

Foundations Project Usability Testing: Bridges Search Interface Study



Introduction

The Foundations Project is a State of Minnesota multi-agency collaborative project developed to facilitate the access to environmental and natural resources data and information on the World Wide Web through the Project's **Bridges Search Interface**. Project leaders developed metadata cataloging guidelines and other searching aids designed to be intuitive and easy to use for both specialists and non-specialists. Project staff and agency participants trained by project staff have added metadata (special HTML search tags) to electronic data and information resources including web pages, PDF documents, tabular data and geographic data. Advanced search and retrieval techniques that integrate access to this information across agency websites have also been designed. The search engine used is the Ultraseek engine developed by Infoseek.

Usability - Definition

The usability of an interface is a measure of the effectiveness, efficiency and satisfaction with which specified users can achieve specific goals in a particular environment with that interface (ISO).

Usability testing of Bridges search interface involved developing the plan, designing the necessary materials, finding participants, choosing the test sites, etc. Finally, all tests conducted were statistically analyzed to find what search strategies the public at large uses and, secondarily, the effect of metadata in efficient retrieval.

Plan for Usability Testing

Goal

To gather information on the ease and comfort level of searchers on Bridges, as well as successful and unsuccessful strategies used for searching governmental and environmental information on the Bridges website. An additional goal: to determine how metadata affects search results. Each page with correct answers to the questions contained Dublin Core metadata.

Procedure

Creating questions from information on several Minnesota state agency websites on Bridges and doing preliminary testing to determine the location of answers and the level of difficulty in finding them.

Delineating what's needed for the successful completion of the task:

1. Retrieval of the specific page determined to have the right information.
2. Documenting search strategy or strategies used to search:

- a. Keywords
 - b. Boolean
 - c. Natural language
 - d. Quotation marks, truncation, etc.
3. Determining if the pages retrieved were relevant¹, plus the number of relevant pages.
 4. Discovering strategies most often used to find answers to a question.
 5. Considering the time taken to answer each query and the overall test. Establishing benchmarks that represent either the average or maximum time to perform the task.

Data Collection Method

The form used to collect data is attached (Appendix D). The data was collected manually. A stopwatch was used to monitor time.

Participants were asked to locate the specific site where the answer to each question could be found. While they were doing this task, test monitors transcribed the search terms used and strategy or strategies used.

Settings

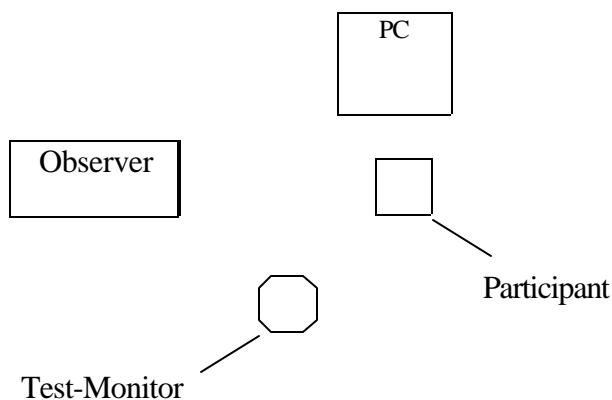


Figure 1

Participants

Participants included a pilot searcher, two searchers from the Minnesota Department of Natural Resources familiar with web searching, one person with some background in this type of discovery from the University of Minnesota, and two with very little searching experience from the College of St. Catherine. A brief user profile questionnaire was developed to determine the skill levels of participants.

¹ Relevant: Any document which on basis of the information it conveys is considered related to your question even if the information is outdated or already familiar to you.

Conducting the Test

Nine questions were created from several Minnesota State Agency home pages and websites on the Bridges website. Preliminary testing was done to determine where answers could be found and how difficult they were to locate. A page of unanswered search queries for each participant was prepared, as well as a page listing queries and the correct URL for each one. This allowed researchers to judge the reliability of answers found by participants. A five-minute time limit was imposed, due to time constraints in the computer lab and to maintain control of the test. If a question remained unanswered after five minutes the participant would be told to move on.

At the testing site (Settings as per Figure - 1), participants were introduced to the two researchers who would be working with them. One person acted as the test observer, timing the participants as they worked on each question, recording the number of hits for each question and observing their behavior and body language. The other researcher, the test monitor, recorded strategies used by the participants to find answers and noted whether the question was answered. (Note: one person was tested off-site by a single researcher using consistent methods.)

Prior to the start of the timed study, each participant was briefed on the Foundations Project and the purpose of the study (Appendix B) and then filled out a pre-test survey (Appendix C) to determine their level of experience in online searching and using the Internet.

Each participant was tested singly, while being observed by the two researchers. Seated at a computer with the Bridges website already up, each was handed the questions (Appendix E) and told to begin. During testing, researchers observed quietly, without speaking or offering suggestions. The post-test questionnaire (Appendix F) was given to each participant after they completed their test. Recommendations for changes to the Bridge site were also a part of this instrument.

Observations

Most participants had success in searching the Bridges site. Only one had difficulty. Search times tended to decrease as users became more familiar with the Bridges site. Each participant's average time per question was well under the five-minute limit, with a minimum average time of .56 seconds and maximum of 4.16 minutes.

Most participants found the correct site promptly and easily. Only one user opted to take multiple searches for each question. It should be noted as well that this person also had the lowest success rate, which would indicate more a problem of the his skill level and search techniques than the Bridges site itself. In addition, one person found the wording of the questions to be a problem and commented on this in her evaluation.

Even when multiple hits resulted (and this was quite common, a fact commented on by a user), most participants found the correct site near the top of the list of sites or by a reasonable amount of scrolling.

This indicates that the addition of keywords and metadata weighted these sites toward the top of long lists of hits. Total number of hits per participant varied greatly, with an average low per question of 461.4 and a high of 15,607. Varying search strategies were used by participants: keyword was the most common (52%), followed by Boolean (42%), then related topics suggested via the Content Classification Engine (CCE) (4%), natural language (1%) and quoted phrases (1%).

Participants, for the most part, seemed comfortable using the Bridges website and said so on the post-test questionnaire. Most displayed some nervousness at the beginning of their test, by sitting forward on their chairs, putting fingers near mouths, toying with their hair, etc. With each new question participants tended to relax. All but one took their time to go over the list of hits they had, examining the description before clicking on the link that led them to sites that would answer their questions.

Analysis of the Test Data

The data collected during the test was entered in an Excel spreadsheet. The statistical analysis of the data was performed using SYSTAT 8.0 software developed by SPSS Inc.

Usability Study Statistics Summary - Table 1

<i>Tester</i>	<i>No. of Tries</i>	<i>Strategies</i>					<i>Hits (Avg.)</i>	<i>Q Ans (%)</i>	<i>Time (Avg.)</i>
		<i>Keywd.</i>	<i>Natural Lang.</i>	<i>CCE</i>	<i>Boolean</i>	<i>Quotes</i>			
DNR-1	10	9	1	0	0	0	1114.6	100	0.56
DNR-2	18	15	0	3	0	0	No data	72	2.24
CSC-1	43	18	0	1	24	0	588.9	33.3	4.16
PILOT	11	7	1	0	3	1	6162	73	1.01
CSC-2	9	4	0	0	5	0	461.4	100	1.18
UMN.	10	0	0	0	10	0	15607	80	2.48
<i>Totals</i>	101	53	1	4	42	1	23,933.90		11.63
<i>Percent</i>		53%	1%	4%	42%	1%			
<i>Average</i>	16.6	8.8	0.3	0.7	7.0	0.2	4786.78	76.38	1.93
<i>Standard Deviation</i>	13.2	6.7	0.5	1.2	9.1	0.4	6495.9	24.6	1.3
<i>Highest</i>	43	18	1	4	24	1	15,607	100	4.16
<i>Lowest</i>	9	0	0	0	0	0	461.5	33.3	0.56

The average time taken by the group to complete the tasks was 1.93 minutes. This is much less than the benchmark time of 5 minutes. It reflects that the overall site usability of the group was good.

Range (highest and lowest) of completion time is 4.16 and 0.56. This statistics implies that some performers viewed the task in an aberrant way or simply lacked needed skills.

The mean time of 1.93 minutes and standard deviation of 1.3 minutes reflects a tightly clustered distribution around the mean, which implies that users performed very similarly to each other.

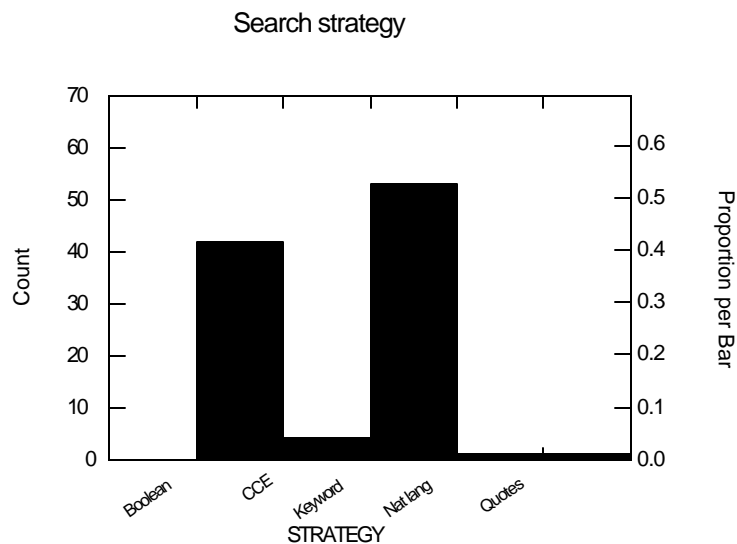


Figure - 2

This summary of statistical data was computed by gathering test data for each participant and merging it into a single file (Appendix A - Table 2). The values thus found were plotted using SPSS into histograms. This immediately highlighted the trends and patterns of searching among different participants.

The bar chart in Figure 2 shows that Keyword searching is the most popular search strategy. Boolean searching is the next most popular strategy. Using the related topics suggested via CCE (Classification Content Engine developed by Foundations Project) is also an option used by some. Usage of Natural Language or Quotation marks seems to be the least used search strategy.

Item retrieved

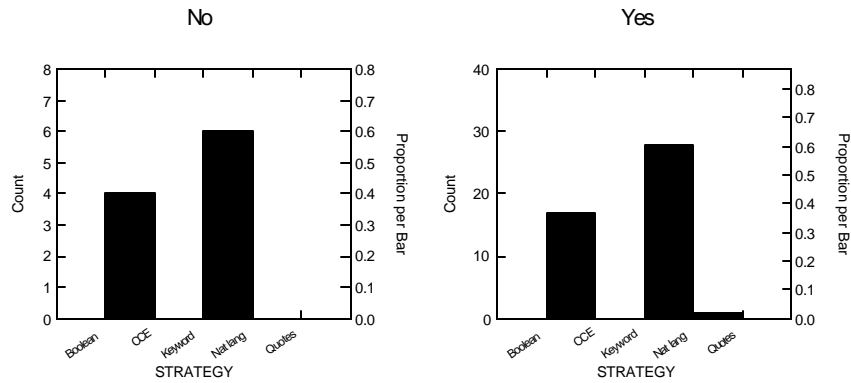


Figure - 3

After completion of the above analysis we also compared which strategy pulled up relevant pages and how many times. The bar chart (Figure 3) illustrates that the Boolean strategy did not retrieve relevant documents about four times but did retrieve the relevant documents about 16 times. Use of keywords did not retrieve relevant items six times, however it did retrieve relevant items about 28 times. Natural language, CCE and quotation marks were seldom used – only once or twice by a few people.

These graphs were produced using SPSS software. The data from the merged file in Table 2 was used to check relevancy.

Findings and Recommendations

Useful information was discovered through observations of the test observers, as well as the answers from post-test questionnaires given the participants and their comments. (Note: a post-test questionnaire was not received from the participant who tested off-site; nonetheless, brief comments from her were obtained.) Most searchers were comfortable with keyword searching and the more advanced Boolean, while opinions on using CCE were mixed: two participants ranked CCE easy to use, two were less enthusiastic and one abstained from answering. Interestingly, the searcher who had trouble with the wording of questions expressed interest in CCE. In more detail, using CCE was spotty: while the more experienced searchers had some success using this search strategy (knowing, for instance, which Minnesota state agency would be likely to offer the necessary information), those with less experience seemed confused by it. Also, while Boolean searching was popular, one user had trouble with there being nothing in Bridges stating that its operators must be capitalized or symbolized.

The least experienced searcher indicated frustration with the hits he received using Boolean as well, commenting negatively on their high number.

As mentioned, the advanced search screen was used by only one participant. Nonetheless, her searches were accurate and expedient. To acquaint more users with this screen, perhaps the advanced search link should be made more obvious. It should be noted as well that those searchers who chiefly used keyword searching had good success percentages. This is very positive, considering that inexperienced users would more likely use keywords.

Overall the Bridges search site performs very well. Most users were able to perform tasks successfully without any assistance.

Keyword searching seems to be the most used strategy providing accurate results. Success of Boolean search strategy depends on the background of the user and his/her approach to the problem. Use of CCE is an option used by some. The use of natural language and quotation marks is rare.

It is suggested that CCE occupy less space while displaying search results. To this end we have made each relevant topic on CCE display on a single line. CCE would be better utilized if links to all the main subject categories appear on the Bridges home page. Some instructions on basic/advanced searching could also be made available on the home page.

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Appendices

1. Appendix A - Usability Study Test Data
2. Appendix B - Orientation Script
3. Appendix C - Background/pretest questionnaire
4. Appendix D - Data collection instruments
5. Appendix E - Task scenarios
6. Appendix F - Post-test questionnaire

Appendix A

Usability Study Test Data - Table 2

Tester	Question	Strategy	Hits	Q_Ans	Time
DNR-1	1	Keyword	17005	Yes	1.5
DNR-1	2	Nat lang	18441	Yes	0.2
DNR-1	3	Keyword	4673	Yes	0.3
DNR-1	4	Keyword	1227	Yes	0.25
DNR-1	5	Keyword	17421	Yes	0
DNR-1	5	Keyword	12337	Yes	1
DNR-1	6	Keyword	15524	Yes	1.3
DNR-1	7	Keyword	7104	Yes	0.2
DNR-1	8	Keyword	1774	Yes	0.2
DNR-1	9	Keyword	15640	Yes	0.1
CSC-2	1	Keyword	88	Yes	3
CSC-2	2	Keyword	1226	Yes	0.45
CSC-2	3	Keyword	578	Yes	2.5
CSC-2	4	Keyword	282	Yes	0.15
CSC-2	5	Boolean	163	Yes	0.3
CSC-2	6	Boolean	1091	Yes	0.3
CSC-2	7	Boolean	563	Yes	3.5
CSC-2	8	Boolean	62	Yes	0.3
CSC-2	9	Boolean	100	Yes	0.15
DNR-2	1	Keyword	17000	Yes	1.17
DNR-2	2	Keyword		Yes	2.14
DNR-2	2	Keyword			
DNR-2	2	CCE			
DNR-2	3	Keyword		Yes	4.05
DNR-2	3	Keyword			
DNR-2	3	CCE			
DNR-2	4	Keyword		No	5
DNR-2	4	Keyword			
DNR-2	4	Keyword			
DNR-2	5	Keyword		Yes	1.05
DNR-2	6	Keyword		Yes	4.13
DNR-2	6	Keyword			
DNR-2	6	Keyword			
DNR-2	7	Keyword		Yes	1.11
DNR-2	7	CCE			
DNR-2	8	Keyword		Yes	0.26
DNR-2	9	Keyword		Yes	1.26
PILOT	1	Keyword	415	Yes	0.3
PILOT	2	Boolean	0	Yes	2
PILOT	3	Keyword	0	Yes	0.3
PILOT	4	Keyword	1837	No	5
PILOT	4	Keyword	18853		7.6
PILOT	5	Boolean	18842	Yes	0.2
PILOT	5	Quotes	0		

PILOT	6	Keyword	3919	Yes	1.3
PILOT	7	Keyword	2933	Yes	1
PILOT	8	Boolean	18511	Yes	2
PILOT	9	Keyword	2682	Yes	0.1
CSC-1	1	Keyword	7229	Yes	1
CSC-1	2	Boolean	2	No	4
CSC-1	2	Boolean	52		
CSC-1	2	Boolean	3		
CSC-1	2	Boolean	1		
CSC-1	3	Keyword	362	No	5
CSC-1	3	Boolean	5		
CSC-1	3	Boolean	0		
CSC-1	3	Boolean	8		
CSC-1	3	Boolean	26		
CSC-1	3	Keyword	2		
CSC-1	4	Keyword	8	No	5
CSC-1	4	CCE	5		
CSC-1	4	Boolean	8		
CSC-1	4	Keyword	26		
CSC-1	4	Boolean	2		
CSC-1	5	Keyword	0	No	5
CSC-1	5	Boolean	3		
CSC-1	5	Keyword	5284		
CSC-1	5	Boolean	356		
CSC-1	5	Boolean	3		
CSC-1	5	Keyword	412		
CSC-1	6	Keyword	5284	Yes	2.5
CSC-1	7	Boolean	0	No	5
CSC-1	7	Keyword	72		
CSC-1	7	Boolean	0		
CSC-1	7	Boolean	7		
CSC-1	7	Keyword	6		
CSC-1	7	Keyword	79		
CSC-1	7	Boolean	1		
CSC-1	7	Boolean	13		
CSC-1	8	Boolean	3	Yes	5
CSC-1	8	Keyword	18		
CSC-1	8	Boolean	0		
CSC-1	8	Boolean	1		
CSC-1	9	Keyword	0	No	5
CSC-1	9	Boolean	0		
CSC-1	9	Keyword	440		
CSC-1	9	Keyword	16		
CSC-1	9	Boolean	5778		
CSC-1	9	Boolean	107		
CSC-1	9	Keyword	440		
CSC-1	9	Keyword	1620		
UMN	1	Boolean	28	Yes	1.5
UMN	2	Boolean	17777.00	Yes	3

UMN	3	Boolean	18086.00	Yes	3
UMN	4	Boolean	17354.00	Yes	4
UMN	5	Boolean	17688.00	Yes	0.3
UMN	6	Boolean	18115.00	No	5
UMN	6	Boolean	17791.00	Yes	
UMN	7	Boolean	18019.00	Yes	0.3
UMN	8	Boolean		No	5
UMN	9	Boolean		Yes	0.3

Individual Test Report - 1

Tester	Q#	Strategy	Hit Number	Q_Ans	Time
DNR-1	1	Keyword	17,005	Yes	1.5
	2	Natural language	18,441	Yes	0.2
	3	Keyword	4,673	Yes	0.3
	4	Keyword	1,227	Yes	0.25
	5	Keyword	17421	Yes	0
	5	Keyword	12,337	Yes	1
	6	Keyword	15,524	Yes	1.3
	7	Keyword	7,104	Yes	0.2
	8	Keyword	1,774	Yes	0.2
	9	Keyword	15640	Yes	0.1
					5.05
	10 Total	9 Keyword	1114.6 Average	100%	.56 Ave
		1 Natural Language			
		90% Keyword			
		10% Natural Language			

Individual Test Report - 2

Tester	Question	Strategy	Hits	Question Answered	Time
DNR-2	1	Keyword	17,000	Yes	1.17
	2	Keyword		Yes	2.14
	2	Keyword			
	2	CCE			
	3	Keyword		Yes	4.05
	3	Keyword			
	3	CCE			
	4	Keyword		No	5
	4	Keyword			
	4	Keyword			
	5	Keyword		Yes	1.05
	6	Keyword		Yes	4.13
	6	Keyword			
	6	Keyword			
	7	Keyword		Yes	1.11
	7	CCE			
	8	Keyword		Yes	0.26
	9	Keyword		Yes	1.26

	18 Total	15 Keyword	*no data	72%	2.24 Ave
		3 CCE			
		83% Keyword			
		17% CCE			

Individual Test Report - 3

Tester	Question	Strategy	Hit Number	Question Answered	Time
CSC-1	1	Keyword	7229	Yes	1
	2	Boolean	2	No	4
	2	Boolean	52		
	2	Boolean	3		
	2	Boolean	1		
	3	Keyword	362	No	5
	3	Boolean	5		
	3	Boolean	0		
	3	Boolean	8		
	3	Boolean	26		
	3	Keyword	2		
	4	Keyword	8	No	5
	4	CCE	5		
	4	Boolean	8		
	4	Keyword	26		
	4	Boolean	2		
	5	Keyword	0	No	5
	5	Boolean	3		
	5	Keyword	5284		
	5	Boolean	356		
	5	Boolean	3		
	5	Keyword	412		
	6	Keyword	5284	Yes	2.5
	7	Boolean	0	No	5
	7	Keyword	72		
	7	Boolean	0		
	7	Boolean	7		
	7	Keyword	6		
	7	Keyword	79		
	7	Boolean	1		
	7	Boolean	13		
	8	Boolean	3	Yes	5
	8	Keyword	18		
	8	Boolean	0		
	8	Boolean	1		
	9	Keyword	0	No	5
	9	Boolean	0		
	9	Keyword	440		
	9	Keyword	16		
	9	Boolean	5778		
	9	Boolean	107		
	9	Keyword	440		
	9	Keyword	1620		
	43 Total	24 Boolean	588.9 Average	33.30%	4.16 Average

					Time
		18 Keyword			
		1 CCE		43	
		55% Boolean			
		41% Keyword			
		4.3% CCE			

Individual Test Report - 4

Tester	Question	Strategy	Hit Number	Question Answered	Time
PILOT	1	Keyword	415	Yes	0.3
	2	Boolean	0	Yes	2
	3	Keyword	0	Yes	0.3
	4	Keyword	1837	No	5
	4	Keyword	18853		7.6
	5	Boolean	18842	Yes	0.2
	5	Quotes	0		
	6	Keyword	3919	Yes	1.3
	7	Keyword	2933	Yes	1
	8	Boolean	18511	Yes	2
	9	Keyword	2682	Yes	0.1
					12.2
	11 Total	7 Keyword	6162 Average	73%	1.01 Average Time
		3 Boolean			
		1 Quotes			
		63% Keyword			
		27% Boolean			
		9% Quotes			

Individual Test Report - 5

Tester	Question	Strategy	Hit Number	Question Answered	Time
CSC-2	1	Keyword	88	Yes	3
	2	Keyword	1226	Yes	0.45
	3	Keyword	578	Yes	2.5
	4	Keyword	282	Yes	0.15
	5	Boolean	163	Yes	0.3
	6	Boolean	1091	Yes	0.3
	7	Boolean	563	Yes	3.5
	8	Boolean	62	Yes	0.3
	9	Boolean	100	Yes	0.15
	9 Total	5 Boolean	461.4 Average	100%	1.18 Average Time
		4 Keyword			
		44% Keyword			
		56% Boolean			

Individual Test Report - 6

Tester	Question	Strategy	Hit Number	Question Answered	Time
UMN	1	Boolean	28	Yes	1.5
	2	Boolean	17,777	Yes	3
	3	Boolean	18,086	Yes	3
	4	Boolean	17,354	Yes	4
	5	Boolean	17,688	Yes	0.3
	6	Boolean	18,115	No	5
	6	Boolean	17,791	Yes	
	7	Boolean	18,019	Yes	0.3
	8	Boolean		No	5
	9	Boolean		Yes	0.3
	10 total	10 Boolean	15607 Average	80%	2.48 Average Time
		100% Boolean			

Appendix B

Orientation Script for Usability Study

Hi, my name is _____. I'll be working with you in today's session. Let me take a few minutes and give you some information about what we'll be doing today. Before we begin, we'd like you to take a moment and fill out a pre-test questionnaire. This will give us some background on your Internet searching experiences and skills. When we're done there, will be a post-test questionnaire as well. We'll talk more about that later.

The purpose of this study is to look at how people search for information on the Internet, in particular government or environmental information. This research is part of the Foundation Project's Bridges Search Interface. Bridges spiders about 13 Minnesota State agencies that deal with environment related data. A large part of what we're doing involves adding a type of metadata, called Dublin Core, to the HTML headers of website and other pages of these agencies. Simply put, metadata is data about data. Library catalogs, for example, are a kind of metadata. We expect adding metadata to website will allow more efficient and accurate retrieval of web documents.

To help us determine this, we want to know more about how people look for information on the Internet, and see if metalanguage helps. That's why you're here. What we'll do is give you a series of questions that have answers on Minnesota State agency website or pages. We'd like you to try to answer them as best you can by finding the appropriate website or pages.

Remember, while you're working on a question that there is more than one way to find the answer. If you don't find what you're looking for, try using a different strategy or method. Also, often links to a page will bring you to a place that will have the answer to a question.

When you're finished with everything, we'll talk a bit. We're very interested in what you thought about the tools you used in searching, your methods, the searches themselves and your results. Thanks a lot for participating.

Appendix C

Background/Pretest Questionnaire

Name:

Address:

Phone Number:

Internet searching background:

Search engines used:

Indexes (such as Yahoo) used:

Strategie(s) used (natural language, keywords, Boolean, etc.):

Appendix D

Test Monitor's Name

Participant's Name

Q #	Strategy (include search terms used)				# of Hits	Question Answered? (Yes/No)	Time	Comments
	Natural Language	Boolean	Thesaurus	Quotes, truncation, etc.				

Test Observer's Name

Appendix E

Task Questions

1. Find information about the Department of Health's Diabetes Program.
2. Find information about health risks associated with lead in well water.
3. Find information about locating land to hunt in Minnesota.
4. Find which Minnesota lakes walleye is native to.
5. Find a page that gives Minnesota's transportation budget for 1997.
6. What is the fax number for the Rochester office of the DOT?
7. Find information about starting your own food business in Minnesota.
8. Locate a map that shows serious juvenile crimes by county in Minnesota for 1994.
9. Find a site that gives bus routes to and from the University of Minnesota.

Appendix F

Post Test Questionnaire

Name:

- Which search strategy worked best for you in searching from with the Bridges site?
 - Natural language
 - Keyword
 - Boolean
 - Quotes
 - Related topics [CCE]
- Rate your level of comfort with each search strategy (ignore those you didn't use). 1 would be least comfortable; 10 would be most.

Nat. language	1	2	3	4	5	6	7	8	9	10
Keyword	1	2	3	4	5	6	7	8	9	10
Boolean	1	2	3	4	5	6	7	8	9	10
Quotes, etc.	1	2	3	4	5	6	7	8	9	10
Related topics [CCE]	1	2	3	4	5	6	7	8	9	10

- What do you like the best about searching on the Bridges site?
- What did you like the least about searching on the Bridges site?
- If you could change any aspect(s) of the Bridges site, what would it be?
- Circle the number that best describes your searching experience using the Bridges site.

I can always find what I want

I can never find what I want

1 2 3 4 5 6 7 8 9 10

- Please add any comments that would help us evaluate the Bridges site.