaning over time Relevance Reliability Selectivity Validity

Table 1 shows the dimensions of "quality" identified in these studies. Though these studies examined the concept of quality in different contexts (e.g. quality management, data quality, value-added model), it is interesting to note that a number of characteristics, such as accuracy, currency, reliability, and validity appear three times across the five studies. Unfortunately, none of these facets has been confirmed on the basis of empirical evidence.

Taylor's (1986) concept of quality in his value-added model appears to provide the most general framework which can be applied to the evaluation of information systems, information, and data. In the value-added model, Taylor identifies 23 values in six categories of user criteria (ease of use, noise reduction, quality, adaptability, time-saving, and cost-saving). According to him, some of these "added" values are tangible; that is, one can see their manifestation, for example in index terms, in feedback displays, or in formats. Others are intangible values, such as accuracy, currency, or reliability. Taylor defines quality as "a user criterion which has to do with excellence or in some cases truthfulness in labeling" (p. 62), and identifies five values included in the judgment of quality, as shown below. It is worth noting that these quality values are for the most part intangible values. According to Taylor, this indicates that "we tend to be suspicious of a system or a package which needs to advertise its reliability or its accuracy by words only" (p. 62). He further argues that these characteristics are earned over time and by reputation. His five quality values were defined as follows:

- Accuracy: the value added by the system processes that assure error-free transfer of data and information
- Comprehensiveness: the value added by the completeness of coverage of a particular subject or discipline (e.g. chemistry) or of a particular form of information (e.g. patents)
- Currency: the value added: (a) by the recency of the data acquired by the system; and (b) by the capability of the system to reflect current modes of thinking in its access vocabularies
- Reliability: the trust a user has in the consistency of quality of the system and its outputs over time
- Validity: the degree to which data or information presented to users are judged as sound

From Taylor's definition, it is inferred that accuracy, currency, reliability and validity are associated with "data" or "information" or "outputs" of a system while comprehensiveness is related to information systems. What is of interest is that these five facets are exactly the same ones that occurred frequently (three times) across the five studies as shown in Table 1. These five facets are also considerably consistent with what the studies on user relevance criteria (e.g. Barry, 1994; Cool et al., 1993; Park, 1993; Schamber, 1991; White & Wang, 1997) have found with respect to the quality of information.

Cognitive Authority

The term "authority" is found in many different forms throughout society, cutting across many disciplines, including philosophy, education, psychology, political science, law, religion, and information science. De George (1976) speaks of authority in two senses: "epistemic authority" (declarative-emotive) and "deontic authority" (performatory), explaining that the first corresponds to being "an authority" and the second refers to being "in authority." Wilson (1983) differentiates two kinds of authority defining "cognitive authority" as "influence on one's thoughts that one would recognize as proper" (p. 15) while "administrative authority" involves the recognized right of the person who is in a position to tell others what to do. It is obvious that our concern with authority in IR refers to cognitive (or epistemic) authority, not administrative authority.

Wilson (1983) provides a useful basis for conceptualizing cognitive authority in his book, *Second-hand Knowledge*. The fundamental assumption of his concept of cognitive authority is that there are two kinds of knowledge: one kind is based on our own personal experience and the other is what others have told us. Wilson calls the latter type "second-hand knowledge." The problem here is that we do not count all "hearsay" from others as equally reliable. Some people know what they are talking about, others do not. Therefore, people need to decide "who knows what about what" (p. 10). That is a question of cognitive authority.

Wilson (1983) notes that cognitive authority is clearly related to credibility. According to him, "the authority's influence on us is thought proper because he is thought credible, worthy of belief" (p. 15). He claims that the notion of credibility has two main components: competence and trustworthiness. The cognitive authorities are clearly among those we think of as credible sources. In other words, "those we think credible constitute the potential pool of cognitive authorities on which we might draw" (p. 16).

With this basic notion of cognitive authority, Wilson (1983) further illustrates a variety of contexts, including a relationship of two people, knowledge industry, everyday life, and information retrieval, in which the concept of cognitive authority applies. Among them, the authority of the printed word in information retrieval is the most relevant framework to this paper.

Wilson (1983) discusses explicitly various external tests for recognizing the cognitive authority of a text. The first obvious consideration would be recognition of its author. According to Wilson, "we can trust a text if it is the work of an individual or group of individuals whom we can trust" (p. 166). He notes that the element of time effects people's recognition of "personal cognitive authority." That is, personal cognitive authority involves only "present reputation and accomplishments up to now" (p. 167). The second sort of cognitive authority is associated with a publisher: a publishing house, a single journal, sponsorship of a publication, and published reviews can acquire cognitive authority. The third kind can be found in the text itself. For example, some reference work such as a standard dictionary has authority in its own right. People are not much concerned about the names of compilers in these reference books. Finally, Wilson addresses the recognition of a text's contents as plausible or implausible and gives or withholds authority accordingly. He is particularly concerned with the "instant recognition" of a work because "a text usually has one chance to capture our attention; reading a few words of it may be enough to discourage us from continuing on to reading the whole thing" (p. 169). If the sample of text we read strikes us as nonsense, we are unlikely to continue; if it seems eminently sensible, we may read on.

Wilson's (1983) conceptual dimensions of cognitive authority in IR contexts can be summarized as follows:
- Personal authority (author)
- Institutional authority (publisher)
- Textual type authority (document type)
- Intrinsic plausibility authority (content of text)

METHODOLOGY

Scholars were selected as the universe for our study because they are more likely to be explicitly concerned with information quality and cognitive authority than other populations. A scholar's work, by nature, is heavily involved in interaction with information: scholars find relevant information, assess the quality of the information, and use information in the research process. Therefore, most scholars feel competent to judge quality and authority based on their own evaluation criteria in the printed environment with which they are familiar. However, since the Web is a relatively new information resource environment, the same rules and criteria they have used in the printed collection might not apply exactly to the Web environment.

The sample of scholars consists of six faculty members and eight doctoral students. All but one were at Rutgers University (the exception was at Queens College, CUNY). The participants had degrees in: Communication, Library and Information Studies, Computer Science, Education, Psychology, Social Psychology, and Organizational Psychology. Nine of them were females and five were males. The basic investigative method was semi-structured interviews with these scholars, which were conducted at two time periods: April and November, 1997.

Each interview, which lasted 40 to 50 minutes, was structured around three topic areas:
- Information problems/tasks and search procedures in the Web in general
- Evaluation of information retrieved in the Web with particular attention to information quality and source credibility
- Comparison of evaluation criteria for making judgment in the Web with those in other types of information systems

At the beginning of each interview, each respondent was asked to describe her or his searching experiences in the Web in terms of information problems and search tasks engaged in. Respondents were encouraged to talk about a variety of tasks, beyond research activities. Most of them identified three to five search tasks that they were engaged in, which gave rise to the particular topics that they searching on.

Two slightly different methodologies were used to ask what steps they take to find and evaluate information in the

Web. The five April participants explained their behaviors only verbally; the nine November participants demonstrated their behaviors on a Web browser, explaining where they usually started, why they chose a particular item rather than anything else, what they were looking at in the search results, and how they decided to finish this search. These demonstrations were repeated with two or three of the different types of tasks that each participant identified. The verbal only interviews followed the same pattern, but without reference to specific Web pages.

After the scholars explained their search behaviors, the interviewer asked whether the respondents were concerned with information quality when they found the information. The interviewer also asked whether there were particular cases in which the respondents were more or less concerned with quality with respect to the tasks or situations. Then, the respondents were asked about their ascriptions of credibility. In many cases, the respondents discussed credibility and truthworthiness associated with quality before the interviewer moved through the interview questions.

In order to compare the evaluation criteria for making judgments about documents, the respondents were asked to describe how they decided whether they were going to use the documents which they had found. Then, they were asked whether they thought that they had different evaluation criteria in the Web than in other information systems.

These interviews were transcribed, and the transcripts were content-analyzed and coded with respect to categories of task/problem, search behaviors, information sources, and criteria for judgment of quality and authority. In the examples discussed in the Results section, **F** means Faculty, **D** means Doctoral student.

RESULTS

Characteristics of Information Problems and Strategies in the WWW

The nature of the tasks that people are engaged in will often determine the criteria that they use in their decision making with respect to information quality and authority. In particular, if the information-related tasks that people engage in on the Web are different from those which they address in other ways, we might expect differences in their criteria for quality and authority in the two cases. We therefore began our interviews by asking people to characterize the problems and tasks which they attempted to resolve on the Web.

This part of the interview transcript was content-analyzed and coded in order to identify the range of types of tasks and problems that our sample engaged in on the Web. These were very diverse: tasks involved not only work-related information but also personal information. Some which were explicitly work-related information problems included: research-related (n=7), teaching related (n=3), conference information (n=4), and information about organizations (n=2). The specifically personal information problems mentioned by the scholars were medical issues (n=3), and hobby information (n=4). Tasks which could be either personal or work-related included book ordering (n=3), travel (n=6), and product information (n=5). In addition, finding personal (n=3) or directory-type information (n=4) about individuals or institutions were mentioned as tasks for which the Web was used.

It was found that some scholars used multiple information resources to solve a single information problem. For example, D2 used the Web as a starting point to get introductory materials for his research. He said: "If I am working on a field that I am familiar with, I would go to the library directly. If it is a field that I am unfamiliar with, I would go there [the Web] as an attempt to get some bibliographies to understand what's out there." D4 also pointed out that she used the information in the Web to help lead her somewhere: "I probably take the information and then start making phone calls. I use it as like a way of educating myself, so that I can be an educated consumer, but I am not going to make a purchase through the Internet."

When the participants were asked to describe how they would start a search in the WWW, several interesting patterns emerged, almost all based on the general strategy of finding a "known" site. This was often done by going directly to some specific site to which they had been directed by other people: expert intermediaries (F1), friends in the faculty (F4), professors (D1). F1 explained this technique as a "short cut to expertise," saying "trial and error in the Web is too time-consuming and too unreliable yet." Two of the subjects also used printed sources to identify sites that would be useful: references in published articles (D3) and newspapers (F6). D3 "always" checked the web sites which were listed in the references of published article because "if this article is refereed, the source is

probably reliable and important." Even some uses of search engines were in order to find the URLs for specific sites, rather than for topical searches.

In speaking of search behaviors in the Web in general, two students (D4 & D6) explicitly claimed that they "never" browsed the Web to see "what's interesting" or "what I come up with." Two faculty members also claimed that they "tend not to just browse" (F5 & F6). This may be because they "don't have time to waste" (D6) or they have difficulty in narrowing down the search in the Web (F5).

Criteria for Judgment of Information Quality

From the analysis of the interview data, seven facets of judgment of information quality were identified: source, content, format, presentation, currency, accuracy, and speed of loading. The interview transcripts were coded into short descriptions with respect to the reasons for the judgment about information quality based on the words that the respondents used. A number of descriptions were merged into categories by grouping similar phrases and similar concepts. The categories were labeled and lead to the set of facets as follows.

1. Source (Where a document comes from) (n=12)
All of the respondents, except two doctoral students (D1 & D5) used characteristics of the source to evaluate the information quality. Indeed, the majority of criteria mentioned by the respondents were evaluation of the sources rather than information itself. When the scholars addressed the source, they referred to two levels of sources: institutional level and individual level. The *institutional level* involved several types of institutional characteristics.

- First, the scholars looked at the URL to see if it comes from "edu," "gov," or "com" (n=3). They specified that education and government sites have "better quality." For instance, D2 said: "I specifically go to the sites that are 'edu' because I figured that [the] academic department made it under the supervision of some professors or faculty members. I think that it has generally better quality, not always. Second are government sites. I found that they had less quality than academic ones." To F6, "First filter or cut is where this comes from. Major university, 'gov' or 'edu' sites are usually credible."

- Secondly, they put some credibility in particular types of institution (n=7). The examples include: "It's a college web site. So there is a reason that I trust it" (D4); "If an academic system put something in the Internet, it tends to be better quality because of checks and balances that were built into academic system, which is good" (D2); "Museum sites. There is no reason for that site to give incorrect information, so I think that they are credible sources" (D6); "If the information is coming from a major university, then I know that they have a great amount to lose if they don't display credible information" (F4); "If I see it is a library school or professional association, then I tend to trust that kind of information" (F2); "If it comes from a library, I tend to believe it" (F6).

- Thirdly, for many scholars (n=9), name of institution was the important criterion for judging information quality. Examples are: "I got the sites such as Stanford, MIT, Oxford. I used that as the base to go. They are pretty good" (D2); "I only download the code from sites that I can trust, for instance, Sun, Microsoft, Apple" (F2); "I see institution name - Johnson & Johnson. I think that's good" (D8); "IBM, Microsoft, Berkeley, MIT. I believe that people just couldn't randomly put things in this site"; "I will go if I know a particular name, like Netscape, Microsoft, IBM, or Sun System. I will visit these sites because I am familiar with those sites from my work. I know that these computer sites have good quality products" (D2).

The *individual level* involved features of author/creator.

- One of the criteria related to source evaluation at the individual level was the identification of author/creator (n=4). For example, F2 said that "It doesn't seem to me that people usually lie about their positions and institution, so I tend to trust the pages which have person's name, address and institution name." D7 said that "There has to be somebody who has written, somebody to whom I can send email. This must be credible, if there is a way that I can get touch with this person." F1 said that "If it is made by somebody whom I could not identify, then I have no confidence."

- Another way to judge the information quality with respect to author and creator was to look at the affiliation (n=7). For example: "it is important for me to look at, for instance, who is responsible for this page, and what is the position, occupation, which institution this person comes from" (F2); "The first aspect of credibility is qualification of creator" (D6); "They have some affiliation that indicates that the person knows what they are talking about" (F3); "I'm still concerned with who wrote this. Credentials of the person" (F5).

- Some scholars specifically paid attention to author/creator's name to judge information quality (n=3). The examples include: "If I am familiar with the author's name and reputation, like I've seen the name in printed articles, I have no doubt in quality" (D3); "Authors that I know, or that other people cited, then I feel comfortable using it. Otherwise, I am a little worried about it" (D7).

2. Content (What is in the document) (n=6)
The scholars in this study perceived quality when the information that they found in the Web was something that was useful for them. For example, D1 said: "Information for the conference - I could get good information about the president. It was good contact information. It had quality which I wouldn't get in other place." D2 also addressed: "There are good education sites for theories. They are good places to get bibliographies if you don't know what you're doing." F5 and D8's approach toward the quality were that they got what they needed in the Web: "It provides all facts that I'm interested" (F5); "If I am searching for restaurant, Argentina restaurant in NY, if I find that content, I would trust it because that's what I am looking for, then I will say, there are five restaurants, and here are the names of restaurant" (D8). 'Specificity' was another thing that F5 was concerned about: "It's too general in terms of content. It is not specific on my topic."

3. Format (Formal characteristics of a document) (n=4)
There seem to be two different aspects to judgments based on format. One is concerned with how the pages themselves are presented. For instance, two students reacted in opposite ways about graphical images in the Web. D3's judgment about graphics was that "there is little information and a lot of graphics, then I doubt information quality" while D8's judgment was that "I think that this is good because it looks nice. All the graphics and background." D4 described the way to judge the sites with respect to the format as: "I try to design my web site not to have flashing lights. It makes it look light." The other format aspect has to do with how the information itself is structured. F4, who has used the Web to get statistical data, said: "In terms of information quality, I'm very concerned with research data gathered, for example, census data that's available for downloading from the Web. ...Not just the authoritativeness of the data, I'm also concerned about how it is arranged so if it is already summarized, if it's already been grouped it's of less value to me so I want the raw data, primary data." This may be related to the next criterion, Presentation.

4. Presentation (How a document is written/presented) (n=4)
The writing style was another thing that the scholars were concerned with. The examples of the responses include: "You can tell how substantial something is by seeing how much they try to do scholarly writing. That's important to me" (D4); "I ask: what do they talk about, does it sound well written, does it have references?" (D7); "They are almost trying to sell this. It's a great, wonderful thing that is going to solve all the problems. It is not...There is no value. I will remember that. I will never go back. That's the concept of quality to me" (D2). F6 judged the information based on the size of document: "Also how large it is. That will tell you something. The larger is the better. When I find small things, it is advertisement, or just some little files. Size is the indicator of substance, at least. I'm not wasting time."

5. Currency (Whether a document is up-to-date) (n=2)
Two faculty members, F1 and F5 mentioned currency as their criteria for judgment. F1 gave the example of weather information. He said: "When I got it, I was excited. But the information was not current. So I threw bookmark away. I am more and more suspicious whether it is going to be current. I'm judging the currency."

6. Accuracy (Whether the information in a document is accurate) (n=3)
Three respondents (F1, F3, and D4) addressed the aspect of accuracy as a criterion of quality. F1 talked about 'Chronicle' as "bench-marking" of accuracy: "I put a lot of credibility on 'Chronicle' because of the accuracy of the chronicles site. I've never questioned it. I assume it is as accurate as newspaper." F3, who owns her own web site, maintains the quality of this site by regularly checking whether the links to other sites are still correct.

7. Speed of loading (How long it takes to load a document) (n=2)

The speed of loading is another criterion used in order to judge information quality. For example, F1 said: "My criteria is, I guess, to browse more quickly and easily. If it takes time to load, I stop it, and forget it." D4 also noted the importance of speed by saying "If the website loads slowly, I don't have patience for it."

Source Credibility and Authority

When the respondents mentioned the aspect of source as a criterion of information quality, they immediately referred to the credibility and truthfulness of the source. These characteristics were indicated by the perceived authority of the source. For example, F3 said that "if it has authority, then it is credible." D4 believed that "there are things that you can do that I am looking for as far as credibility is concerned. They have to do with institutional authorization." There were a number of ways in which the subjects understood, or ascribed authority. F6 perceived authority in the following context: "My friend told me that there was a web site on how to make Sushi. Some guys talk about how to make Sushi. I was stunned by the fact that this is just some guy. There is no authority. They are just putting it on a site, telling you what to do. There is no evaluation of it. From there, that time, I have started being concerned about information quality." F3 used connection to other authorities as a measure of authority: "They make some reference to an authority or they have some affiliation that indicates that the person knows what they are talking about. If they are linked to authoritative sources then, one assumes that they at least know enough to approve the authorities in that field…." F4 seems to judge quality of the information on a site according to authentication of that site by some recognized authority: "I need to have some authoritative guide to know that it is viable information. Lots of people create their own personal Web sites. All the people's home pages and all their own little personalized sites are of little interest to me because that information is not refined. It is not authenticated. It is not from an authoritative source."

Relation of Information Quality to Information Problems

The scholars in this study were more or less concerned with evaluating information quality depending upon three factors:
- the consequences of use of information;
- act or commitment based on information; and,
- the focus of inquiry.

D6 is more cautious about quality if she thinks that the consequences of having wrong or bad information are serious. She said: "My mom wanted the information on how to feed the dog. It can have terrible consequences. For me, the importance of what credibility I give to the sources really varies upon what is the result of the information." Quality was important for F2 when he wanted to download executable code that would run in his computer. Three subjects (D3, D6, and D7) were concerned about quality when they wrote research papers. Medical information (D1 and D5) was another example in which subjects in our study were careful about the information quality because of the consequences of use of information.

To F5, quality was an issue if she was going to act on the basis of the information, and if the action required a commitment of resources. She took an example of travel information: "I'm going to spend the money, I'm going to do something, I'm going somewhere." F6's idea was similar to F5's: "If there is something that I know that I'm going to commit to this, then I track the data really very careful."

D2 said that the importance of information quality changed according to how focused his problem was. According to him, "If my focus is very cloudy like very little focused, I would accept more stuff. If my focus is finely tuned, then I would be a lot choosier. I trash everything. I'm doing that in other systems. That happens more in the web than other systems."

Application of Traditional Evaluation Criteria to the Web Environments

When the scholars were asked whether they could apply the evaluation criteria that they used in the traditional information systems to the Web environment, three faculty members responded that they evaluated the information in the same way across different information systems. Eight respondents said that they used "different rules" for the Web than in other information systems. Three students responded that they could not compare because they used

the Web and online database systems for very different goals and tasks.

The three subjects (F1, F2, and F4) who said they used the same criteria gave the following reasons. F1's idea was that if an online journal in the Web follows the same procedures as used in printed journals, such as a refereeing system, then he would use it. He said "It is a process of quality control. It is all the same as associated with printed materials." For F4, what matters was the source, not the medium of information. In his words, "What happens at the source when the information is created and how it's then authenticated. It's not at the transmittal level." In the case of F2, the issue was also associated with authority and credibility of sources. He said: "You can't believe what you read in books either...You can apply the same principles from books to the Web... You are not going to believe it until you look for other information sources which confirm that. If you hear something from your adviser or other people you trust, if you read it in the newspaper, then you would believe it. Same thing in the Web. You will go to several Web sites trying to confirm the information."

Eight respondents gave reasons for why they couldn't apply their familiar and traditional criteria to the new Web environment. Three primary reasons emerged out of these data: 1) physical convenience of the Web; 2) features of information content in the Web; 3) lack of institutional authority of the Web. About physical convenience of the Web, for example, D6 said that, in the Web, she pulled up some information which was not relevant, but which looked interesting because looking at the interesting sites and going back to a prior search was much easier in the Web than in printed sources. Regarding the feature of information content, D2 said that he might use different criteria because information in the Web tends to be overview information, tends to be less rigorous. But the most often mentioned reason for the use of different criteria was the lack of institutional authority of the Web. For example, F5 emphasized the problems of authority and credibility of the Web, and illustrated how this aspect affects her searching behavior and evaluation criteria. She said: "I believe that most people who get published and get abstracted in a database have legitimate credentials. So authority or credibility is not something that I'm struggling with...In database searching, my evaluation focuses on content. I say: Is this really useful for my project? Is this telling me something new? Is this something that I'm looking for? In the Web, I am more primarily concerned with credibility and understanding the sources before I get into evaluating the sources. I also do different kinds of searching." Another example was from D4: "Absolutely different because the web is a new medium and you can self-publish in the web...There is no standard. The web doesn't exist just for scholarly information like academic library does. You have to have a lot more filtering devices up front before you even get to the documents that you're going to make decision about whether you're going to use it or not...Because of standards and review process, I can be sure that a larger percentage of what I am going to find in the library is credible information. What I have to do on the Web is to apply all standards and requirements to everything I see because nobody is filtering for me." D6 was "more suspicious" in the Web because "I don't feel that there is any company overall which makes sure everything on the Web has high quality." F6 also said that he was "more skeptical of anything in the Web" and "I'm not comfortable with anything in the Web."

DISCUSSION AND CONCLUSIONS

With respect to the types of problems which led our subjects to search on the Web, it seems that overall there were no types of problems which were associated exclusively with either the Web, or more traditional information resources. Thus, it seems that this factor would not, on its own, lead to different criteria for quality and authority in information interaction in the Web.

One of the significant findings of this study is that the subjects assessed information quality based on source credibility and authority - at both institutional and individual levels. They paid considerable attention to institutional authority, giving credit to academic and governmental institutions. They believed that commercial companies often use the Web for marketing purposes, rather than for information sharing, and thus gave such sources less credibility and authority. They also took into account the affiliation of author/creator. They tended to give authority to professional experts such as professors, doctors, librarians, and so on. This importance of source as a criterion for quality has been mentioned in previous studies such as Barry (1994), Park (1993), and White & Wang (1997) in terms of author and journal reputation. However, our results indicate that the range of evidence people use for ascribing source authority is much broader in the Web than in printed sources, and also that people depend upon such judgments of source authority and credibility more in the Web environment than in the print environment. This may be because most people in our study were aware of the self-publishing character of the Web, and of the lack of

an overall quality control mechanism. They were therefore forced to assess information quality on the basis of source authority and credibility rather than information content and other criteria used in more traditional information environments. But since authority is not necessarily as easily identified in the Web environment, they used many different, and new characteristics of Web information objects (pages) in order to make their judgments of authority and credibility.

These findings support Wilson's (1983) arguments about the relationships between cognitive authority, source credibility, and information quality. Wilson claims that people apply some sorts of tests for recognizing the cognitive authority of a text through personal authority, institutional authority, document type and the content of text. The subjects in this study used common patterns for identifying authority and quality of information in the Web by assessing source credibility at both institutional and individual levels. It is interesting to note how our subjects applied their traditional perceptions of authority to this relatively new environment. In this study, people often started to search in the Web by visiting sites that they learned about from experts, friends in faculty, professors, published articles, and newspapers. They did so because they thought that these types of authoritative sources guaranteed information quality. This is not a very different form of behavior than what is found in print environments. However, it seems that these people were reluctant to go beyond what they had been recommended, perhaps because they were uncertain of how to judge quality in the Web without external authority. That we found that if our subjects had doubts about the quality and credibility of information, they tended to ask other people whom they thought credible, or they checked with an authoritative print source, supports this conclusion. We might say that they did so because they were unable to be certain about the quality of the information based solely on the resources available to them in the Web environment.

In this study, seven criteria which affect judgment of information quality were identified: source, content, format, presentation, currency, accuracy, and speed of loading. Source and content were common facets identified in a number of studies (Barry, 1994; Cool et al., 1993; Park, 1993, Schamber, 1991; White & Wang, 1997), though the focus of judging the content and source of information appears slightly different across the studies. For instance, while the subjects in our study were concerned with source credibility in both institutional and individual levels, those in Schamber's study mentioned the reliability and the verifiability of sources, and those in Barry's study identified the source quality, source reputation, external verification, and source novelty. Presentation was also found in previous studies: clarity (Schamber, 1991); writing style (Cool et al., 1993); style (Park, 1993). Format is a facet that only Cool et al.'s (1993) subjects identified with full text documents. Currency and accuracy have been found by Barry (1994), Schamber (1991), and White & Wang (1997). The speed of loading was, of course, a unique feature in the Web.

In a study of information quality in electronic environments, Olaisen (1990) found that bank managers scored the credibility, trustworthiness, reliability and accessibility of information produced by banks or credit-evaluation companies as quite high. This result corresponds to one of findings of this study. Our scholars gave high authority to academic institutions and government institutions, and low authority to commercial sites, which they considered sales vehicles. These two results suggest, as might be expected from Wilson (1993), that rules for ascribing authority are based on whether the two parties belong to the same, or different reference groups.

In conclusion, our results indicate that issues of quality and authority are indeed important to people who search in the Web. That all of our subjects routinely begin their searches in the Web from known, recommended starting points, and that many of them never go beyond such points, indicates that they have substantial doubts about the general quality of information sources on the Web. This interpretation is reinforced by the comments indicating the necessity to expend more effort on quality and authority assessment in the Web than in other information systems. And although our subjects did use the same general criteria for judging quality and authority of information in the Web as have been reported for other information systems, the specific forms of evidence that they used were often quite different, and were based on largely speculative analogy to familiar criteria. Our results, although clearly preliminary, thus suggest that additional and more explicit forms of evidence of quality and authority will be required, on the Web, in order for people to interact with information effectively in this environment. Some categories of such evidence are also suggested by our results, but explicit identification of the appropriate types of evidence, and how they would be made known awaits further research.

The next steps we will undertake will be to enumerate more explicitly the elements of the facets of information quality and authority that we have identified in this study. A general limitation of this study is that we had no data

concerning actual searching behavior, but only retrospective accounts. In our further studies, we will utilize a number of different data collection methods, including logging of searches and collection of diaries, as well as interviewing and post-hoc protocol analysis. We will also extend our sample in both quantity and quality (more categories of people).

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