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Uncovering the Online Information Seeking Behaviors of Chinese University Students: A Pilot Study

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Abstract

The online behaviors of researchers have been studied from many angles in the library and information science literature. This collaborative study presents a unique perspective by detailing the behaviors exhibited by Chinese university students executing a researcher-defined task. Data was collected using a verbal protocol analysis method. The study results are correlated to research provided by leading scholars in the field of information seeking behaviors. The results of the study provide a valuable starting point for understanding the behaviors exhibited by a growing and significant group of online researchers.

1. Introduction

The amount of information available online has grown exponentially as the technological landscape has evolved. Many sources previously published in print format with limited access are now available electronically to a huge online audience. New consumers of online information increasingly live in emerging economies. China represents the world's largest technology, communications and media market, and more than ever, Chinese researchers choose to go online in their quest for information. According to the China Internet Networks Information Center (CNNIC) China has the largest online population in the world with 618 million Internet users, a 45.8 percent usage rate at the end of 2013.¹ The growth of the online Chinese audience, and the proliferation of online information retrieval systems has led to the need for greater knowledge and understanding of Chinese users' information seeking behavior.

There are many definitions of information seeking behavior. The authors of this study have adopted the definition proposed by Peter Ingwerson and Kalervo Jarvelin that states that information seeking behavior deals with "searching or seeing information by means of information sources and (interactive) information retrieval systems."² It is "a complex dynamic, social human behavior that needs as rich a picture as possible to truly understand the phenomenon – and even then there will be many unanswered questions."³

In the information seeking behavior literature authors have explored many of the variables that have an impact on information seeking behaviors including the amount of searcher experience or expertise, personality types, learning styles, and cultural differences.⁴ This paper details a pilot project which explored using verbal protocol analysis to investigate the information-seeking behaviors of Chinese university students. For this project the authors selected the search strategy categories developed by Andrew Thatcher in his investigations of users' web searching strategies⁵. Thatcher's four step theory is discussed in greater depth in Section 3.5, Analysis Methods.

1.1 Research Rationale

The purpose of this pilot project was to observe and identify the online information seeking behaviors of Chinese students. This study is unique, as it is one of the first projects to employ verbal protocol analysis to learn about the information seeking behaviors of university-level students in China. It is intended to provide the groundwork for a larger and more inclusive research project.

The research question asked is: What are the information seeking strategies of Chinese university students using the Internet in a researcher-defined task?

2. Literature Review

Donald Case suggests that there has been "an escalating growth rate: 30 items per year during the early 1970s, 40 during the early 1980s, 50 by the late 1980s, 100 by 1990, and 120 items per year by 2005" in studies of information seeking behavior.⁶ These studies cross a wide range of topics, including but not limited to studies exploring health information seeking behaviors, online purchasing decisions, habits of academic and students researchers, and information seeking behaviors in developing countries.⁷

Over time, the emphasis of information seeking behavior studies has changed from a focus on professional researchers to include all kinds of information seekers. Heidi Julien et.al. reviewed information seeking behavior research from 1999 to 2008.⁸ Building on earlier work,⁹ the authors found that while theory continued to play an important role in information seeking behavior research, a move towards "more qualitative approaches and greater interest in everyday life information seeking" could be identified.¹⁰ Pertti Vakkari agrees, noting that qualitative research on information seeking behavior has continued to increase since the mid-1960s with most researchers using survey methods (questionnaires and interviews). Vakkari also concludes that early studies on information seeking behavior tended to focus on professionals; however, in later years there has been an increase in studies on the information seeking behavior of everyday users.¹¹

Studies have been conducted, both in North America and China, to learn about the needs of Chinese student researchers and their perceptions and use of libraries and the Internet. Xiaoying Dong studied the use and usefulness of the Internet through a

questionnaire administered in Chinese academic libraries.¹² A Canadian study conducted by Guoying Liu and Danielle Winn used in-depth interviews to explore Chinese graduate students' perceptions and expectations of academic library services at the University of Windsor.¹³

An extensive search of the mainland Chinese core information science journals reveals more than 90 articles published in the past 10 years that focus on the information seeking behavior of university-level Chinese users. A study by Hu Changping et al. explored the information seeking behaviors of researchers in higher education, both on the Internet and in the library. Using surveys, the authors found that 58% of respondents used mainly library resources supplemented with online search engines, and 42% of respondents used the opposite search process (mainly search engines supplemented with library resources).¹⁴

Tao Fanglin's study looked at university teachers and their information seeking behavior. The study found that 68% of university teachers' first choice for an information search was an online search.¹⁵ Research by Li Fengqing and Li Laisheng echo Tao's findings, which also found that 67% of faculty used electronic journals and 45% used electronic books in their information seeking tasks.¹⁶ It is interesting to note the increased preference for web-based searching in both the Tao study and Li and Li study, as compared to the Hu et al. study published just two years earlier.

A handful of articles that focus on college students and information seeking behaviors have been published in China.¹⁷ Wang Yiming studied the research behaviors of Beijing college students writing their dissertations. The study found that students spent 46.5% of their total research time focused on electronic sources.¹⁸ Similarly, Zhai Yanxiang et al.'s investigation found that over 50% of students used the Internet as their primary resource for finding information.¹⁹ Chen Jiewei's research found that more and more library users were using digital resources during their information seeking task and users were focused more on information that is innovative, accurate and systematic.²⁰

A counterpoint to Wang's and Zhai et al.'s investigations is Zhang Caoxia and Zhang Weiyi's study of the information seeking and retrieval behavior of medical school students at Suzhou University. Eighty percent of students who did use the Internet for research responded that they solely relied on public websites; only 11% of students used university-subscribed research databases.²¹

Ren Qixiang and Wang Yanni used a survey to investigate university students' online information seeking behaviors. They found that the primary factors affecting students' choice of search tool was convenience and efficiency of the search engine, and the quantity of information available. When extracting the most useful results, credibility and the academic value of the information were critical.²²

Tong Yanrong and Song Pengbo surveyed 600 Chinese university students to explore online information seeking behaviors in three areas: general Internet use, use of electronic library resources, and use of search engines for finding information. The

questionnaire uncovered that the majority of students find academic information primarily from the library's print collection. 65% of students use Internet search engines and 51% use professional websites. Only 3% of students indicated familiarity with the library's electronic resources. The popular Chinese search engine, Baidu, was preferred by 96% of students. When searching, 80% of students used keywords; however, 40% of students indicated they might also type in an entire sentence or phrase when searching. After an unsuccessful search attempt, 96% of students restart their search with new keywords. Few students showed competency improving a search strategy by combining search terms or choosing advanced searching options. Many students indicated that they would change search engines or add more keywords instead of refining an existing search strategy. It is interesting to note that all students reported that learning search methods and skills is necessary to have a successful online retrieval experience.²³

Guo Liwei surveyed the information behaviors of graduate students. Although Guo found the majority of students were able to describe their information needs, only 10% of respondents were willing to ask for help from an information specialist if their attempts were unsuccessful. The remainder of respondents either gave up the task or just randomly searched the internet without a plan. Guo's research also found that about 32% of the surveyed graduate students preferred to rely solely on electronic resources. 14.4% of the students only utilized print sources, while the remaining 53.6% were willing to consult either print or electronic sources, depending on their needs. When choosing where to search for information most students use library databases (88.41%) and web search engines (78.26%). Approximately one third of students (34.78%) use only websites they are familiar with, and over 20% (21.74%) preferred to rely on websites recommended by others.²⁴

A limited number of articles in the Chinese academic press use verbal protocol analysis to study information seeking behavior. In 1992, Wang Su and Wang Ansheng first presented verbal protocol analysis as a methodology to the Chinese audience in their book *Renzhi xinlixue* 认知心理学 [Cognitive Psychology].²⁵ Later articles provided more detail on verbal protocol analysis across several Chinese fields of study.²⁶ This study is the first to utilize verbal protocol analysis in the area of information seeking behavior in China. Existing studies are concerned mainly with uncovering the particulars of student use of the Internet, but do not explore information-seeking strategies or decisions in detail. Studies that collect qualitative data illuminating the decisions Chinese students make when they search online will become increasingly important as the Internet in China, as the research has shown the Internet has developed into the most important resource for academic research. This study is unique, as the information seeking behavior of Chinese university students' utilizing verbal protocol analysis has not been investigated to date.

Outside of China, verbal protocol analysis methodologies are emerging as a qualitative research technique applied in the investigation of information-seeking behaviors in academic environments. Jennifer L. Branch collected over 140 verbal protocols in her study of the information seeking processes of junior high students as they accessed information using CD-ROM encyclopedias.²⁷ Using the same methodology, Tamal Kumar

Guha and Veena Saraf learned about users' satisfaction and dissatisfaction with an online library catalog.²⁸ Maaïke van den Haak, Menno De Jong and Peter Jan Schellens also tested the usability of an online library catalog through a comparison of concurrent and retrospective methods of verbal protocol analysis.²⁹

3. Method

3.1 Site

Liaoning University in Shenyang, Liaoning Province, People's Republic of China was the site for this project. Liaoning University is a multidisciplinary university with 25 colleges offering undergraduate and graduate degrees. As a Project 211* University, it is one of approximately one hundred universities participating in a government initiative to strengthen the quality of education, scientific research, management and institutional efficiency. Liaoning University has a teaching faculty of over 1,360 and a student body of over 27,000. This pilot project took place over a two week period toward the end of the 2011 spring semester.

3.2 Participants

Three test administrators, current students or recent graduates of the Master's program in English at Liaoning University, were trained in conducting verbal protocol analysis sessions. The test administrators were given the responsibility of preparing participant transcripts, as well as the English translations of the transcripts. As remuneration the test administrators were given 1,000 RMB (about \$150.00 USD) at the conclusion of the project.

Study participants were selected using the nonprobability judgment sampling method. One department was selected from each of the three major divisions at Liaoning University: social sciences (business), science, and the humanities (English). A call was sent out to the three departments asking for student volunteers, and from this pool 15 students were chosen as participants.

English majors at Liaoning University spend the first two years focusing on basic language skills, listening, speaking, reading and writing. In their junior year students begin to write research papers; however, students do not receive instruction or training on locating information or evaluating the found information. Business majors enrolled at the International Business School at Liaoning University participate in the 2+2 program. This program is a partnership with a university in Great Britain. The curriculum is designed by the British university and professors from the British university teach a

* Project 211 is a Chinese government project to strengthen selected institutions of higher education and key disciplinary areas as a national priority for the 21st century.

minimum of two weeks at Liaoning University each semester. Program instruction includes research methods and research paper construction during the freshman year. At the time of this study, the science students had begun work on their Master's theses and displayed greater familiarity with finding and evaluating academic content.

Human subject approval was not necessary at Liaoning University for this project, as no personal information beyond age, gender, major, class, and searching level was collected during the research sessions.

3.3 Procedures

Participants were given a question (a researcher-defined task) requiring them to perform a search for an appropriate article. After locating an article, participants were asked to record the article citation. Sessions were conducted in Chinese. The English majors were asked to find a review of the novel *Five Spice Street*. The science majors were asked to find an article about sustainability and green technology. The business majors were asked to choose a major Chinese company and find an article discussing the company's market strategy. Each session was audio recorded and lasted between 15 and 30 minutes. At the beginning of each individual session the test administrators explained the purpose of the study and outlined the specific process involved with collecting a concurrent verbal protocol. Participants received an Arizona State University T-shirt upon completion of the verbal protocol session.

The data collected was gleaned entirely from the verbal protocol transcripts. While participants did access the library's web page, they used it only as a place from which they could link to other databases. They did not use the library's online system. Participants also went directly to Baidu or Google.

3.4 Verbal Protocol Analysis Method

Verbal protocol analysis requires participants to verbalize their thoughts aloud while performing a task or a set of tasks. Statements are usually recorded or transcribed for analysis. The basic assumption of this method is that when people "think aloud" while performing a task, the verbal stream functions effectively as a "dump" of the contents of working memory.³⁰ According to this view, the verbal stream can be taken as a reflection of the cognitive processes in use. Verbal protocols reveal information about the process by which decisions are made that might be overlooked through other data collection methods. Concurrent protocols are collected at the same time the participant performs the task. They are uninterrupted, unprompted verbal streams produced by the participant. Retrospective protocols are provided after the task has been completed in response to specific questions. For example, questions such as "How did you solve this problem?" and "Where did you go to find the information you needed?" will produce retrospective verbal protocols.

Verbal protocol analysis allows for a verbalization of the decision-making process without an alteration of the sequence of thoughts, and can therefore be accepted as valid data on decisions and behaviors. Based on their theoretical analysis, K. Anders Ericsson and Herbert A. Simon argued that the closest connection between thinking and verbal reports is found when subjects verbalize thoughts generated during task completion.³¹ When subjects are asked to think aloud, they vocalize “inner speech,” which would otherwise have remained inaudible. The goal is for subjects to express out loud the thoughts that occur to them naturally.

In a comprehensive review of dozens of studies, Ericsson and Simon found no evidence that the sequences of thoughts (accuracy of performance) were changed when subjects thought aloud as they completed the tasks when compared to subjects who completed the same tasks silently.³² However, some studies showed that when a verbal protocol is generated simultaneous to task performance, the act of verbalizing thoughts may slow down the cognitive processes slightly.

As is the case with most research methods, verbal protocol analysis has both advantages and limitations. Obviously, subjects can verbalize only thoughts and processes about which they are consciously aware. Thus, processes that are automatic and executed outside of conscious awareness are not likely to be included in verbal protocols, and other means of assessing such processes must be used. Also, nonverbal knowledge is not likely to be reported. Another limitation of the verbal protocol analysis methodology is that it is very labor intensive. Verbal protocol data is considered “expensive” data. The collection and coding of the protocols is extremely time-consuming as compared with other methodologies. However, the potential value of the information that can be acquired about the contents of working memory during task performance is arguably worth the time required.

3.5 Analysis Methods

The following data was collected from the verbal protocols and test administrator notes: time to complete task, number of queries, participant age, participant major, participant class, participant gender. Lastly, the participant’s success in completing the task (successful, partially successful, or unsuccessful) was recorded. The sample size (15 participants) was too small to provide any meaningful statistical analysis, therefore, only descriptive tables are provided in Section 4 of this article.

The analysis of the cognitive search strategies from the participants’ verbal protocols followed the categories devised by Andrew Thatcher’s investigation of information seeking behaviors on the Internet.³³ Thatcher based his categories on the work of Gary Marchionini and Raya Fidel et al.³⁴ Marchionini explained that searching for information can be broken into five areas: initiating the task, developing search terms, sustaining the search, terminating the search, and unusual behaviors. Thatcher modified this model to be “represented in four steps: initiation, search terms (formulating query and examining results), sustaining, and terminating.”³⁵ Within these four steps, Thatcher identified several cognitive search strategies.

1. Safe Player strategies according to Thatcher are those where the searchers stay in search environments familiar to them. Thatcher describes four Safe Player strategies:
 - a. **Broad first** where “participants would first search using one or more general search terms defined by the search task” before moving to more precise search terms when the broad terms failed to produce an acceptable result.³⁶
 - b. **Search engine narrowing down** where searchers select “a search engine based on the known or perceived attributes of the search engine or chose the subject categories on a search engine that would assist in narrowing the search domain” .³⁷
 - c. In the **search engine player strategy** searchers “used different search engines to search different portions of the Web with the same search terms based on the known, or perceived, capabilities of different search engines or would use meta-search engines to achieve the same goal”.³⁸
 - d. **Known address search domain** where searchers go to a web site they were familiar with and that could be used as a portal or starting point for the search, rather than a search engine.
2. **Parallel Player strategy** searchers open “multiple browser windows”³⁹ and simultaneously “conduct different searches” ⁴⁰ using different search strategies in each browser.
3. Searchers using the **link-dependent strategy** rely “on hyperlinks from the homepage to move from one webpage to another”.⁴¹
4. In the **to-the-point strategy** searchers “first used quite specific search terms with the intention of getting directly to the answer”.⁴²
5. **Known address strategy** is where searchers go directly to a web site they have experience where they feel they are likely to find the results required.
6. The **sequential player strategy** “is a combination of the “safe player” and “to-the-point” strategies.
7. In the **deductive reasoning strategy** searchers “reason through the task, based on their own conceptualization of the problem domain”.⁴³
8. **Virtual tourist strategy** is one where the searcher follows a “predetermined set of links”⁴⁴ in order to solve the information task.
9. In the **parallel hub-and-spoke strategy** searchers instead of returning to the results pages of a search engine would open up each search result in a new browser window”.⁴⁵

Andrew Thatcher in his research (which used researcher-defined tasks) found that more experienced searchers “were more likely to use “Parallel player” and “parallel hub-and-spoke” strategies and to a lesser extent, the “Known address search domain and Known address strategies”.⁴⁶ However, he found the less experienced searchers “were more likely to use strategies that involved less cognitive effort such as the “Virtual tourist”, Link-dependent”, “To-the-point”, “Sequential player”, Search engine narrowing”, and “Broad first” strategies”.⁴⁷

4. Results and Discussion

4.1 Descriptive Data

Table 1 presents the demographic information for the each group of participants.

Table 1
Demographic Information Summary

	N	% of Total
Group ¹		
Business/Freshmen	5	
English/Juniors	5	
Science/Grad Students	5	
Age		
19-20	5	33
21-24	7	47
25	3	20
Gender		
Female	11	73
Male	4	27

¹ In this study all freshmen are Business majors, all juniors are English majors, and all grad students are Science majors, therefore the class and major data have been combined.

The time to complete task, number of queries, and success in completing the task are illustrated in Table 2 below.

Table 2
Time, Queries, Searching Level, and Success Summary

Participant	Time	Queries	Level	Task Completion
Business 1	13	5	Intermediate	Successful

2	10	6	Intermediate	Successful
3	6	3	Beginning	Unsuccessful
4	9	4	Intermediate	Unsuccessful
5	9	3	Beginning	Unsuccessful
Average	9.4	4.2		
English				
1	10	9	Beginning	Successful
2	10	3	Intermediate	Unsuccessful
3	7	3	Beginning	Unsuccessful
4	10	7	Intermediate	Unsuccessful
5	13	4	Beginning	Successful
Average	10	5.2		
Science				
1	9	4	Intermediate	Unsuccessful
2	5	4	Intermediate	Successful
3	7	4	Intermediate	Successful
4	7	4	Beginning	Successful
5	9	2	Intermediate	Successful
Average	7.4	3.6		

Though there can be no statistical analysis of the data in Tables 1 and 2 because of the sample size, several interesting observations can be made from the data. The results from the Science Group showed the fastest completion time (7.4) and the fewest queries (3.6), and also turned in the greatest number of successful task completions (4 out of 5). Six of the participants identified themselves as having only a beginning level of search experience, and 9 participants identified themselves as intermediate searchers. None of the participants identified themselves as advanced searchers. This may be more a reflection of the participants' reluctance to classify themselves as advanced users, rather than a real skill level assessment.

4.2 Verbal Protocol Analysis.

The primary goal of this research, as defined by the research question, is to determine the dominant information seeking behaviors of Chinese university students when using the Internet to answer a researcher defined task. The analysis of the verbal protocol transcripts revealed several themes.

One of the initial themes discovered during the analysis phase was that over half the participants in this study (eight out of 15) used the *To-the-Point* strategy as their first strategy. According to Thatcher, information-seekers using the *To-the-Point* strategy use specific search terms (exact words or phrases) in their favorite search engine. "[T]heir intention was to get directly to the answer straight away."⁴⁸ They do not begin their

search with broad terms and then narrow them down. Selecting their favorite search engine (most often Baidu), these participants entered the exact phrase asked by the test administrator. An example of this strategy is Business 2 who commented when given the task question:

I type in keywords “company’s market strategy for the future.”

Notice that Business 2 did not input a series of keywords but instead transposed the exact question phrase. After unsatisfactory results, Business 2 tried the following:

I’d like to switch keywords to “a research article of Chinese company” so that I can find some academic articles.

Once again the participant used the *To-the-Point* strategy and input an exact phrase. However, not all participants who began their information task with the *To-the-Point* strategy continued with the strategy after unsuccessful searches. Many participants in this study changed strategies, moving to one of the *Safe Player* strategies.

According to Thatcher, *Safe Player* strategies are centered on the participant’s intention to “remain within a safe or familiar search environment, and not to wander too far into ‘unknown’ search territory.”⁴⁹ One of the most-used *Safe Player* strategies in this study was the *Search Engine Player* strategy where the information-seeker uses different search engines based on their attributes (real and perceived) using the same search terms. “They would use different search engines depending on whether the capabilities of a search engine matched the particular search task.”⁵⁰ If the initial search engine choice resulted in an unsuccessful return, then the information-seeker changes search engines rather than revise the original search terms. Science 1 began searching in Google. After realizing that a research article was required, Science 1 commented:

...we use Google because we can find a wide range of information ... in our university we normally go to CNKI[†] to find research articles.

Science 1 did not change the search terms when he/she decided to try the scholarly CNKI database. Science 1 continues:

Here, uh, if you are not skillful in searching for information at CNKI, you can, like me and my classmates, we would first use Google or Baidu.

Science 4’s comments further illustrate the rationale for using the *Search Engine Player* strategy:

If I want to search for some non-academic articles, I’ll use Baidu. If I want an academic paper, I’ll use the electronic library of our university.

[†] CNKI stands for China National Knowledge Infrastructure

The participants did not change the search terms but moved from one search engine to another based on their assumptions about the search engine's capabilities and the information it retrieves.

Another *Safe Player* strategy used quite often by participants in this study was the *Known Address Search Domain* strategy. Information-seekers using this strategy go directly to a known website to begin their search. The webpage is "selected because it defined a known search domain or contained links to webpages that may have had the answer."⁵¹ In this study participants most often use the Liaoning University Library's homepage as a portal to link to databases, especially the CNKI database; however, most did not know the URL of the Library homepage and had to use a search engine to find the URL. Users of this strategy did not expect "to find the answer, but rather the point from which they intended to embark on their search task."⁵² Some participants were familiar with the databases available on the Liaoning University Library homepage. For example, Science 5 commented:

Generally speaking, if we are hunting for some documents, I will go to the Liaoning Library website.

The *Broad First Safe Player* strategy used by the group (Science) was the most successful in completing the task correctly. In this strategy, the information-seeker selects a search engine they are familiar with, and uses search terms that are relevant to their task but still "broad enough to obtain a wide range of search results."⁵³ This group did thoughtfully consider which key words to use, as evidenced by Science 2's comments:

I'd like to start from two key words sustainability and green technology. A question occurs to me immediately, namely, what are the general ideas of the two key words?

Science 5 provided a road map for this strategy by commenting after the verbal protocol session:

First I make the requirements clear, then I decide the specific measures of my search. I begin searching the Internet in a wide range then I select a narrow range out from the wide range.

A few participants used the *Search Engine Narrowing Down Safe Player* strategy. In this strategy participants select a "search engine based on known (or suspected) attributes of the search engine,"⁵⁴ thus narrowing their search without leaving their comfort zone. The difference between the *Search Engine Player* strategy and this strategy is that users "choose a search engine category to narrow the search."⁵⁵ For example, English 2 began his/her search in Baidu but decided:

I am ready to alter the searching mode. I'd like to go to CNKI

English 2 moved from a general search engine to a much narrower search engine thus narrowing his/her search without altering the search terms.

The *Link-Dependent* strategy was rarely used by the participants in this study. Information-seekers employing the *Link Dependent* strategy use homepage links to find information about the task because they are uncertain about using search engines. According to Thatcher the intention is either to use “links from the homepage in searching for information on the particular”⁵⁶ or “they were unfamiliar with search engines and felt more comfortable using links.”⁵⁷ For example, after several failed keyword searches in Baidu, English 1 tried the link to the:

“Baidu Encyclopedia, I hope I can find some information about this book.”

This approach was not successful. Instead of attempting a keyword search, the participant then decides:

...let's go to Baidu Knows[‡] and see if there are some comments about the book.

This strategy also proved unsuccessful. Next, the participant used Baidu to find several blogs. After viewing several blogs without successful results, English 1 found something in a blog which they decided completed the task. English 1 did try both Baidu and Google but quickly moved away from using search engines and felt more comfortable using the *Link-Dependent* strategy then rethinking his/her search terms.

A few participants used the *Sequential Player* strategy which combines one or more *Safe Player* strategies (*Broad First*, *Search Engine Narrowing Down*, *Search Engine* or *Known Address*) and *To-the-Point* strategy. They move rapidly between two strategies going from general search terms to exact phrases or vice versa during their information-seeking task. For example, Business 1 commented:

I will input “information on the company’s market strategy in the future”, then eh, I will input, eh, first I enter the keywords, then I will define the range and input “Chinese company”, and click “search.”

Once Business 1 realized that the exact phrase was not going to provide the results necessary to complete the task, he/she decided to reduce the search terms:

I will reduce the number of the keywords because I find it is hard to search when typing in all the keywords.

In this case, the revised search strategy increased the number of possible results, and was in fact a *Broad First* strategy. The participant moved from the *To-the-Point* strategy to the

[‡]Baidu Knows is similar to (but not entirely like) Ask.com where one can ask a question and other users will answer.

Broad First Safe Player strategy by going from exact words or phrases to general search terms.

Two strategies identified by Thatcher were not used by participants in this study: the *Parallel Player* strategy or the *Deductive Reasoning* strategy.

5. Limitations

Because the sample size is small, (15) it is not possible to generalize the findings of this study. The verbal protocol analysis sessions were conducted in Chinese, and then translated by the test administrators into English. The possibility of incorrectly translated verbal protocols transcripts has been mitigated by the participation in this study by Ms. Wang, a graduate level English instructor at Liaoning University. Ms. Wang carefully reviewed the transcripts before the results were analyzed. In addition, examples cited in this article were reviewed again by Ms. Wang to ensure that the translation was correct.

Verbal protocol analysis as a data collection methodology has had critics. One criticism put forth by Alison Green is that the methodology requires a large amount of time to analyze the verbal data.⁵⁸ This is perhaps less a criticism, than a warning for researchers to be aware of the time it takes to scrutinize verbal protocol data. Peter Samgorinsky observed that many critics of the methodology are concerned that “the act of talking while performing a given task might alter the process from the way it would naturally occur.”⁵⁹ However, Mark C. Fox et al.’s meta-analysis of verbal reporting studies supports Ericsson and Simon contention that verbalization does not affect task performance during a verbal protocol session.⁶⁰ Another concern of critics is that “[p]rotocols invariably include moments of silence, in which the subject struggles with a thought...”⁶¹ Samgorinsky reports that Ericsson and Simon suggested that even gaps provide additional information about the thought processes of the subject during the verbal protocol session.⁶²

A wide variety of studies have replied to these criticisms. In their meta-analysis of verbal reporting studies, March C. Fox et al. report “that think-aloud is a legitimate and practical method of collecting information on thought processes. Although the think-aloud procedure has limits and does not assure a complete record of participants’ thoughts, it is at present the only nonreactive method of collecting the verbalized contents of thoughts while participants focus on completing challenging tasks.”⁶³

6. Conclusions

The original research question asked was: What are the information seeking strategies of Chinese university students using the Internet in a researcher-defined task? As we progressed through the protocol analysis it became apparent that a dominant information seeking behavior demonstrated by Chinese university students did not exist. Instead, we identified several strategies that participants employed during a research

task. Rarely did a participant stay with one strategy, but tended to move quite quickly from one strategy to another supporting both Andrew Thatcher and Raya Fidel, et al.'s observations that information-seekers often revise their search strategy as they progress through a task.⁶⁴ Thatcher continues: "In fact, some participants changed their search strategy as many as three times for one task."⁶⁷ In this study twelve of the 15 participants changed their strategy at least once. Of these twelve participants, seven changed search strategies two times, and five changed search strategies three times. Our evidence supports the theory that information seekers change their behavior, sometimes more than once, during an information seeking session.

The authors recognize that, as a foundational study, it is not possible to generalize the findings of this study to all university students in China. Regardless, there are many applications for future explorations as the results do contain insights into the information-seeking behaviors of Chinese university students using the Internet. Those who are interested in cross-cultural studies may find useful information in this study. Teachers, librarians, and others who provide instruction in the use of electronic research tools may find the findings useful as they develop curriculum introducing students to the online environment. Lastly, website and interface designers, and search engine developers may gain a more nuanced view of the commonalities in information-seeking behaviors of university-level researchers.

Notes

- 1 "Statistical Report on Internet Development in China" China Internet Network Information Center. January 2014.
<http://www1.cnnic.cn/IDR/ReportDownloads/201404/U020140417607531610855.pdf>
- 2 Peter Ingwersen and Kalervo Jarvelin, *The Turn: Integration of Information Seeking and Retrieval in Context*, Berlin, Germany: Springer 2005, 21.
- 3 Ina Fourie, "Learning from the Web Information Seeking Studies: Some Suggestions for LIS Practitioners," *The Electronic Library* 24, no. 1 (2006): 20.
- 4 For research on searcher experience or expertise see: Andrew Thatcher, "Web Search Strategies: The Influence of Web Experience and Task Type," *Information Processing and Management* 44, no 3 (2008): 1308-1329. doi:10.1016/j.ipm.2007.09.004; and Ard W. Lazonder, Harm J.A. Biemans and Iwan G.J.H. Wopereis, "Differences Between Novice and Experienced Users in Searching Information on the World Wide Web," *Journal of the American Society for Information Science and Technology* 51, no. 6 (2000):576-581 doi: 10.1002/(SICI)1097-4571(2000)51:6<576::AID-ASI9>3.0.CO;2-7. For research on personality types and learning styles see: Jannica Heinström, "The Impact of Personality and Approaches to Learning on Information Behavior," *Information Research* 5, no. 3 (2000) retrieved 6/3/2011 from <http://informationr.net/ir/5-3/paper78.html> and Nigel Ford, David Miller and Nicola Moss, "Web Search Strategies and Approaches to Studying," *Journal of the American Society for Information Science and Technology* 54, no. 6 (2003): 473-489. For research on cultural differences see: Anita Komlodi and Michael Carlin, "Identifying Cultural Variables in Information-seeking," *Proceedings of the Tenth Americas Conference on Information Systems*. New York: New York, August (2004): 1-6; Wingyan Chung et al., "Internet Searching and Browsing in a Multilingual World: An Experiment on the Chinese Business Intelligence Portal (CBizPort)," *Journal of the American Society for Information Science and Technology* 55, no. 9 (2003): 818-831; and Xiaoying Dong, "Searching Information and Evaluation of Internet: A Chinese Academic User Survey," *The International Information & Library Review* 35, no. 2-4 (2003): 163-187.
- 5 Andrew Thatcher, "Information-seeking Behaviours and Cognitive Search Strategies in Different Search Tasks on the WWW," *International Journal of Industrial Ergonomics* 36, no. 12 (2006): 1055-1068. doi: 10.1016/j.ergon.2006.09.012 and Andrew Thatcher, "Web Search Strategies: The Influence of Web Experience and Task Type," *Information Processing and Management* 44, no 3 (2008): 1308-1329. doi:10.1016/j.ipm.2007.09.004.
- 6 Donald O. Case, *Looking for Information: A Survey of Research on Information Seeking, Needs, and Behavior*, 2nd ed., New York: Elsevier, 2003, 242.

7 For research on health information seeking behaviors see: Abbey R. Roach et al., "Differences in Cancer Information-seeking Behavior, Preferences, and Awareness Between Cancer Survivors and Healthy Controls: A National, Population-based Survey," *Journal of Cancer Education* 24, no. 1 (2009): 73-79. doi: 10.1080/08858190802664784; and Tana M. Luger, Thomas K. Houston, "Older Adult Experience of Online Diagnosing: Results from a Scenario-Based Think Aloud Protocol", *Journal of Medical Internet Research* 16, no.1 (2014):e16 doi:10.2196/jmir.2924. For research on online purchasing decisions see: Alex M. Susskind and Michael A. Stefanone, "Internet Apprehensiveness: An Examination of On-line Information Seeking and Purchasing Behavior," *Journal of Hospitality and Tourism Technology* 1, no. 1 (2010): 5-29. doi: 10.1108/17579881011022990. For research on habits of academic and students researchers see: C. Carol Tenopi et al., "Academic Users' Interaction with ScienceDirect in Search Tasks: Affective and Cognitive Behaviors," *Information Processing & Management* 44, no. 1 (2008): 105-121. doi: 10.1016/j.ipm.2006.10.007; Niu Xi et al., "National Study of Information Seeking Behavior of Academic Researchers in the United States," *Journal of the American Society for Information Science and Technology* 61, no. 5 (2010): 869-890 doi: 10.1002/asi.21307; and Hamid R. Jamali and David Nicholas. "Interdisciplinary and the Information-seeking Behavior of Scientists," *Information Processing and Management* 46, (2010): 233-243. For research on information seeking behaviors in developing countries see: Renee Dutta, "Information Needs and Information-seeking Behavior in Developing Countries: A Review of the Research," *The International Information and Library Review* 41, (2009): 44-51; Heidar Mokhtari, "A Quantitative Survey on the Influence of Students' Epistemic Beliefs on Their General Information Seeking Behavior", *The Journal of Academic Librarianship* 40, no. 3-4 (2014): 259-263. Doi: 10.1016/j.acalib.2014.04.001; and Yin Cui, Lucy Gongtao Chen, Jian Chen, Srinagesh Gavirnent, and Qi Wang, "Chinese perspective on newsvendor bias: An exploratory note", *Journal of Operations Management* 31 (2013): 93-97 doi:10.16/j.jom.2012.10.001.

8 Heidi Julien, Jen (J.L.) Pecoskie, and Kathleen Reed, "Trends in Information Behavior Research, 1999-2008: A Content Analysis," *Library & Information Science Research* 33, no. 1 (2010): 19-24. doi:10.106/j.list.2010.07.014

9 Heidi Julien, "A Content Analysis of the Recent Information Needs and Uses Literature," *Library & Information Science Research* 18, no. 1 (1996): 53-65. doi: 10.1016/S0740-8188(96)90030-4 and Heidi Julien and Lawrence J. Duggan, "A Longitudinal Analysis of Information Needs and Uses Literature," *Library & Information Science Research* 22, no. 3 (2000): 291-309. doi: 10.1016/S0740-8188(99)00057-2.

10 Heidi Julien, Jen (J.L.) Pecoskie, and Kathleen Reed, 20.

11 Pertti Vakkari, "Trends and Approaches in Formation Behavior Research," *Information Research* 13, no. 4 (2008) retrieved 6/3/2011 from <http://informationr.net/ir/13-4/paper361.html>.

12 Xiaoying Dong, "Searching Information and Evaluation of Internet: A Chinese Academic User Survey," *The International Information & Library Review* 35, no. 2-4 (2003): 163-187.

13 Guoying Liu and Danielle Winn, "Chinese Graduate Students and the Canadian Academic Library: A User Study at the University of Windsor," *The Journal of Academic Librarianship* 35, no. 6 (November 2009): 565-573. doi: 10.1016/j.acalib.2009.08.001.

14 Hu Changping 胡昌平, He Na 贺娜 and Zhang Junla 张俊娜, "Wang luo huan jing xia gao xiao key an ren yuan xin xi cha xun xing wei de diao cha yu fen xi" 网络环境下高校科研人员信息查询行为的调查与分析 (Investigation and Analysis of the Information Seeking Behaviors of the Researchers in Higher Education in the Network Environment), *Qing bao li lun yu shi jian* 情报理论与实践 [Information Studies: Theory & Application] 31, no. 2 (2008): 223-224.

15 Tao Fanglin 陶方林, "Gao xiao jiao shi xin xi cha xun xing wei de gong xing yu mo xing" 高校教师信息查询行为的共性与模型 (The Similarities and Models of University Teachers' Information Seeking Behavior), *Da xue tu shu qing bao xue kan* 大学图书情报学刊 [Journal of Academic Library and Information Science] 28, no. 5 (2010): 50-53.

16 Li Fengqing 李逢庆 and Li Laisheng 李来胜, "Yan jiu xing da xue jiao shi xue shu xin xi xing wei diao cha yu fen xi" 研究型大学教师学术信息行为调查与分析 (Academic Information Behavior Investigation and Analysis of Research University Faculty), *Xian dai jiao yu ji shu* 现代教育技术 [Modern Education Technology] 22, no. 4 (2012): 5-8.

17 Long Fengjiao 龙凤姣 and Zhou Pei 周佩, "Gao xiao tu shu guan yong hu qun xin xi xing wei diao cha fen xi" 高校图书馆用户群信息行为调查分析 (Investigation and Analysis on the Information Behavior of College Library Users), *Tu shu guan xue kan* 图书馆学刊 [Journal of Library Science] 35, no. 10 (2013): 126-130.; and Ban Junfeng 班俊峰, "Duo xiao qu du zhe de xin xi xing wei bi jiao yan jiu: yi Guangdong yao xue yuan wei li" 多校区读者的信息行为比较研究--以广东药学院为例 (Comparative Research on the Information Behavior of the Multi-campus University Users—A Case Study of Guangdong Pharmaceutical University), *Shu zi tu shu guan lun tan* 数字图书馆论坛 [Digital Library Forum] 2, no. 117 (2014): 54-58.

18 Wang Yiming 王益明, "Beijing shi gao xiao xue sheng wan cheng lun wen qi jian de hu lian wang xin xi cha xun xing wei yan jiu" 北京市高校学生完成论文期间的互联网信息查询行为研究 (The Study on the Internet Information Seeking Behavior of the College Students in Beijing during Their Dissertation and Theses Writing Period), *Shu zi tu shu guan lun tan* 数字图书馆论坛 [Digital Library Forum] 30, no. 11 (2006): 1-11.

19 Zhai Yanxiang 翟延祥, Jin Minghua 金明华 and Yang Lin 杨琳, “90 hou da xue sheng de wang luo xin xi xing wei yan jiu: yi Nanjing hang kong hang tian da xue wei li” 90后大学生的网络信息行为研究—以南京航空航天大学为例 (Research on the Network Information Behaviors of University Students Born after 90s—Taking Nanjing University of Aeronautics and Astronautics as the Example), *Ke ji qing bao kai fa yu jing ji* 科技情报开发与经济 [Sci-tech Information Development & Economy] 20, no. 1 (2010): 180-183.

20 Chen Jiwei 陈洁薇, “Gao xiao tu shu guan du zhe xin xi xing wei xin dong Xiang tan tao” 高校图书馆读者信息行为新动向探讨 (Exploration of the New Trend of the Information Behavior of College Library Users), *Sichuan tu shu guan xue bao* 四川图书馆学报 [Journal of the Library Science of Sichuan] 1, no. 179 (2011): 84-87.

21 Zhang Chaoxia 张朝霞 and Zhang Weiyi 张维毅. “Yi xue sheng wang luo huo qu li yong diao cha fen xi” 医学生网络信息获取利用调查分析 (Investigation and Research on the Information Seeking and Retrieval Behavior of Medical School Students), *Yi xue xin xi* 医学信息 [Medical Information] 20, no. 4 (2007): 575-578.

22 Ren Qixiang 任其翔 and Wang Yanni 王艳妮. “Da xue sheng wang luo xin xi xing wei diao cha: yi Wuhan da xue wei li.” 大学生网络信息行为调查—以武汉大学为例 (Investigation on the On-line Information Searching Behaviors of University Students—Taking Wuhan University as an Example), *Ke ji qing bao kai fa yu jing ji* 科技情报开发与经济 [Sci-tech Information Development & Economy] 20, no. 21 (2010): 17-19.

23 Tong Yanrong 童艳荣 and Song Pengbo 宋蓬勃, “Da xue sheng wang luo xue xi zi yuan li yong xian zhuang de diao cha yu fen xi” 大学生网络学习资源利用现状的调查与分析 (Investigation and Analysis on the On-line Academic Information Retrieval Behaviors of University Students), *Shandong sheng qing nian guan li guan bu xue yuan xue bao* 山东省青年管理干部学院学报 [Journal of Shandong Youth Administrative Cadres College] 5, no. 147 (2010): 49-51.

24 Guo Liwei 郭利伟, “Wang luo huan jing xia pu tong gong ke yuan xiao yan jiu sheng xin xi xing wei diao cha yan jiu: yi Xi'an ke ji da xue wei li” 网络环境下普通工科院校研究生信息行为调查研究--以西安科技大学为例 (Research on the Information Behaviors of the Graduate Students in Engineering Colleges and Universities under Network Environment—A Case Study of Xi'an University of Science and Technology), *Ke ji qing bao kai fa yu jing ji* 科技情报开发与经济 [Sci-Tech Information Development & Economy] 23, no. 9 (2013): 130-135.

25 Wang Su 王甦 and Wang Ansheng 汪安圣, *Ren zhi xi li xue* 认知心理学 [Cognitive Psychology], Beijing: Beijing daxue chubanshe, 1992.

26 For research on verbal protocol methodology see: Li Yifei 李亦菲 and Zhu Xinming 朱新明, "Yi zhong tong yong de kou yu bao gao bian ma fang an" 一种通用的口语报告编码方案 (A Common Code Scheme of Verbal Protocol Analysis), *Xin li xue dong tai* 心理学动态 [Journal of Developments in Psychology] 6, no. 4 (1998): 47-51.; Li Yifei 李亦菲 and Zhu Xinming 朱新明, "Qian yi yan jiu zhong de shi yan she ji, qian yi liang ji suan yu kou yu bao gao fen xi" 迁移研究中的实验设计, 迁移量计算与口语报告分析 (Experiment Design, Calculation of Translocation Amount and Verbal Protocol Analysis in the Research on Translocation), *Xin li ke xue* 心理科学 [Psychological Science] 24, No. 1 (2001): 98-99.; Li Feifei 李菲菲 and Liu Dianzhi 刘电芝, "Kou yu bao gao fa ji qi ying yong yan jiu ping shu" 口语报告法及其应用研究评述 (Reviews on the Technique of Verbal Protocol Analysis and its Applications), *Shanghai jiao yu ke yan* 上海教育科研 [Shanghai Research on Education] 1 (2005): 39-41, 44.; Li Xian 李贤 and Yu Jiayuan 余嘉元. "Guo nei wai xue zhe shi jiao zhong de kou yu bao gao fang fa" 国内外学者视角中的口语报告方法 (The Reviews of Verbal Protocol Analysis of Domestic and Foreign Scholars), *Suzhou da xue xue bao (Zhe xue she hui ke xue ban)* 苏州大学学报 (哲学社会科学版) [Academic Journal of Suzhou University (Philosophy and Social Science)] 1, no. 1 (2006): 119-121.; and Jian Jiajun 蹇佳君 and Zhang Wenpeng 张文鹏, "Kou yu bao gao fa de fen lei ji qi zai yu yan ren zhi yan jiu zhong de ying yong" 口语报告法的分类及其在语言认知研究中的应用 (Classification of Verbal Protocol Analysis and its Application in Cognitive Studies), *Dian zi ke ji da xue xue bao* 电子科技大学学报 [Journal of Electronic Science and Technology] 12, no. 2 (2010): 50-53.

27 Jennifer L. Branch, "Junior high students and Think Alouds: Generating Information-seeking Process Data using Concurrent Verbal Protocols," *Library & Information Science Research* 23, no. 2 (2001): 107-122.

28 Tamal Kumar Guha and Veena Saraf, "OPAC Usability: Assessment through Verbal Protocol," *The Electronic Library* 23, no. 4 (2005): 463-473.

29 Maaïke van den Haak, Menno De Jong and Peter Jan Schellens, "Retrospective vs. Concurrent Think-aloud Protocols: Testing the Usability of an Online Library Catalogue," *Behaviour & Information Technology* 22, no. 5 (2003): 339. doi:10.1080/0044929031000

30 K. Anders Ericsson and Herbert A. Simon, *Protocol Analysis: Verbal Reports as Data*, Cambridge, MA.: MIT Press, 1984 and K. Anders Ericsson and Herbert A. Simon, *Protocol Analysis: Verbal Reports as Data*. Cambridge, MA.: MIT Press, Rev. Edition, 1993.

31 K. Anders Ericsson and Herbert A. Simon, *Protocol Analysis: Verbal Reports as Data*. Cambridge, MA.: MIT Press, Rev. Edition, 1993

32 Ibid.

33 Andrew Thatcher, "Information-seeking Behaviours and Cognitive Search Strategies in Different Search Tasks on the WWW," *International Journal of Industrial Ergonomics* 36, no. 12 (2006): 1055-1068. doi: 10.1016/j.ergon.2006.09.012 and Andrew Thatcher, "Web Search Strategies: The Influence of Web Experience and Task Type," *Information Processing and Management* 44, no 3 (2008): 1308-1329. doi:10.1016/j.ipm.2007.09.004.

34 Gary Marchionini, *Information Seeking in Electronic Environments*, New York: Cambridge University Press, 1995 and Raya Fidel et al., "A Visit to the Information Mall: Web Searching Behavior of High School Students," *Journal of the American Society for Information Science* 50, (1999): 24-37.

35 Thatcher, 20078, 1316

36 *ibid*, 1316

37 *ibid*, 1316

38 *ibid*, 1316

39 *ibid*, 1316

40 *ibid*, 1316

41 *ibid*, 1317

42 *ibid*, 1328

43 *ibid*, 1328

44 *ibid* 1327

45 *ibid* 1327

46 Thatcher, 2006, 1059.

47 *ibid*, 1062.

48 *ibid*, 1060.

49 *ibid*, 1061.

50 *ibid*. 1061

51 *ibid*. 1061

52 *ibid*, 1060.

53 *ibid*. 1060

54 *ibid*. 1060

55 *ibid*, 1962.

56 *ibid*. 1962

57 *ibid* 1962

58 Alison Green, *Verbal Protocol Analysis in Language Testing Research: A Handbook*. New York: Cambridge University Press, 1998.

59 Peter Smagorinsky, "The Reliability and Validity of Protocol Analysis," *Written Communication* October 6, no. 4 (1989): 465.

60 Mark C. Fox, K. Anders Ericsson, and Ryan Best, "Do Procedures for Verbal Reporting of Thinking have to be Reactive? A Meta-analysis and Recommendations for Best Reporting Methods," *Psychological Bulletin* 137, no. 2 (2010): 316-344 and K. Anders

Ericsson and Herbert A. Simon, "Verbal Reports as Data," *Psychological Review* 87, (1980): 215-251. doi:10.1037/0033-295X.87.3.215.

61 Peter Smagorinsky, 468.

62 K. Anders Ericsson and Herbert A. Simon, *Thinking-aloud Protocols as Data: Effects of Verbalization*, CIP Working Paper no. 397, Pittsburgh: Carnegie-Mellon University, Department of Psychology, 1979.

63 Mark C. Fox et al., 338.

64 Andrew Thatcher, 2006 and Raya Fidel et al., 1999.

65 Andrew Thatcher, 2006: 1059.