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The UNC Plant Information Center's (PIC) "Ask the Expert" module is a question-answering system that allows PIC web site visitors to communicate with botanical experts at the North Carolina Botanical Garden. The objectives of this study were to test users' interactions with the "Ask the Expert" prototype while they sought answers to plant-specific questions and to measure users' satisfaction with specific aspects of the interface. A usability study was conducted with nine members of the PIC Advisory Panel using a web-based test instrument. The results show that participants' reactions to the "Ask the Expert" prototype were positive, especially with respect to its flexibility, ease of use, and the attractiveness of its interface. However, the study did identify some areas where the usability of the application can be improved, particularly with regard to clarifying the details of the multi-step process for submitting a question.

Headings:

      Ask the Expert

      Usability

      Interface

      World Wide Web

      Plants

      Botany

THE UNC PLANT INFORMATION CENTER'S
"ASK THE EXPERT" MODULE:
A USABILITY STUDY

by
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Introduction

  This study investigates the usability of an "Ask the Expert" prototype developed for the UNC Plant Information Center (PIC). The study focuses on user satisfaction. The Plant Information Center is a web-based learning center that links digital images of herbarium specimens, botanical resources, educational materials, and outreach services of the North Carolina Botanical Garden. "The intent of the project is to connect the research community and the general public (including school children) so that primary research materials owned by the University can be made available to these new audiences and that expert knowledge may also be shared" (Daniel, White, Greenberg & Massey, 2000). To evaluate the effectiveness of PIC, three areas of research have been identified: image access and use, metadata issues, and electronic access to subject experts (Greenberg, Daniel, Massey & White, 2000). This study addresses an aspect of electronic access to subject experts by testing the "Ask the Expert" prototype.

  The "Ask the Expert" service is a question-answering system that allows PIC users to communicate with botanical experts at the North Carolina Botanical Garden. Selected screen shots are shown in Appendix A. Users submit general botanical and PIC-specific questions using a web-based form. The system answers the questions by retrieving similar question-answer sets (i.e., questions with a hyperlink to the answer) that were answered previously and stored in the database. If a satisfactory answer to the user's question is not found within the collection of previously answered questions, the "Ask the Expert" system gives the user the option of submitting the question to a

botanical expert at the North Carolina Botanical Garden. An email containing the user's question is automatically generated and sent to the expert, who then contacts the user with an answer. The user may specify a preferred method of contact of email, phone, fax, or postal mail. As the experts answer the incoming questions, they have the option of storing their answers in the database for future use, making determinations based on the novelty of the question or how often it is asked. The collection of questions and answers in the database assists with the compilation of a Frequently Asked Questions (FAQ) web page, which is generated dynamically from the information in the database.

The goals of this project were to test users' interactions with the "Ask the Expert" prototype while they sought answers to plant-specific questions and to measure users' satisfaction with specific aspects of the interface. This evaluation was conducted using a web-based test instrument that focused on four components of data collection: (1) participant profiles; (2) participant interactions with the "Ask the Expert" prototype; (3) user satisfaction questionnaire data; and (4) participant responses to three open-ended questions. Determining the success of the PIC "Ask the Expert" application in facilitating electronic access to subject experts will assist PIC in further refining the application and will help define usability principles for similar "Ask the Expert" sites.

Literature Review

Usability of Question-Answering Systems

Searching for answers to questions on the World Wide Web can be a difficult and frustrating task for novice and experienced users alike. Organizations are actively seeking ways to support question-answering in the Web environment. Significant research has been done in the area of developing Web-based systems that act as intermediaries between users and human experts. The evaluation of these systems has focused primarily on the algorithms used for the indexing and retrieval of the question-answer sets. However, the usability of the systems has also been tested using a few different approaches.

Kulyukin, Hammond, and Burke (1998) evaluated the usability of their Chicago Information Exchange (CIE) system by measuring the *average number of interactions* (ANI) that a subject had with the system before the answer was found. In the CIE system the organization's expertise is structured according to the organization's units and represented as a dynamic collection of question-answer pairs previously answered by an expert. Using a Web interface, the client can ask natural language questions of the question-answer collections, browse the collections, or email his question to an expert. After the expert answers the client's question, the new question-answer pair is added to the expert's collection and emailed to the client.

The researchers state that the typical CIE client wants to find the first relevant answer fast. To measure this, they counted the number of interactions each subject had

with the system before a relevant answer was found. The ANI results were variable; the researchers cited the differences in the term ambiguity of different samples as an explanation for the variability. In other words, the subject who was given questions with the most ambiguous terms had to interact with the system multiple times to clarify her search preferences.

The method of *heuristic evaluation* was used to evaluate the usability of Q&A (Budzik & Hammond, 1999), which was developed at the same time as CIE. Like CIE, Q&A is a Web-based system that answers incoming questions by retrieving questions it has previously answered or by referring users to experts. The most important difference between Q&A and CIE is that Q&A has no predetermined organizational structure, while CIE assumes that the organization of expertise should mirror the organization's internal structure. Q&A relies on the experts to add structure to their own areas of expertise.

Budzik and Hammond performed an informal *heuristic evaluation* to demonstrate the usability of Q&A. Heuristic evaluation (Nielsen & Molich, 1990) is a method for finding usability problems in a user interface design by having a small set of evaluators judge whether the interface conforms to a list of established usability principles. The evaluation showed that Q&A consistently provides shortcuts to the user, consistently attempts to discourage user errors, speaks the language of the users, and provides both browsing and searching facilities. The researchers argue that an overall evaluation of a system should include both an evaluation of retrieval algorithms and an evaluation of the system's usability.

The technique of *field study* has also been used to evaluate the usability of question-answering systems. In 1994 Ackerman published findings from a field study of

Answer Garden using software engineers as the participants. Answer Garden is a tool for capturing a record of an organization's expertise. It allows organizations to develop databases of frequently asked questions that grow "organically" as new questions are answered. A branching network of diagnostic questions helps users find the answers they want. New questions from users are automatically routed to knowledgeable human experts and then inserted (along with their answers) into the network. The original Answer Garden was implemented using the X Window System, but it was later implemented again in the World Wide Web (Ackerman & McDonald, 1996).

The most important difference between Answer Garden and Q&A is that Answer Garden does not provide automatic indexing and retrieval of questions and answers. Users must navigate a diagnostic network of questions, instead of simply entering their question and examining the retrieved answers as in Q&A. Furthermore, the Answer Garden experts must construct a network aimed at guiding the user down the correct path, whereas the Q&A experts simply associate their expertise with topics of their choosing.

While Ackerman's field study demonstrated that Answer Garden could work in principle, two key issues were uncovered. The design of Answer Garden failed to account for the need for experts to maintain their organizational "face." Four of the experts showed a marked formality in their responses, and their answers were more detailed and complete than a quick electronic mail response would contain. They felt that if their answer was not complete and accurate, it might reduce their status with people who did not know them well. A second issue was that a large proportion of the users got answers that were either inaccessible for a novice or too general to be applied. Ackerman

states that his assumption that users should always have their questions answered by experts may have been false.

The field study approach has also been used to investigate the usability of web assistant systems (Aberg & Shahmehri, 2001a). Web assistant systems feature both computer-based and human-based support. Unlike the asynchronous email communications used in the systems described above, human web assistants provide real-time support for web site users via a text chat or voice chat interface. Knowledge is represented as questions and answers, in the style of FAQs. When a user asks a natural language question to the web assistant system, the best matching FAQ items are presented to the user. If the user does not find the answer to the question in these items, the user can choose to connect for a chat with a human assistant. Web assistant systems can be used in the context of electronic commerce, digital libraries, and technical support.

Aberg and Shahmehri conducted a field study of a web assistant system that was attached to a site for artists and writers. The results showed that textual chat is a viable means for help conversations on most topics. Human assistants make the use of a web site more fun for most users. Most users have a high level of trust in the advice provided by human web assistants. Assistants should adapt to users' differences in conversational style and in background knowledge. The results of the study were summarized with five recommendations for designing and implementing web assistant systems (2001b): 1) clearly define the kind of questions that should be made into FAQ items, 2) provide a short training period for assistants before they start to use the system, 3) allow the modification of the topic hierarchy for FAQ items, 4) include spell checking for FAQ items, since the information retrieval method is based on keywords, and 5) give users the

option to browse the FAQs along with the option to search them. Aberg and Shahmehri conclude that the use of a web assistant system should be considered whenever user satisfaction is of importance.

This review of the literature shows that much work has been done in developing Web-based question-answering systems that act as intermediaries between users and human experts. However, further evaluation of the usability of such systems is needed. The success or failure of these systems depends on their ability to be easily used by both experts and information-seeking users. There is a need for more knowledge about how people use Web-based learning tools to access expertise in a domain-specific area like botanical science.

Design of the PIC "Ask the Expert" Prototype

The design of the PIC "Ask the Expert" prototype incorporates several features highlighted in the literature. First, the prototype speaks the language of the user by providing a natural language interface to its database of botanical expertise. Second, the "Ask the Expert" prototype provides a combination of browsing and searching facilities in an effort to reap the benefits of both approaches to information access. Third, the prototype addresses the problem of what Budzik and Hammond call the "expert/novice goal conflict" (1999). This term describes a situation where the information-seeking user's goal to have regular access to expert advice is in conflict with the expert's goal to use his time for other things. The "Ask the Expert" prototype minimizes this problem by presenting the user with similar question-answer sets that have been previously captured in the database. The expert is only notified when the user has determined no answer is available from the system.

The "Ask the Expert" application was built during the fall of 2001, and is a component of the larger PIC web site. In preparation for the official launching of the "Ask the Expert" application, the PIC team decided that it would be good to first conduct a usability test of the prototype. This research project involves a usability study to investigate where users perceive breakdowns in the "Ask the Expert" prototype, as well as confirm useful features of the prototype.

Objectives

This project was part of an initiative by the PIC team to develop an "Ask the Expert" module that allows PIC users to communicate with botanical experts at the North Carolina Botanical Garden. Specifically, the project was designed to accomplish the following goals:

1. Test users' interactions with the "Ask the Expert" prototype while they sought answers to plant-specific questions; and

2. Measure users' satisfaction with specific aspects of the interface.

The findings of the study will be used to refine the prototype, and the resulting module will be integrated with the PIC web site.

Research Methodology

To meet the objectives of the project, a usability study of the "Ask the Expert" prototype was conducted using a web-based test instrument. A sample of nine participants was recruited from members of the PIC Advisory Panel. This panel consists of science teachers, librarians, ecologists, and college professors in the Chapel Hill, North Carolina area. None of the panel members had seen the "Ask the Expert" prototype prior to the study. The members were invited to participate in the study via individual emails.

The experimental design was completely web-based and could be completed from participants' home or place of work. A link to the experiment's web site was included in the recruitment email. Prior to any data collection, each participant was asked to submit the *Consent Form* (Appendix B). The participant was then asked to complete a brief *Profile Questionnaire* regarding his/her current level of Internet use (Appendix C). This questionnaire was based on the 10th WWW User Survey (1998), developed by the Graphic, Visualization and Usability Center at the Georgia Institute of Technology.

Following completion of the *Profile Questionnaire*, each participant was asked to think of a plant-specific question of personal interest. Then the participant was directed to the "Ask the Expert" prototype and invited to use the prototype to obtain the answer to his/her question. For example, one participant submitted the question, "Are there any bulbs (e.g., iris, lilies) that will do well in a damp, shady area?"

Following the interaction with the "Ask the Expert" prototype, each participant completed the *User Satisfaction Questionnaire*, which was based on the Questionnaire

for User Interaction Satisfaction (QUIS), a tool developed at the Human-Computer Interaction Lab (HCIL), University of Maryland at College Park (About QUIS 7.0, 1998). Each section of the QUIS measures users' satisfaction with a specific aspect of the interface, using a 9-point scale. QUIS is configurable by including only the sections that are relevant to the particular study. This study utilized selected questions from five parts of the QUIS, which measure:

- Overall User Reactions (Part 3) - "satisfaction along six high level interface factors"

- Screen (Part 4) - "satisfaction with a number of factors related to visual displays"

- Terminology and System Information (Part 5) - "satisfaction with system messages, user feedback, and task related wording that the system generates"

- Learning (Part 6) - "user's perception of their ability to learn complex system tasks"

- System Capabilities (Part 7) - "satisfaction with the system's performance and reliability, both in error recovery and error prevention"

See Appendix D for the version of the questionnaire used in this study.

After completing the *User Satisfaction Questionnaire*, participants were asked three open-ended questions to allow them to provide feedback in their own words. These questions can be found in Appendix D. All responses were stored in a database housed at the School of Information and Library Science.

Results

  The results from the usability study focused on four components of the study: (1) participant profiles; (2) participant interactions with the "Ask the Expert" prototype; (3) user satisfaction questionnaire data; and (4) participant responses to the three open-ended questions.

Participant Profiles

  The participant group included nine members of the PIC Advisory Panel. Using the *Profile Questionnaire* (Appendix C), basic information about the group was collected. Five women and four men participated and ranged in age from 31-35 up to 56-60. All participants had at least a college education. Six participants (67%) rated their level of computer comfort as very comfortable, while three (33%) rated their comfort level as somewhat comfortable. All participants had been using the Internet for at least four years. Eight participants (89%) indicated they use their web browser at least once a day, while one participant (11%) indicated using a browser a few times a week. Thus, the participants as a whole are familiar with computers and the Internet.

  Participants were asked how often they use the Internet to search for specific information. Three participants (33%) indicated "most of the time" and six (67%) indicated "sometimes." When asked how often they had used the Web to access reference materials during the past six months, all participants responded either daily or weekly. The results of these last two questions on the *Profile Questionnaire* suggest an

initial willingness to consider using an online "Ask the Expert" application to search for

or obtain answers to botanical questions.

Participant Interactions with the "Ask the Expert" Prototype

The test instrument collected the questions that were submitted by the

participants. Eight of the nine participants (89%) submitted questions, which are shown

in Table 1. A possible reason that one participant did not submit a question could be that

s/he found the answer by browsing the FAQ or the matches retrieved by the system.

Table 1. Submitted Questions

Questions Submitted by the Participants
1. What type of plant tissue can humans digest? (For example, why can we eat lettuce, but not grass)
2. Are there any bulbs (e.g., iris, lilies) that will do well in a damp, shady area?
3. My hydrangea bushes have only a few blooms. They have been planted for 4 years on the South side of my home here is Orange County. I can remember that my grandmother\\
4. What would be the ideal soil mix for a raised bed of hybrid tea roses?
5. How can I find out about the distribution of plants in North Carolina - which plants are found where?
6. What is an angiosperm?
7. What are some plants that grow or thrive in the shade?
8. how do i fertilize azaleas?

The end segment of the third participant's question was lost. Later investigation

showed that when the user's question includes a word that contains an apostrophe (i.e.,

"grandmother's"), the scripting language views the apostrophe as a text delimiter, and the

remaining text is lost. The final version of the system should parse the text for

apostrophes to address this problem. However, it is important to note that the emphasis

of the test instrument was on participants' experience with the system, not whether or not

they found the answer to their question. Also, due to resource constraints, this study did

not collect data about the paths the participants took through the site or how long they viewed each page.

User Satisfaction Questionnaire Data

Following their interaction with the PIC "Ask the Expert" system, each participant completed the *User Satisfaction Questionnaire*. The results are shown in Table 2; the mean and the standard deviation are calculated for each item in the questionnaire. The items concerning error messages, the correction of typos, and the ability to undo operations (items 5.6, 7.4.1, and 7.4.2 in Appendix D, respectively) were not considered in the analysis because they received an NA (not applicable) answer from five or more of the participants. The high number of NA responses for these items is probably because the participants did not have an interaction with the system in which a mistake was made. Thus, the participants could not rate this aspect of the system.

The midpoint of the rating scale (5) was used as a criterion. If the item had a mean above 5, it was perceived as being better than an arbitrary, mediocre value. All of the questions had a mean score above five. The questions with the lowest means were:

- Question 5.2: Terminology relates well to the work you are doing, never – always

- Question 6.4.3: Feedback on the completion of steps, unclear - clear

Both of these questions had means of 6. The confidence interval around the mean for each of these two questions was calculated to determine its reliability. The 95% confidence interval for question 5.2 was equal to 6 ± 1.7, while the 95% confidence interval for question 6.4.3 was equal to 6 ± 2.0. Each interval includes 5 within its boundaries, indicating that the mean is not significantly different from 5 at the 0.05 level

of significance. Thus, the results suggest the participants found the terminology not to be well-related to the work they were doing and the feedback on the completion of steps to be unclear, pointing to a need for improvement.

The questions with the highest means were:

- Question 6.1: Learning to use the system, difficult - easy

- Question 6.1.3: Time to learn to use the system, slow - fast

Both of these questions had means of 9. Thus, the *User Satisfaction Questionnaire* results suggest the participants found that learning to use the system was easy and fast, revealing strengths that should be maintained in the final design of the "Ask the Expert" application.

Table 2. User Satisfaction Questionnaire Results

		MEAN	STD DEV
OVERALL REACTIONS TO THE SYSTEM			
3.1	terrible - wonderful	7	1.6
3.2	difficult - easy	8	1.0
3.3	frustrating - satisfying	7	1.3
3.4	inadequate power - adequate power	8	1.5
3.5	dull - stimulating	7	1.7
3.6	rigid - flexible	8	1.2
SCREEN			
4.1	Characters on the computer screen, hard to read - easy to read	8	0.9
4.1.2	Character shapes (fonts), barely legible - very legible	8	0.9
4.3	Screen layouts were helpful, never - always	8	1.4
4.3.1	Amount of information that can be displayed on screen, inadequate - adequate	8	1.4
4.3.2	Arrangement of information on screen, illogical - logical	8	1.0
4.4	Sequence of screens, confusing - clear	8	1.2
4.4.1	Next screen in a sequence, unpredictable - predictable	8	0.8
4.4.2	Going back to the previous screen, impossible - easy	8	1.0
TERMINOLOGY AND SYSTEM INFORMATION			
5.2	Terminology relates well to the work you are doing, never - always	6	2.6
5.2.1	Computer terminology is used, too frequently - appropriately	8	0.7
5.2.2	Terminology on the screen, ambiguous - precise	8	1.1
5.3.1	Position of instructions on screen, inconsistent - consistent	7	2.2
5.5.2	Performing an operation leads to a predictable result, never - always	8	0.8
5.6	Error messages, unhelpful - helpful	*	*
LEARNING			
6.1	Learning to use the system, difficult - easy	9	0.7
6.1.3	Time to learn to use the system, slow - fast	9	0.7
6.4	Tasks can be performed in a straight-forward manner, never - always	8	0.7
6.4.1	Number of steps per task, too many - just right	8	0.8
6.4.2	Steps to complete a task follow a logical sequence, never - always	8	0.9
6.4.3	Feedback on the completion of steps, unclear - clear	6	3.1
SYSTEM CAPABILITIES			
7.4	Correcting your mistakes, difficult - easy	8	1.2
7.4.1	Correcting typos, complex - simple	*	*
7.4.2	Ability to undo operations, inadequate - adequate	*	*
7.5	Designed for all levels of users, never - always	7	1.5

An asterisk (*) indicates the question was not considered in the analysis, because it received an NA (not applicable) answer from five or more of the participants.

Participant Responses to the Open-ended Questions

After completing the *User Satisfaction Questionnaire*, participants were asked

three open-ended questions to allow them to provide feedback in their own words. The

first question asked participants, "Did you look for the answer to your question in the

FAQ (Frequently Asked Questions) page? Why or why not?" The "Ask the Expert"

application is designed to encourage users to browse the FAQ first so that the botanical

experts avoid receiving the same question repeatedly from users. Thus, the first open-

ended question gauges whether this aspect of the design is working. All participants

responded positively; each had visited the FAQ. Their comments are shown in Table 3.

Table 3. Open-Ended Question #1

Participant Comments: Did you look for the answer to your question in the FAQ (Frequently Asked Questions) page? Why or why not?
"yes"
"Yes, although I didn't really expect an exact answer. I wouldn't have been surprised to find some information about planting in various conditions. I looked in part out of curiousity to see what FAQ for this topic were."
"Yes, beacause I asked about a particular plant or shrub and wanted to make sure that others had not asked the same question."
"I did. It was interesting to see the FAQ and I'm sure I would go back to that just to gain some general knowledge. FAQ had excellent questions"
"Yes - I wanted to see the types of questions already asked."
"Yes"
"Yes, I wanted to see the info on poison ivy, oak, and sumac."
"Yes. Instructed to do so before typing question."
"i wanted to see how to submit a question..."

Reasons for browsing the FAQ were summarized by the researcher into four categories:

- to satisfy one's curiosity,

- to comply with the instructions to do so before submitting a question,

- to make sure the question had not been previously asked,

- to see what kinds of questions had already been asked.

Overall, the responses to the first open-ended question suggest that the participants

realized the value of browsing the FAQ prior to submitting a question to the experts.

The second open-ended question asked participants to comment on the most

negative aspect(s) of the "Ask the Expert" application. While three of the participants

(33%) found no negative aspects, the remaining participants (67%) provided negative

comments, which indicate that the "Ask the Expert" prototype has room for

improvement. Participant comments are shown in Table 4.

Table 4. Open-Ended Question #2

Participant Comments: Please comment on the most negative aspect(s) of the "Ask the Expert" application.
"no negatives that I can think of."
"I asked about specific kinds of plants (e.g., iris) in specific growing conditions. One of the FAQ's was where to go to find such information. It almost made me think I shouldn't continue with the ask-the-expert application, but rather consider the pointer as my answer, and have to make further effort. Also, I didn't notice if there was any hint as to how long I should expect to wait for an answer?"
"Had none. I only wanted q quick response to the question but waiting is not a real problem."
"Seems generally clear. Was there a screen that said "Your question has been sent?" is there any acknowledgement?"
"No real negatives - it would be nice the the technology allowed the query boxes to wrap the text. Having the text extend indefinitely on one line is a bit disconcerting, but not completely off-putting. It makes it challenging to review a long question (like this one) to search for typos, etc."
"I found no negative aspects (assuming that I get a response)."
"I didn't see any overt negatives."
"having to wait for an answer - i thought it was gonna be like "ask jeeves"..."

All of the negative observations related to functional aspects of the application

design. One participant's observation was: "Seems generally clear. Was there a screen

that said 'Your question has been sent?' is there any acknowledgement?" This

observation points to the importance of confirming the question submission for the user.

Two participants expressed dissatisfaction with having to wait for an answer instead of getting a quick answer. These observations suggest that the wait for an answer needs to be explained up-front, with a clear indication of the time frame in which the botanist expert will contact the user.

One participant noted a lack of wrapping in the text boxes on the forms. Later investigation revealed that this participant was using Netscape's web browser. The "Ask the Expert" prototype was developed using Microsoft's Internet Explorer browser, but the participant's comment highlights the need to optimize the application for use in the Netscape browser.

Another participant's comment reveals some confusion about the relationship between the FAQ and the "Ask the Expert" application:

> "I asked about specific kinds of plants (e.g., iris) in specific growing conditions. One of the FAQ's was where to go to find such information. It almost made me think I shouldn't continue with the ask-the-expert application, but rather consider the pointer as my answer, and have to make further effort."

This participant's experience indicates that the connection between the FAQ and the "Ask the Expert" feature needs to be delineated more clearly for the user.

The third open-ended question asked participants to comment on the most positive aspect(s) of the "Ask the Expert" application. Their comments are shown in Table 5. Two participants commented on how the prototype was structured, stating that the layout "led in the right direction" and that the FAQs were "well organized." Two participants mentioned functional features of the prototype as positive attributes: "I like the variety of forms in which one could request the answer to be sent" and "I like being able to consult master gardeners about any question and get a response to solve the problem." One participant liked the content of the FAQs, stating "... I wanted to spend

some time exploring them -- they piqued my curiousity." Two of the participants

mentioned the aesthetics as a positive aspect of the "Ask the Expert" prototype, using the

adjectives: "colorful" and "attractive." All of these observations describe strengths of the

"Ask the Expert" prototype that should be maintained in the final design.

Table 5. Open-Ended Question #3

Participant Comments: Please comment on the most positive aspect(s) of the "Ask the Expert" application.
"easy to use"
"I like the FAQs, they're well organized and I wanted to spend some time exploring them -- they piqued my curiousity. I like the variety of forms in which one could request the answer to be sent."
"I like being able to consult master gardeners about any question and get a response to solve the problem."
"It appears that anything you want to know will be answered."
"Colorful, attractive, easy to use - I'll be showing it to my garden-conscious teenage daughter!"
"Flexible and easy"
"Layout looked good and led in the right direction."
"very straightforward"
"well-designed and attractive."

One participant gave this observation as a positive: "It appears that anything you

want to know will be answered." This comment actually reveals a weakness of the

design, since the scope of the "Ask the Expert" service is limited to questions on native

plants, plant conservation, gardening, and landscaping, all with special reference to the

Piedmont of North Carolina. This comment shows that the description of the scope on

the starting page for the "Ask the Expert" service was not perceived by at least one

participant.

Discussion and Recommendations

The results show that participants' reactions to the PIC "Ask the Expert" prototype were generally positive. All of the questions on the *User Satisfaction Questionnaire* received an average rating above 5, on a scale from 1 to 9 where positive adjectives anchor the right end of the scale and negative adjectives anchor the left. Participants confirmed these useful features of the system:

- They liked being able to consult with botanist experts about their gardening questions.

- They found the interface to be colorful and attractive.

- They commented that the prototype was flexible, straightforward, and easy to use.

The study did identify some areas where the quality and overall usability of the PIC "Ask the Expert" application can be improved, in the following ways:

- The scope should be set apart and emphasized on the starting page.

- The steps involved in using the application should be delineated clearly, so that users know what to expect. This will keep the users from expecting the application to behave like "Ask Jeeves."

- The wait for an answer should be explained up-front, with a clear indication of the time frame in which the botanist expert will contact the user.

- The connection between the FAQ and the "Ask the Expert" feature should be delineated more clearly for the user.

A screen shot of the revised starting page can be found in Appendix E.

Responses for item 6.4.3 (feedback on the completion of steps) on the *User Satisfaction Questionnaire* suggest the participants found the feedback to be unclear, pointing out a need for improvement. To improve feedback, the design will display an acknowledgement to the user that his question was successfully submitted to the expert. Results for item 5.2 (use of terminology) indicate that the terminology used on the web site could be improved to be more related to the work users are doing.

The other primary area of concern involves the operation of the prototype. The interface should be optimized for the Netscape Navigator web browser so that text wraps in the text boxes. Also, the scripting code should be modified to parse any apostrophes that are contained in users' questions. Both of these problem areas will be addressed in the final implementation of the "Ask the Expert" module.

Summary and Conclusion

The results of this study are intended to assist in the revision of the PIC "Ask the Expert" prototype, but they may also have implications for other designers interested in using question-answering systems to facilitate electronic access to subject experts. This research is important because there is a need for more knowledge about how people use Web-based learning tools in a domain-specific area like botanical science. By designing a straightforward, easy-to-use "Ask the Expert" system, users can obtain answers to their plant questions in a fun and interactive way. The system also assists the botanical experts by presenting the user with similar questions that have already been answered.

This investigation was limited to the PIC Advisory Panel for practical reasons, although the PIC site aims to serve a wide range of users who seek information about plants. Future studies should test the usability of the "Ask the Expert" application with other user groups, especially school children, to give a more complete representation of users' needs. The study was also limited by the design of the test instrument. No data were collected about the paths the participants took through the site or how long they viewed each page. A future usability study may bring the participants on-site so that client-side web tracking software can be used to record their movements through the application. An on-site study would also allow richer qualitative data to be collected through interviews and think aloud reactions, instead of relying on participants to supply comments to open-ended questions on a web form. The main advantage of the test instrument used in this study was that it allowed participants to explore the "Ask the

Expert" application in a familiar environment, without the pressure of a study proctor observing their every movement.

Given its strengths and limitations, the study supported the collection of data that generated some useful results. Participants' responses highlighted the importance of providing clear feedback about a user's progress through the site. Some operational problems with the prototype were also uncovered. These findings will be used to improve the PIC "Ask the Expert" application so that it fulfills its goals of facilitating knowledge capture and reuse and fostering communication between botanical experts and information-seeking users.

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Appendix A: Sample Screen Shots of the "Ask the Expert" Prototype

Starting Page

Frequently Asked Questions Page

Similar Question Retrieved from FAQ

Contact Information Form

Appendix B: Participant Consent Form

Appendix C: Profile Questionnaire

6. How long have you been using the Internet (including using email, gopher, ftp, etc.)?

- ○ Less than 6 months
- ○ 6 to 12 months
- ○ 1 to 3 years
- ○ 4 to 6 years
- ○ 7 years or more

7. On average, how often do you use your WWW browser? *By this, we mean using your browser for a specific set of tasks or activities. We do not mean how many times you launch your browser per day.*

- ○ More than 9 times/day
- ○ 5 to 8 times/day
- ○ 1 to 4 times/day
- ○ A few times a week
- ○ Once a week
- ○ Once a month

8. To what extent would you say you use the Internet to search for specific information? Would you say...

- ○ Most of the time
- ○ Sometimes
- ○ Seldom
- ○ Never

9. How often you have used the Web to access reference materials during the *past 6 months*?

- ○ Daily
- ○ Weekly
- ○ Monthly
- ○ Less than once a month
- ○ Never

Your task for this study is to think of a question related to plants or botany and use the "Ask the Expert" application to obtain the answer to your question. When you have thought of your question, please click the "Continue" button below. The "Ask the Expert" application will appear in your browser. Thank you.

Continue

Source: GVU's 10th WWW User Survey, www.gvu.gatech.edu/user-surveys/
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Done   Internet

Appendix D: User Satisfaction Questionnaire

PIC "Ask the Expert" Usability Study - Microsoft Internet Explorer

File   Edit   View   Favorites   Tools   Help

Back ▾ → ▾ ⊘ ⊘ ⊘ | ⊘Search ⊡Favorites ⊘History | ⊘▾ ⊘ ⊡ ▾ ⊡ ⊘ ⊘

Address ⊡ http://www.ibiblio.org/pic/experiment/quis.php   ▾ ⊘Go | Links »

Plant Information Center (PIC) "Ask the Expert" Usability Study

Post-Experiment Questionnaire

Instructions: Please rate your satisfaction with the "Ask the Expert" system. Since the system is a prototype, you are rating your experience with the system, not whether or not you found the answer to your question.

- Select the numbers which most appropriately reflect your impressions about using this computer system.
- For items that are not applicable, use "NA"
- If you have questions regarding the questionnaire, please contact Emily Warmoth, the principal investigator (warme@ils.unc.edu)

OVERALL REACTIONS TO THE SYSTEM		1	2	3	4	5	6	7	8	9		NA
3.1	terrible	○	○	○	○	○	○	○	○	○	wonderful	○
3.2	difficult	○	○	○	○	○	○	○	○	○	easy	○
3.3	frustrating	○	○	○	○	○	○	○	○	○	satisfying	○
3.4	inadequate power	○	○	○	○	○	○	○	○	○	adequate power	○
3.5	dull	○	○	○	○	○	○	○	○	○	stimulating	○
3.6	rigid	○	○	○	○	○	○	○	○	○	flexible	○

SCREEN		1	2	3	4	5	6	7	8	9		NA
4.1 Characters on the computer screen	hard to read	○	○	○	○	○	○	○	○	○	easy to read	○
4.1.2 Character shapes (fonts)	barely legible	○	○	○	○	○	○	○	○	○	very legible	○
4.3 Screen layouts were helpful	never	○	○	○	○	○	○	○	○	○	always	○
4.3.1 Amount of information that can be displayed on screen	inadequate	○	○	○	○	○	○	○	○	○	adequate	○
4.3.2 Arrangement of information on screen	illogical	○	○	○	○	○	○	○	○	○	logical	○
4.4 Sequence of screens	confusing	○	○	○	○	○	○	○	○	○	clear	○
4.4.1 Next screen in a sequence	unpredictable	○	○	○	○	○	○	○	○	○	predictable	○
4.4.2 Going back to the previous screen	impossible	○	○	○	○	○	○	○	○	○	easy	○

TERMINOLOGY AND SYSTEM INFORMATION		1	2	3	4	5	6	7	8	9		NA
5.2 Terminology relates well to the work you are doing	never	○	○	○	○	○	○	○	○	○	always	○
5.2.1 Computer terminology is used	too frequently	○	○	○	○	○	○	○	○	○	appropriately	○
5.2.2 Terminology on the screen	ambiguous	○	○	○	○	○	○	○	○	○	precise	○
5.3.1 Position of instructions on screen	inconsistent	○	○	○	○	○	○	○	○	○	consistent	○
5.5.2 Performing an operation leads to a predictable result	never	○	○	○	○	○	○	○	○	○	always	○
5.6 Error messages	unhelpful	○	○	○	○	○	○	○	○	○	helpful	○

LEARNING		1	2	3	4	5	6	7	8	9		NA
6.1 Learning to use the system	difficult	○	○	○	○	○	○	○	○	○	easy	○
6.1.3 Time to learn to use the system	slow	○	○	○	○	○	○	○	○	○	fast	○
6.4 Tasks can be performed in a straight-forward manner	never	○	○	○	○	○	○	○	○	○	always	○
6.4.1 Number of steps per task	too many	○	○	○	○	○	○	○	○	○	just right	○
6.4.2 Steps to complete a task follow a logical sequence	never	○	○	○	○	○	○	○	○	○	always	○
6.4.3 Feedback on the completion of steps	unclear	○	○	○	○	○	○	○	○	○	clear	○

SYSTEM CAPABILITIES		1	2	3	4	5	6	7	8	9		NA
7.4 Correcting your mistakes	difficult	○	○	○	○	○	○	○	○	○	easy	○
7.4.1 Correcting typos	complex	○	○	○	○	○	○	○	○	○	simple	○
7.4.2 Ability to undo operations	inadequate	○	○	○	○	○	○	○	○	○	adequate	○
7.5 Designed for all levels of users	never	○	○	○	○	○	○	○	○	○	always	○

	1	2	3	4	5	6	7	8	9	NA

Did you look for the answer to your question in the FAQ (Frequently Asked Questions) page? Why or why not?

Please comment on the most **negative** aspect(s) of the "Ask the Expert" application:
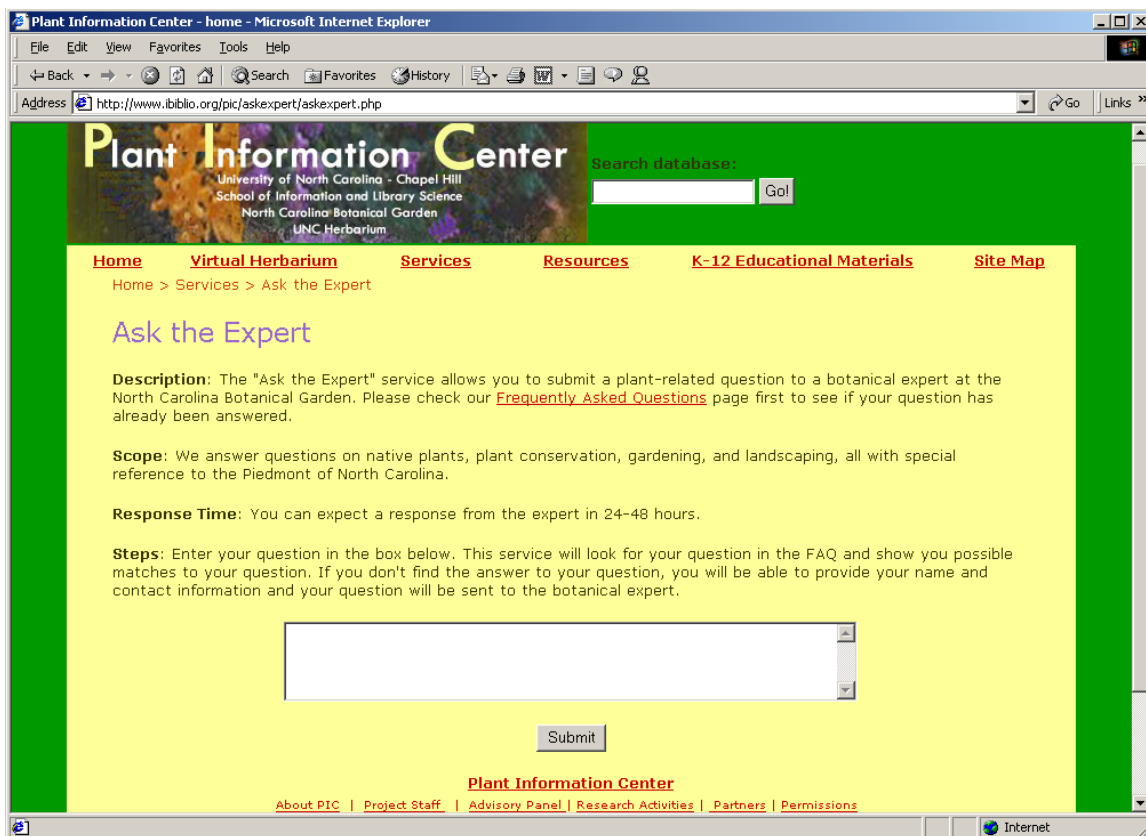
Please comment on the most **positive** aspect(s) of the "Ask the Expert" application:

Submit

Source: The Questionnaire for User Interaction Satisfaction (QUIS)
Human-Computer Interaction Lab, University of Maryland, College Park
http://www.cs.umd.edu/hcil/quis/

Done   Internet

Appendix E: Revised Starting Page