Chapter 7 Conclusion and Implications

This study has addressed the issue of information quality and cognitive authority in a large uncontrolled environment, i.e. the Web. The issue has been examined by observing scholars’ information seeking behaviors in the Web with respect to their judgments of quality and authority. This study has identified users’ decision-making and selection processes given multiple information sources in the Web. During the process it was noticed that users make extensive efforts with regard to judgments of quality and authority. Furthermore, users identified and characterized a number of factors influencing their judgments of quality and authority.

In order to address the problem of quality and authority, a model of judgment of information quality and cognitive authority was proposed in Chapter 3. In this chapter, the model is revisited based on the results and discussions of the empirical study. The revised model and empirical findings suggest implications for Web-based information system design. Limitations of this study and future research directions are also discussed in this chapter.

7.1 Judgment and Criteria (Model Revisited)

The initial model presented in Section 3.1 suggests that judgment of information quality and cognitive authority is a central process in information retrieval interaction which occurs between a user and information presented on the Web page (see Figure 1). Five facets of judgment of information quality and cognitive authority were originally presented in the model: goodness, usefulness, currency, accuracy, and trustworthiness. With respect to information in the Web, there are several factors which might influence
users’ judgment including content, source, presentation, and format, which were identified in a preliminary study (Rieh & Belkin, 1998). From a user’s point of view, there are also some factors which could affect their judgment such as task, intention, and knowledge. The original model also presents two kinds of judgment: predictive judgment and evaluative judgment, which have been adopted from Hogarth’s (1987) conceptual framework. According to the model, predictive judgment guides a decision regarding which information source a user is going to select given multiple alternatives. As a result of this judgment, a new Web page is presented to the user. When the user looks at the page, another kind of judgment, an evaluative judgment is made.

A major finding of this study is that users indeed make judgments of information quality and cognitive authority a great deal when they search in the Web. This finding supports the basic assumption of this study: during interaction with information in the Web, judgments of quality and authority are important cognitive activities of users. The results of this study also verify the framework of two different kinds of judgments (Hogarth, 1987), predictive judgments and evaluative judgments. An additional finding with respect to Hogarth’s framework is that users are confronted with decision-making points continuously in the Web interactions, and therefore, their predictive judgments and evaluative judgments are iterated until they finish searching.
Figure 12. Revised Model of Judgment of Information Quality and Cognitive Authority
Figure 12 presents the model of judgment of information quality and cognitive authority which has been revised based upon the findings of this study. The changes were made in the following area: (a) facets of judgment of information quality and cognitive authority; (b) factors influencing users’ judgment with respect to information in the Web; (c) factors related to users’ side in terms of knowledge. Some new features were added to the previous model: (a) other factors such as situation, ranking in search output, and general expectation; (b) users’ characteristics in terms of academic status and discipline areas; and (c) tasks given to the users.

The results of content analysis of users’ judgments indicate that the facets of judgment of information quality and cognitive authority are more diverse than are proposed. As presented in Figure 12, the analysis of interview transcripts and think-aloud verbal protocols resulted in 11 facets of quality and authority: five facets of judgments of information quality (good, accurate, current, useful, and important) and six aspects of judgment of cognitive authority (trustworthy, credible, reliable, scholarly, official, authoritative).

With respect to characteristics of information in the Web, the original model proposed four different categories. The results of content analysis identified two distinct kinds of characteristics: one is related to information objects and the other is associated with sources. Information objects were characterized as six different categories (type of information object, title, organization/structure, presentation, graphics, and functionality) and sources were classified as five different groups (URL type, type of source, source reputation, one-collective source, author/creator credentials). It was also found that users mentioned two different kinds of knowledge, domain knowledge and system knowledge.
The characterization of knowledge by the mode of acquisition (first-hand experience and second-hand knowledge) was verified based on the empirical findings.

New findings show that there are other factors identified by the users, which were not included in the original model such as situation, ranking in search output, general expectation. Additional findings of this study which have been integrated in the revised model include users’ demographic characteristics in terms of academic status (e.g., faculty members and doctoral students) and discipline areas (e.g., social sciences and natural science and engineering). Also, it was found that the tasks (e.g., research, travel, medicine, and computer price) affect judgments of quality and authority as well as criteria for those judgments.

7.2 Theoretical Implications

As discussed in Chapter 2, numerous empirical studies on relevance judgment (e.g., Barry, 1994; Cool, Belkin, Frieder, & Kantor, 1993; T. K. Park, 1993; Schamber, 1991; Wang & Soergel, 1998) have reached some general consensus by which it can be argued that users use much more diverse criteria than mere topicality to make relevance judgments. Furthermore, relevance criteria elicited from users reveal that there are common characteristics and factors across the previous studies. Although some researchers attempted to compare the criteria which emerged from numerous studies (e.g., Barry & Schamber, 1998; Wang, 1997), little effort has been made thus far into investigating individual relevance criteria more deeply.

The findings of this study provide some implications for future research on relevance judgment. Among a number of relevance criteria identified in the previous studies, this study focuses on two particular aspects of relevance judgments: quality and
authority. It was found that the subjects were indeed concerned with judgments of quality and authority when they were searching in the Web. It indicates that there is connection between the kinds of judgment that users make and the information retrieval interaction context that they engage in. It was apparent that quality and authority were important issues for users when they interact with information in the Web environment where there is little quality control mechanism. It can be argued that issues of accuracy might be a significant factor for relevance judgment when users interact with numeric database. That implies that research on relevance judgments can move forward by examining the nature, dimensions, and criteria of relevance with respect to a particular information interaction environment.

The definitions and discussions of information quality in general (e.g., Taylor, 1986) and information quality in the Web environment in particular (e.g., Cooke, 1999) have been based primarily on theoretical and hypothetical assumptions. This study identified and characterized the facets of information quality mentioned by the users’ own terms. More importantly, this study examined the concept of information quality as it related to another critical concept, cognitive authority. The findings suggest that indeed information quality and cognitive authority are not two independent concepts: they are closely inter-related each other. The subjects in this study often made judgments of information quality based on the authority of sources. It indicates that the concept of information quality can be explained more precisely when it is related to the concept of cognitive authority. This is because the authority of information source provides the potential pool in which users can make a judgment of information quality.
The results presented by this study certainly validate the notion of cognitive authority defined by Wilson (1983). Wilson states that “All I know of the world beyond the narrow range of my own personal experience is what others have told me. It is all hearsay. But I do not count all hearsay as equally reliable. Some people know what they are talking about, others do not. Those who do are my cognitive authorities” (p. 13). In this study, there were numerous instances in which the subjects mentioned that they wanted to go to the Web sites because they already had been there before (first-hand experience). The subjects did not go to the Web sites based on “any” information that they had heard or read. Apparently, they decided to select a Web page or go to the Web site when there was some indication for authority of the source. Sources can be recognized based on their own experience, other people’s recommendations, or something that they heard of, although they did not remember the exact sources. It was also noticed that the subjects often referred “other people” to an engineer, friend, colleague, or professor who seem to serve as “cognitive authorities.” Some instances were observed in which the subjects said their “cognitive authorities” were newspapers, journal articles, and even television advertisements. Having discussed all this, it can be claimed that this study has contributed to the conceptual definition of cognitive authority by providing empirical evidence of the importance of first-hand and second-hand knowledge in making judgments of cognitive authority.

This study also offers some implications in the field of interactive information retrieval (IR) research with regard to the methodological approach taken. Probably the most significant implication can be found in “generic” tasks used in this study. The tasks were claimed to be generic in the sense that they outlined the kinds of task while not
restricting the specific information problems. For example, the subjects were asked to find some good papers, and they were allowed to choose their own topics related to the research project in which they were engaged. Another example was that the subjects needed to find the best price for a new computer while they could choose a particular computer model in which they were personally interested. These “generic” tasks worked well for this research by demonstrating various topics that individual subjects chose, while not digressing from the tasks given. Another contribution that this study has made to the methodology of interactive IR research is the way that post-search interviews were conducted. Using search logs during the interview, rather than relying on the subject’s own memory, proved to be useful for both the subjects and interviewers to understand users’ behaviors and judgments. This method also provided a basis for the replicability of data collection, therefore, increased the reliability of this study.

7.3 Practical Implications for Web Information System Design

The revised model, which emerged from the empirical findings, has a number of implications for designing Web information systems. Perhaps the most fruitful findings of this study are in the results that users are indeed making judgments of information quality and cognitive authority to a great extent. The challenge for a system designer then is to build a Web system that supports and enhances the users’ decisions of quality and authority to facilitate more effective judgments.

An important finding of this study is that users’ judgments of information quality and cognitive authority occur in two distinct stages, prediction and evaluation, in the Web interaction. In other words, even before users look at the Web pages, they make quality
and authority assessments in the prediction stage. Once the page is presented to the
users, they then make judgments of quality and authority focusing on evaluation of the
information. This indicates that we can consider implications for designing Web systems
to support these two types of judgments: a) predictive judgments of quality and authority
by providing appropriate clues of quality and authority which allow users to effectively
decide which page to look at; b) evaluative judgments by presenting explicit forms of
evidence of quality and authority in the Web pages so that users have plenty of elements
with which they can make judgments.

While making predictive judgments, it was found that users paid attention to
source characteristics including source reputation and type of source as well as
characteristics of information objects such as title, content, and type of information
object. It seems that existing search engines do not support users’ needs for source
characteristics effectively in general. This is because they tend to focus on retrieving by
topics. Currently, as a result of search, most search engines (e.g., AltaVista, Excite,
Lycos, Yahoo!) display the representation of information which contains title, summary,
URL, size, updated date, and others. According to this study, users would benefit from
the representations if they contain more information about sources at both institutional
(the name or type of organization) and individual (author/creator) levels.

It was noticed that the subjects often would like to visit the sites where they have
been previously based on their own experience. Or they also tend to locate the sites
which they heard about from others whom they believe (cognitive authorities). In a lot of
instances, they remembered the names of organizations or institutions (source name), but
could not recall the exact URL. However, it was not easy for users to locate “known
sites” by entering a source name as a query in current search engines. This is because most existing search engines rely heavily on frequency of keywords to retrieve information, without differentiating whether query terms are associated with “topic” or “source.”

For instance, S008 typed in “American Medical Association” in the query box of a search engine. However, the homepage of AMA was not highly ranked in the results because the home page may not use “American Medical Association” as often as other pages. The same problem was observed in the searches of S015 who attempted to go to the site of the Center for Disease Control. These two subjects failed to locate the site that they wanted, and had to change their search strategies. Kleinberg (1999) noticed a similar problem, taking the example of the Harvard University (www.harvard.edu) which is not the one that uses the term Harvard most often. He claims that the Harvard home page is “the most authoritative page” for the query “harvard,” but a search may fail to locate it. His model is based the relationship between the authorities for a topic and those pages that link to many related to authorities (hub). It is discussed in detail in Section 2.5.3. Unlike Kleinberg’s approach, it is suggested here that users will likely locate the site more easily and effectively if they can specify their query as a source name rather than a query into the search engine. This is because it was apparent that users make predictions of quality and authority based on characteristics of sources to a great extent.

Thus far, we have discussed the implications for designing better search engines with respect to users’ predictions. The results of this study also have some implications for Web browsers for supporting predictive judgments. As described in Chapter 5, users made decisions about which information source to select not only from the results of
search engines but also from the list of links in the Web page. The difficulty that users encountered was that they often do not have enough clues beyond a title when making predictions. Numerous instances were observed in which users click one of them based on predictive judgments, look at the new page, but come back to the previous page because it is not what they have expected. These findings indicate that showing descriptions of the page as users point the cursor on the link may help users to make a decision whether to follow a particular link or not before they click it. This certainly would save the time and effort of going back and forth between pages. Current Web browsers display only the URL of the link at the bottom of screen; however, the results of this study suggest that users want to know more than the location of the Web page.

The approaches taken by Stanyer and Procter (1999) to “link lens” have some commonalities with our suggestions in the sense that users would benefit through enhanced representation of the link by making “informed” decisions. However, Stanyer and Procter believe that a bigger problem than the selection and activation of a link lies in download times which are “often long and unpredictable and may leave users uncertain about when it will be completed” (pp. 1533-1534). The subjects of this study did not mention the downloading times as a factor influencing their predictive judgments. Rather, the results of this study suggest that displaying enhanced content and source information would help users to decide which one has quality and authority more easily.

In order to support evaluative judgments, it is suggested that additional and more explicit forms of evidence of quality and authority should be presented in the Web pages. The users mentioned that they found such evidence from a number of different characteristics of information objects and sources such as content, source reputation,
domain knowledge, type of source, graphics, author/creator credentials. However, it was noticed that sometimes users were not able to locate what they wanted to know about source information. Or, it took a long time for them to find out what they needed to know to make judgments. The easiest way of improving Web design is to place source information, including organization name, author/creator credentials, and contact information on the top of the page. It was observed that most Web pages have all the important information at the bottom, and users have to scroll down to find what they want.

Another way to support users’ behaviors with respect to evaluative judgments is to make the “Find” functionality of Web browsers clearer. It was observed that a number of subjects spent some time in locating the exact information, which can be a couple of terms, a sentence, or a paragraph, that they wanted to find. Only one subject (S006) utilized “Find” from the menu bar to locate the exact word in the Web page. All other subjects read through the whole page to find very specific information, which turned out to be very time-consuming. It was thought that “find” or “search on the page” could be more extended for users when they intend to place some specific piece of information.

7.4 Limitations of the Study

There are several limitations of this study which should be addressed before we generalize the findings, the model, and system implications. First, the empirical evidence of this study is confined to a relatively small number of participants - 15 subjects. And the sample was chosen nonrandomly: the scholars were selected by judgmental sampling (Krathwohl, 1993) in which the researcher selected individuals considering
representativeness of the sample. Therefore, it may not be true if we argue that the findings of this study are generalizable to all Web users, or even to all scholars.

However, it should be noted that a basic unit of analysis in this study is a web page that the subjects selected, not the individual subjects who participated. This is because this study has investigated people’s judgments of quality and authority and factors influencing those judgments. Therefore, the sample size should be seen as 1321 web pages from 60 search sessions which were collected for 15 hours in total. In addition, it is important to point out that this study, taking the approach of qualitative research, is written up as a case study. The case study precisely conveys the characteristics of a single individual, situation, or problem in order to illuminate a generic problem (Krathwohl, 1993). Like other case studies, this study is bounded by a particular institution (Rutgers University), time period (December 1998 – June 1999), and a group of people (faculty members and doctoral students). However, a case study was ideal for the research problem discussed in this study as it made it possible to speculate on the results at a more conceptual level.

The second limitation of this study is related to the experimental setting that we used for data collection. As discussed in Section 4.1, there are some constraints posed in the laboratory setting in terms of tasks, time, and physical space. As the tasks were given to the subjects in the experiments, it might reduce the variety of tasks which could be identified in the “natural” setting. Furthermore, we know little about whether time constraints affect users’ judgment of quality and authority. A major problem noticed is that as the subjects were forced to use the computer in the laboratory, they were not able to access the Web sites that they had previously visited through “bookmarks” saved on
their own computers. In some cases, the subjects were able to remember the sites in terms of URL or name of the site. However, in other cases, it could affect their searching behaviors and further judgments of quality and authority in the Web. On the other hand, to deal with this problem of topic restrictions, four “generic” tasks were used instead of predetermined “topics” for searching so that each user could specify their own topics. Also, time constraints (15 minutes for each search) given to them may affect users’ searching behaviors in the Web. However, it may be true that users always have some time constraints when they are searching in the Web.

Another general limitation of this study is that we presumed that people’s relevance criteria and decision rules accumulated in the traditional information systems might not be directly applicable to this new interaction environment, the Web, and information quality and cognitive authority might be more important facets of relevance judgment. However, there are no actual data comparing the two different interaction environments. Therefore, there is a limitation to make arguments about the difference.

All of the limitations discussed above need to be considered with a focus of how they may have influenced the results of this study. Despite these limitations, however, this study was able to address all the research questions raised about judgments of quality and authority in the Web. Some of the limitations guide interesting directions for future research.

7.5 Future Research

The analysis of judgments and criteria showed that the subjects made two distinct kinds of judgment: evaluative judgment and predictive judgment. These two kinds of judgment were differentiated in terms of whether the subjects made verbal statements
before looking at a page or after opening a new page. In this study, predictive judgments and evaluative judgments were characterized based upon the same classification scheme. The findings indicate that although the subjects mentioned more or less the same kinds of facets of judgments and criteria, the differences lie in the extent to which the subjects were concerned with a particular facet and criterion for making two kinds of judgment.

Further research is needed to examine the differences between two types of judgments in a more detailed level. The research can be conducted focusing on how users express their predictive judgments and evaluative judgments differently with respect to cognitive activities and perceptions beyond the characterization of facets and criteria used. In Section 5.2.1, keywords and phrases which appeared in predictive judgments and evaluative judgments were noted. The subjects expressed predictive judgments including [it] “would be a good search engine,” “likely to be good,” “will give me reliable database,” “sounds like generic name.” They used the words such as “it turned out,” “I did find,” “it looks,” “it seems,” when they made evaluative judgments. Clearly, more work can be done to see what makes users express differences with respect to the context, situation, and stage of search process.

Another step which can be taken for future research is to extend the model of judgment of information quality and cognitive authority presented in Figure 12. In particular, an additional study can be conducted to examine “other factors” (situation, ranking in search output, general assumption) which were not mentioned frequently by the subjects in this study, but certainly have potential to be important factors contributing to users’ judgments. For instance, as Cool (1997) has demonstrated, situation can be defined in a broader sense by including a user’s goal for understanding various aspects of
the interaction situation. Another way to extend the model can be found in the tasks.

The results may imply that the *type* of task (i.e., research, travel, medicine, and computer price) used in this study was a factor which influenced users’ judgment of quality and authority. As a next step, new tasks can be tested in judgments of quality and authority by looking at the differences between the tasks that users are familiar with and unfamiliar with, or between the tasks that are complex vs. factual.

Other directions for future research are closely related to the limitations of this study discussed earlier. In this study, scholars were selected as the sampled population as it was thought that they are more likely to be concerned with making judgments of information quality and cognitive authority than any other population. That is because scholars’ work is heavily involved in finding and assessing information, and therefore, most scholars would feel competent in judging quality and authority of information. Future research is needed to expand the generality of the findings of this study by investigating similar research problems in different settings or with different subject groups. We can examine, for instance, how people in business settings make judgments of quality and authority in their work environment. The sample in this study, scholars, tend to trust the information from academic institutions and government institutions while giving low authority to commercial sites. Therefore, it might be interesting to examine whether the two parties belong to the same, or different reference groups. Another way to extend the findings of this study is to investigate the research agenda with high school students or college students who have not acquired the knowledge and skills to evaluate information sources in the printed environment, and have been exposed to uncontrolled environments such as the Web. Comparing these students group’s way of
making judgments of quality and authority with the findings of this study is of importance.

As discussed in the previous section, we don’t have actual comparative data regarding judgments of quality and authority between the print environment and the Web environment. Therefore, in the future, we can extend this study by comparing directly people’s judgments of information quality and authority in the Web environment and in the printed environment, focusing on the perceptions of information accuracy and credibility in different information interaction environments.

This study attempted to identify the implications for Web design which will effectively support people’s judgment of quality and authority, but did not go further. Another possible area of research might be to implement some interface features and functionalities identified in this study into a system, and evaluate the effectiveness and usability of the new system.

7.6 Summary

The results of this study verify a number of concepts proposed in the original model: (a) judgments of quality and authority are important cognitive activities occurring during users’ interaction with information in the Web; (b) users make two distinct kinds of judgments, predictive judgments and evaluative judgments. The results also imply that the model needs to be revised and extended to reflect new findings of this study with respect to: (a) facets of information quality and cognitive authority, (b) factors influencing users’ judgments, (c) users’ characteristics, and (d) tasks.

The findings of this study provide theoretical implications for future research on relevance judgment by demonstrating the importance of looking at some particular
aspects of relevance judgments with respect to the information retrieval interaction environment. This study has contributed to the field of information quality by relating the concept of information quality to cognitive authority. It was noticed that information quality and cognitive authority are closely inter-related with each other during the process of judgment and decision-making in the Web. The results of this study validate the notion of cognitive authority defined by Wilson (1983). Although Wilson provides a critical concept in information retrieval, his notion has never been tested in empirical research thus far. This study clearly demonstrated empirical evidence of first-hand and second-hand knowledge identified by Wilson, and described how these two modes of acquisition are related to the concept of cognitive authority. In addition, the methodology used in this study offers some implications for the field of interactive IR research, particularly with respect to the use of “generic” tasks in the experiments and search logs during post-search interviews.

The revised model which emerged from the empirical findings has a number of implications for Web information system design. The approaches to implications aim at supporting people’s judgments of information quality and cognitive authority eventually. To support predictive judgments, we can consider some ways of providing appropriate clues of quality and authority which allow users to effectively decide which page to look at. In order to support evaluative judgments, we might develop ways of presenting explicit forms of evidence of quality and authority in the Web pages.

The limitations of this study are associated with its small sample size, experimental setting for data collection, and lack of direct comparative data of relevance criteria between traditional information systems and Web environments. These
limitations guide directions for future research. For instance, further research is needed to investigate similar research problems in different settings or with different subject groups. This will increase the generality of the findings of this study. We can also extend the research by directly comparing people’s judgments of information quality in the Web environment and in the printed environment. A further direction can be found in implementing new features which can support judgments of quality and authority in the ways identified in this study, and evaluating the system.