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Language Fluency, Expertise and Information Searching

in the Library

by

Fatemeh Bagherian

Thesis submitted to The Faculty of Graduate Studies and Research

in partial fulfilment of the requirements for

the degree of Master of Arts

Department of Psychology

Carleton University

Ottawa, Canada

August 1993

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of Canada

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**"Language Fluency, Expertise and Information Searching
in the Library"**

**submitted by Fatemeh Bagherian, B.A.
in partial fulfilment of the requirements for
the degree of Master of Arts**

Thesis Supervisor

Chair, Department of Psychology

**Carleton University
7 September 1993**

Abstract

This study examines how fluency in language, familiarity with a subject, familiarity with the Library of Congress classification of information, and familiarity with computers affect the efficiency and success of library information searching. Forty graduate students, 19 native English speakers and 21 non-native English speakers from Business and Geography Departments, first answered a background questionnaire, then wrote a list of word associations to six topics and searched for references about these topics using the Carleton University Bibliography Enquiry (CUBE) computer system. As expected, results showed that fluency in English and familiarity with a subject increased students' ability to find more information and be faster in their search. The study also revealed that participants' difficulties in finding information are mainly related to the lack of knowledge about how information is classified in CUBE and about how to use CUBE efficiently. Suggestions are made for improving training in the Library of Congress classification system and in various information retrieval programmes.

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A review of studies in library science reveals that almost all of them have concerned libraries, librarians, and the prestige of libraries in universities (Senn & Gee, 1989). Only a small proportion addresses issues of user access.

Of the information searching studies that have been published, most have examined how to improve the Library of Congress or other official classifications to increase users' chances of finding the information they need. There are many studies of indexing (e.g., Harris, 1988), and of developing efficient methods in categorizing information (e.g., Blair, 1991; Damias & Landauer, 1984), for example, determining whether pen should be categorized under stationary or under school. There are studies attempting to improve the efficiency of training for librarians (Brake, Hounsell & Irving, 1982). Finally, there are studies of software (e.g., CUBE) to keep information in an appropriate organization (Clarkson, 1991; Griffiths, 1982; Manson, 1978). Programmers produce several kinds of software to store information and retrieve it (Rowley, 1987; Wormell, 1987). They often seem to enjoy creating complicated programme optimized for computer efficiency and speed, but they often forget the abilities and needs of users. As a result, most of the programmes for seeking bibliographic information are difficult to use (Edwards, 1983).

Problems of Accessing Relevant Information

We need relevant information to make good decisions (Thorngate, 1990), but accessing relevant information is often difficult (Chen & Hemon, 1982). Considering people's time limitations, it is very frustrating when people cannot find the information they need. Many times people find references to several publications that seem relevant to their needs, but when they examine the publications they find the content irrelevant. One reason is that the library classification does not always represent the content of the publication. Many times people believe there should be information about a topic but they cannot find it because they lack knowledge about the hierarchical classification system used in the library

manage information and to assist people in obtaining the information of their interest.

Until recently, most literate people were able to find relevant information with few problems, because the amount of information was more limited and consequently more easily searched. People could usually find the information they wanted by using catalog cards or by consulting librarians (Garvey, 1979). Librarians were a good source of advice about finding information; they usually knew which information would be relevant to a topic and where the information would be found. Today so much information is produced that librarians are not able to remember the names of the new volumes, much less their contents. For example, the Carleton University Library receives approximately 70 books every day.

The rapid rate of information production has created several kinds of information professionals to study the most convenient way to store information so that people are able to retrieve what they want with few problems (Chen & Hernon, 1982; Krol, 1992). They include librarians, cataloguers, indexers and programmers as well as information scientists who collect and categorize information for libraries.

Large amounts of money are now invested to equip libraries with computers, to employ experts to classify information, and to train professional librarians to increase the success rate of information searches (e.g., see Dowlin, 1984; Heap, 1978; Kohl, 1986; Immorth & Daily, 1971; Stone, 1969). However, the quantity of technology does not mean necessarily more success in finding relevant information.

Complexity in Information Access

As libraries expand, access to their information becomes more complicated. This should increase the need for user training. Yet although library science programmes offer many courses to train librarians, there is almost no training for users of information retrieval systems. For example, The Carleton University Library provides a one-hour orientation to the new students in the first week of the academic year, but no training on the

use of CUBE (Carleton Library Bibliography Inquiry) or CD-ROMs such as PsycLit or SocioLit.

Informal conversation with some of the librarians at Carleton University reveals that students ask about 9,000 questions each month in busy months such as October or November. Most of the questions are about how to use the computers for information searching. Librarians believe that the computers in the library are a useful facility and are surprised that students have problems using them. Some librarians claim that many students ask for help because they are afraid to use the computers. Librarians assume that students know about the computer system and about the Library of Congress information classification system.

Systems of Information Classification

Most information in libraries is classified in either of two ways: hierarchically or by cross-reference. The two ways have their advantages and disadvantages. In a hierarchical system, information is classified unambiguously in identified categories. For example, radio has been classified under the category of communication and one can find information about radio under communication. Those who defend a hierarchical system believe that our mind naturally keeps information this way (Schneiderman, 1987; Thompson, 1971). However, psychological research casts doubt on this belief (Furnaz, Landauer, Gomez and Dumais, 1983; MacGregor & Lee, 1987). These studies show that people classify information in a variety of different ways, mostly related to their learning and experience. As a result, these researchers suggest that information be classified in a cross-referenced system that lets users access information from multiple entry points. In a cross-reference system, unlike a hierarchical system, information users are able to access the information of interest through several links. For example, a topic such as radio might be found under electric device, communication, entertainment inventions or radar. Cross-referencing,

however, does have problems. For example, associations in cross-reference may not match those of many users; too much unwanted information may be found; developing and maintaining cross-references are more difficult than hierarchies.

Almost all publications in North America are now classified according to the Library of Congress (LC) classification system. This system of classifying is hierarchical and rather difficult to learn, judging from the fact that graduate students in library science are required to pass courses in it. The Library of Congress (LC) designates standardized terms for topics of information called Library of Congress Subject Headings (LCSH). The subject headings are labelled with call numbers such as BF or HM; manuals exist for translating keywords into standardized terms and standardized terms into call numbers. Thus, LC refers to the concept of Library of Congress classification of information and LCSH refers to the manuals available in the libraries for information users.

The Library of Congress system can, in principle, be very efficient for retrieving information if the user knows how to use it. But information users usually choose the terms they think are appropriate to a subject heading and often their terms do not match the standardized terms (Furnaz & et al, 1983). Many of the Library of Congress classifications do not seem intuitive. For example, a glance at the manuals of Library of Congress Subject Headings (LCSH) shows that information about bike will be found under term motorcycle and information about Persian under Iranian. Most users do not know about the Library of Congress Subject Headings manuals to find standardized terms or do not know how to use them or are unwilling to use them because of time limitations (Chen & Dhar, 1988). If a user does not use the standard Library of terms he/she won't find the relevant information he/she is seeking. Thus, many researchers have expressed reservations about using Library of Congress classification system and have suggested alternative classification systems based on cross-referencing (e.g., see Bromley & Allott, 1988).

Current Studies of Information Searching in Library Science

A review of studies in library science reveals that almost all of them have concerned libraries, librarians, and the prestige of libraries in universities (Senn & Gee, 1989). Only a small proportion addresses issues of user access.

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or because their keywords do not match the keywords that professional indexers used to index the desired information.

Blair (1979) speculates about how people perform information searches on a large interactive document retrieval system. He believes that as a document retrieval system becomes larger, browsing through the documents becomes more complicated and frustrating for searchers. Blair claims the large size of an interactive document retrieval system increases a searcher's confusion about the information he/she has retrieved. This confusion may cause a searcher to give up the task of searching before retrieving the most relevant information. A large amount of information discourages searchers from examining all combinations of keywords that will retrieve desired information. For example, when a user is looking for the effect of oil in Middle East countries, the user may try several combinations of "history of oil", "history of OPEC", "history of Middle East", etc. while the exact information may have indexed under "OPEC and Middle East". Blair claims a searcher usually tends to keep his/her first keywords in all combinations s/he tries. For example, when a user is looking for keyword phrases searching information about the history of oil, he/she may try several keywords start with history, as mentioned above, and no keywords start with OPEC or Middle East. Blair suggests adding a thesaurus feature to the retrieval programme that offers all combinations of keywords to retrieve a searcher's desired information. For example, under the inquiry words of history of oil, the system would offer other combinations of keywords such as the history of oil, OPEC, Middle East, mines, black gold, and so on.

Additional problems of information seeking appear when searchers use different systems in a library. For example, the CUBE system in Carleton University works according to the Library of Congress Classification System (LCCS) and has limited capability of cross referencing but; some CD-ROMs work according to LCCS and some according to cross-reference systems. Searchers are likely to be more successful if they

know about the difference and the function of each system, but most do not. Surprisingly, many librarians do not know the systems used in different CD-ROMs in the library.

Despite many studies related to improving the efficiency of library use, to information gathering or retrieving, and to librarian assistance to users (Mason.D, 1978), information searching remains a demanding and sometimes frustrating task. Curiously, few studies explore the process and problems of users seeking information. Following is a review of some psychology literature related to my proposed study.

Psychological Studies of Information Seeking

Psychological studies of information seeking have appeared only occasionally in the past 25 years. An early study by Tinker (1966) examines how often professional indexers use the same keywords to describe the same abstracts. Fifteen indexers were asked to write their own descriptors of 50 abstracts. The results show that the overlap keywords among indexers is low; on average, any two indexers would write the same descriptors only 6.5% of the time. Although indexers are usually trained to use the same words to describe abstracts, the low overlap of their keywords of the same abstracts suggests a low overlap between their keywords and those of users. Tinker speculates that the reason for the indexers' low overlap concerns word meaning; there is not a common definition of words among people. A word may have a number of meanings associated with indexers' idiosyncratic experiences. For example, pen may be associated with stationary for one indexer and with school for another. Tinker suggests a better education programme for indexers to standardize the definition of words and their meanings. He also suggests a thesaurus or multiple indexing to help indexers improve the common meaning of words. However, he does not extend his argument to untrained users. Improving the indexers' training to increase their proportion of common keywords will not necessarily increase the chances that users will employ the same keywords; increasing reliability is not sufficient for increasing validity.

Library scientists, for many years, have recognized that students using online public access catalogues (OPACs) often do not find the information they seek, even in simple tasks such as finding the author of a book whose name is known. For example, Gouke and Pease (1982) conducted an experiment to see how often online users are successful finding the correct call number of a document in a library. They asked 104 randomly selected users to write down the call number for specific titles selected from an online system. Only about 67% of the users gave the correct answer.

Bates (1977) conducted a study to measure which factors affect the success of information searching. Bates asked 22 senior or graduate students in psychology and 22 senior or graduate students in economics to generate their own keywords for finding information about topics of their own field. For example, subjects were asked to find relevant books about hypnosis or taxation in China. Bates used 17 library graduate students as a comparison group. All students were asked to retrieve relevant information in a library using the Library of Congress cataloging system. Results show that the chance of retrieving relevant information among the psychology and economics students was on average a little more than 20%. Library students were successful in finding relevant information on average 35% of the time. The results suggest that library training improves the success of information seeking even without expertise about the topic. The study encouraged Bates to study how to raise the chance of retrieving the desired information.

Bates (1978) claims that "we know discouragingly little about just what bibliographic search skills are and how they develop; we cannot yet define what it is that an experienced searcher knows and a beginner does not" (p.205). He then presents an exhaustive description of 29 tactics employed to increase the rate of success in finding desired information. The 29 tactics are categorized in four groups: (1) monitoring, such as checking the amount of available information or correcting spelling mistakes; (2) file

structure, such as surveying information or selecting a general topic to search; (3) search formulation, such as fixing on a specific topic or choosing a narrower topic or synonyms of a previous topic; and (4) inquiry words, such as using appropriate keywords to retrieve information in a topic of interest. These tactics vary from topic to topic or user to user, i.e., a user might choose part of these tactics according to a topic or to the user's need. Bates discusses these tactics to assist users in their information searching. Although these tactics help searchers to navigate a library computer system, they do not solve the problem of finding common keywords between indexers and users.

Furnas, Landauer, Gomez, and Dumais (1983) conducted four studies to determine how often people use the same words to describe the same things. In the first study, 48 high school students and secretaries were asked to write down list of keywords to describe computer text editing operations such as insert, delete and change. In the second study, 337 university students were asked to categorize 50 common items taken from 10 categories such as food, cities, animals and names. In the third study, 30 homemakers were asked to classify 64 items of swap meet listing. And in the fourth, 24 cooks including 8 experts, 8 intermediates and 8 novices, were asked to index 188 cooking recipes chosen from 12 cookbooks. Despite the contents of the different tasks, data gathering, and sample sizes, the researchers found a consistent result: there was little overlap in the keywords subjects generated; on average subjects generated the same words only about 15% of the time. Though experts generated more keywords than novices, they rarely used the same keywords.

The Furnas et al's (1983) studies suggest that individual variation in word associations is great, and perhaps not greatly reducible by training. As a result, Furnas et al suggest that information retrieval systems should address the variation, perhaps by including a thesaurus programme that offers several alternative associations to words. For example, a computer system might show boot, snowshoe, wooden shoe, slippers,

pantoffle when a user types shoes.

A study by Blackshaw and Fischhoff (1988) considers information users' problems using computers in libraries. Sixty subjects, in four groups, were asked to retrieve bibliographic information from an online computer system. Subjects searched for simple information such as book title or author, and for more complex information such as book subject. Each group was given different instructions about using the system. One group received instructions offered by librarians. A second group received experimenters' advice about how to use the system. A third group received instructions suggested by subjects in the pretest. A fourth group, considered a control group, received no instruction.

Subjects were successful searching for simple information such as titles and authors about 90% of the time. However, subjects failed to complete a subject search (searching by keyword or topic) 26% of the time. The four groups did not differ significantly in their success rate. Results also indicate that subjects had more problems searching information than problems using the system. The study further reveals that when subjects are uncertain about the relevance of retrieved information they usually give up more searching. For example, subjects who were searching information about salmon fishing became doubtful about which of the retrieved information represented the most relevant materials about the topic and stopped their search.

Blackshaw and Fischhoff suggest that users should learn about the library catalog system and offer advice regarding how to use online computers in libraries efficiently. For example, they suggest (taken from users' comments) that users first input a general topic (e.g., history of psychology) rather than a specific one (e.g., the origins of mental testing), then they will likely have broader choices for browsing the information related to what they need. If they do not find relevant information they can try a specific topic and then broaden it until they find the relevant information. The recommendation is similar to Bate's tactics

of surveying.

In a recent study, Thorngate and Hotta (1990) examined the overlap between users' terms and PsychLIT terms. Twelve professors, 15 graduate students and 54 undergraduate students in social sciences were asked to provide keyword descriptions of 24 research articles published after 1985. All of the articles were catalogued in PsychLIT CD-ROM by professional indexers. Each participant was asked to read the first page of eight articles out of 24 that included the title, author(s), abstract, and about 100 words of introduction. The participants were asked to write down about five keyword descriptions as the best for each of the eight articles. Results show a low overlap of keywords used by the participants and keywords used in PsychLIT CD-ROM. Professors and graduate students generated the same keywords as PsychLIT about 10% of the time; undergraduates generated the same keywords about 5% of the time. Though professors and graduate students produced more keywords than undergraduate students, the chance of matching PsychLIT descriptors is very low for them as well. The authors suggest increasing more descriptors for an article and also training users to improve people's success in information searching.

Chen and Dhar (1990) also conducted a study of information searching with an online catalogue system. They asked 30 business school students, including graduates and undergraduates students, to search information in the subjects of their own interests. Subjects were also asked to think out loud and their words were recorded. The computer system the subjects used provided seven search options: author search, title search, author and title combined search, subject search, keyword search, call number, and Boolean search. Results show that subjects have many misconceptions about (a) subject searching, (b) classification of material and (c) the computer system.

Users' misconceptions about subject searching in turn reveal three problems. The first is choosing inappropriate general terms at the beginning of a search. The Library of Congress Cataloging System (LCCS) has "official" terms for subject headings. These

official terms are provided in the three volumes Library of Congress Subject Heading (LCSH) manual and are available in libraries at the information desk. However, users must consult the official terms, otherwise they cannot find the relevant information even they are very close to the official terms. For example, a subject searching information about "measure theory" tried "measurement theory" and after ten minutes browsing he realized the term "measurement" did not substitute for "measure."

Misconceptions about subject searching also lead to incorrectly estimating the amount of relevant information. Some users, especially Ph.D students, look for very specific information. If they do not use appropriate terms at the beginning of their search they find nothing and assume that there is no relevant information about their subject of interest. For example, in Chen and Dhar's study, one subject looking for relevant material about "career" found only one piece of relevant information using the word and stopped, even though there were over fifty relevant items listed under subject heads such as "occupation", " professions", and "vocational guidance."

And misconceptions about subject searching also lead to search at an inappropriate level of specificity. Chen and Dhar observed a tendency to use broader terms at the beginning of information searching. More than 70% of the subjects used terms too general for the desired information. For example, a subject examined several citations under "statistics" while she was looking for information about "statistical power." Other studies confirm users' tendency to input a general term rather than specific one (Pulis & Ludy, 1988).

The Chen and Dhar's study (1990) additionally reveals misconceptions about classification. One reason for the misconceptions is users' lack of knowledge about the Library of Congress Indexing system. A common reaction among the subjects when they used incorrect terms and consequently found no match, was to say: "it is impossible, there should be something about the inquired term." Few subjects believed that they had simply

chosen the wrong term. According to the standardized indexing in the LC system, a book is indexed according to its entire content not according to its subtopics. For example, a book with several subtopics about learning will be indexed under education. However, users tend to enquire only about the subtopics when searching for specific information. Only one of the thirty subjects consulted the LCSH manual. Chen and Dhar claim that users do not consult the manual because of the time needed to learn to use it. However, I think most of the users do not know about its existence. One reason might be that librarians rarely encourage users to consult the LCSH manual.

Finally, Chen and Dhar (1990) found misconceptions about the computer system. Chen and Dhar categorized these misconceptions in two types: (1) system messages, and (2) system capability. When a subject inputs a wrong command, the computer may print an ambiguous error message that users misinterpret as feedback about their search. For example, one subject incorrectly typed "South Africa, sport" before selecting the "search" option. The mistake resulted in this message: "Your selection not recognized by the system" which the subject believed was indicating that there was no document under "South Africa, sport". Some subjects confused the meaning of system options such as the command PREVIOUS SCREEN which brings back the previous screen and BAC which scrolls backward in the list of headings.

Subjects also had misconceptions about the capability of system. For example, the subjects were confused about the system options named of SUB and SUBK. SUB is used for subject headings in LC system while SUBK is used for keywords.

Such problems can be solved by using words for system options that are more related to the words people use in real life. Indeed the problems that arise in this section stem from confusion between the language used by people and the language used by the system. We should not attribute it solely to users' misconceptions about the system; it

could be attributed to system design.

Chen and Dhar (1990) conclude that if information users have knowledge about the subject, classification and system they will be more successful in finding relevant information. The authors also suggest developing systems with more capability in search options about what to use and how to use options. The suggestion seems to conflict with Blackshaw & Fischhoff's results about system knowledge. Unfortunately few statistics are reported in Chen and Dhar's study, so it is not possible to determine the relative frequency of the users' misconceptions about the three different areas. Moreover, Chen and Dhar's suggestions for information users demand a rather intensive training course in subject, classification, and system area. Users may not have time for such a course.

Some library scientists have noted that many of the users' mistakes are the result of confusion about the computer interface or an inadequate mental model of how a computer works. For example, Cherry and Clinton (1991) conducted an experiment about how to train students to use The University of Toronto online public access catalogue (OPAC). Cherry and Clinton compared a lecture on the OPAC with an online tutorial written using Hypercard. Three groups of students participated in this study, one group received a lecture on how to use library computers, one group received a computer tutorial on using library computers and the third group received no instruction. Those who were trained with the computer tutorial achieved the same search success rate as those who received the lecture. The result also showed a significant difference between those who received no instruction and those who received some instruction; instructed subjects found information about 21% more often than unstructured subjects. The experiment lead Cherry and her colleagues to develop the computer tutorial training as instruction for online users in University of Toronto.

In summary, several different factors seem to influence the chances of success in information seeking. As mentioned above, some researchers have shown that the human-computer interface can influence search success (Cherry & et al, 1991; Lee & MacGregor, 1985; Reisner, 1981). They suggest ways of improving the interface to make the computer easier for untrained computer users. Other researchers see the major problem as lack of training in library systems, and see the solution in better training for library users (Bates, 1979; Brittain, 1970; Chen & Dhar, 1990; Colin, 1988; Jax & Houlso, 1988).

Yet there can be other causes of information searching problems, and perhaps the most important of these concern language. Cherry and Clinton asked the subjects questions that needed little knowledge of language. For example, in their 1991 research they asked subjects "Who wrote the book North of Boston?" and "What is the title of a book about William Faulkner?" Seeking answers to these questions needs little more than typing skills. Many library users come with more challenging questions. For example, a library user may go to an OPAC in order to search for information about AIDS or about post modernism and psychology. To find this information the user must know keywords or phrases associated with the desired information. Lacking the knowledge of language or local culture makes this difficult. For example, someone who does not know North American culture may not know that information on Mickey Mouse can be obtained by typing Walt Disney.

The Present Study

The purpose of my study was to determine the extent to which (1) knowledge of English, (2) knowledge of an academic discipline, (3) knowledge of library systems, and (4) familiarity with computers can influence the chances and the speed of finding information. I thus asked native and non-native English speaking students who varied in

their library and computer knowledge to find information in the library either within their academic major or outside it. The speed and success of their searches was then compared.

In discussion with other international students and non-native English speakers, I realized that most of us have difficulty finding information in the library. Many have been frustrated using computer technology in the library such as CUBE or the CD ROMs. Some mention that searching for information in the library using the technology is noxious because they have spent several hours in front of a computer trying to find information without success. Many prefer to ask professors or friends for sources of relevant information rather than to use the computer technology.

Though all students may have problems in information searching, I think non-native English speakers suffer more problems than do native English speakers. Many of the additional problems seem to be the result of linguistic limitations. Non-native English speakers usually know fewer English words than do natives, and have fewer English word associations. For example, an international student may know only one or two different words to describe shoes (perhaps boots and sandals), while a Canadian may know 6 or 8 (boots, sandals, footwear, leather goods, galoshes, street, high heel, running, orthopaedic, etc.). Having more association allows Canadian students to try more keywords in a computer information search and thus to increase the chances of finding relevant information. I thus expect that international students will be less successful than will Canadian students in finding library information.

As information grows and becomes more specialized, the search for specific information may require increasingly specialized knowledge of its context, topic area and vocabulary. Even native English speakers may not have this knowledge in many areas. For example, a psychology major may not know that information about modernism may be found in geography, political science, international development and literary criticism. Similarly, a geography major may not know that information about Bayesian conservatism

may be found in the literature on the psychology of judgement and decision making. As a result, I expected that native English speaking students will be no better than non-native English speakers when trying to find information outside their areas of expertise.

Familiarity with classification of information helps library users to access information faster (Bates, 1977). For example, a student familiar with the LC system may consult the Library of Congress Subject Heading (LCSH) manual to select the standard keyword in LCCS. Thus, those users who know about the Library of Congress system should find more relevant information than those who do not. Consequently, I expect that students more familiar with the LC system will achieve higher success rate than will students less familiar with it.

Finally, familiarity with computers may affect people's success in accessing relevant information. I would expect that people who are more familiar with computers will be faster and more efficient using them than will people who are unfamiliar with the machines. Most international students come to Carleton with no training in computer use, while most Canadian students now have at least some training or practice in high school and in their undergraduate programme. As a result, I expect international students will be slower and will make more system errors using the library computer than will Canadian students.

In order to test my expectations, I asked international students and Canadian students majoring either in business or in geography to find references on topics within their major, on topics within the other major, and on topics of general interest. I selected business and geography as the two majors partly because I know more about these two areas than about others, and partly for convenience. Each volunteer participant completed a background questionnaire asking for a self-report of English competence, library knowledge, computer background, and other demographic information. Then I gave each

participant a list of pre-selected topics, two in each of business, geography and more general areas. Participants were asked to list on paper as many words or phrases they could think of that might be used to find information in the library about each topic. Finally, each participant was asked to use the Carleton Library CUBE bibliographic computer system to find references related to the same six topics. The computer terminal they used recorded all words, phrases and other interactions they had with CUBE.

The paper lists and computer recordings were used to derive several dependent variables, including (1) the number of words and phrases written/typed for topics in and out of each participant's major, (2) the number of references retrieved from CUBE using the words and phrases, (3) the overlap of these references among participants, and (4) the number of different CUBE commands used by each participant. Also, several analyses were made of the strategies of information searching as revealed by the keywords input to CUBE. After the dependent variables were derived, participants' scores on each were calculated and examined for linguistic, specialization, library and computer familiarity differences related to the remaining background variables.

Method

Participants

Forty graduate students participated in this study, 19 were native English speakers (E) and 21 were not native English speakers (non-E); 22 were males and 18 females; 20 were geography and 20 business majors. The average age of participants was 29 ($SD = 5.2$; mode = 25; range = 22 to 45 years). The vast majority were students at Carleton University (37/40) and the remaining 3 were students at Ottawa University. Participants were recruited by advertisement at common places at Carleton University and also by the traditional snowball technique of asking participants for names of eligible acquaintances.

Design

A 2 x 2 by 6 mixed factorial design was employed in this study. The first (between

subject) independent variable was language: native English speakers versus non-native English speakers. Of course, not all non-native English speaking students are equally fluent in English, nor are all native English speaking students. There are several ways to measure linguistic competency. One method is self report; another is objective test result. The self-report method was used in this study. To obtain a self report of English competency, I used three items from a standard test made by the Applied Linguistics Department with the Department's permission.

The second (between subject) independent variable was the student's field of study. Two majors were considered: Business and Geography. The background questionnaire provided self-reports of the level of education in these majors (see Appendix 1).

The third (within subject) independent variable was the search topic. Two topics were selected in each of three categories: Business, Geography and General Interest. The specific topics were selected following informal pretests and consulting a professor in Business and a few students in Geography (Appendix 2).

I attempted to assess each participants' familiarity with each topic by using self-report; participants rated their own familiarity with each of the six topics (see Appendix 3). A simple word association task, derived from Landauer (1983) and Thorngate & Hotta (1990) was used to estimate participants' competency in English and familiarity with the search topics. Participants were given a sheet of paper with the topics printed on it in random order and asked to write down whatever words or phrases they believed would help them in their library information search.

The dependent variables included the number of participants' key words and phrases, total search time, success rate (the number of participants' references), the number of different CUBE commands, and the number of mistakes (e.g., typing nonexistent commands or no command).

Procedure

The experiment was conducted in an office in Loeb building in Carleton University. Students participated individually.

Questionnaire. The experimenter first explained the purpose of study and the nature of the experimental task, answered participants' questions, and requested each participant to sign an informed consent form. Participants were told that there was no deception in the study and that they could withdraw from the experiment at any time. Participants were then asked to complete the background questionnaire (see Appendix 1). The questionnaire asked for personal background information (e.g., age, sex, citizenship, etc.), for information about familiarity with computers, and for information about fluency in English. This section lasted about 7 minutes.

Word Association Task. After completing the questionnaire, each participant was asked to write down all keywords and phrases he/she believed would be useful to find information about the six given topics: two each in business, geography and general knowledge as mentioned before (Appendix 2). Participants were told they could ask the experimenter if they had any questions while completing the task. After completing the Word Association Task, participants were asked to rate their familiarity with each topic in a scale from 1 (not familiar) to 9 (extremely familiar) (Appendix 3). This task lasted approximately 12 minutes.

Computer Retrieval Task . Participants were asked to be seated in front of a Macintosh computer directly connected to the library computer running CUBE, and given a few minutes training on the basics of CUBE use and call numbers. They were then given a sheet of paper summarizing the basic commands in CUBE they had just practiced (Appendix 4).

After the training session, each participant was given an instruction sheet stating his/her task: to find as many books as possible judged to be relevant to each of the six

topics (Appendix 5). Attached to the instruction sheet was a Call Number Response Sheet listing the six topics in random order with spaces next to each where the call numbers of books or manuscripts judged relevant could be written (Appendix 6). The experimenter then read the instructions while the participants followed along. Participants were told that each time they found a reference they believed was relevant to a topic, they should write down its call number on the Response Sheet. They were encouraged to search topics in any order they wished and to shift back and forth if they desired. Participants were not allowed to see their lists of keywords for the topics generated in the Word Association Task, but instead were asked to generate whatever keywords and phrases they believed were most appropriate for using CUBE to find relevant references. Any questions were then answered, the link to CUBE was made, and the session began. During the task, the experimenter sat in the back corner of the room, available to answer any more procedural questions as they arise.

The Red Ryder communication programme running on the Macintosh computer was set to record on a disk file everything that appeared on the screen during the task. The resulting data file thus gave a complete record of everything entered and examined by a participant in its natural order. Participants completed this task within an hour. Following the search task, participants were debriefed and excused.

Results

Background Characteristics of Participants

Competency in English. The most common native languages among Non-E participants were Chinese (4/21), Hindi (4/21), Arabic (3/21), and Luhya (3/21). Non-E participants were asked to rate their ability in reading, writing and speaking English (question 6 and 7 of the background questionnaire, Appendix 1) on a scale from 1 (minimum English) to 9 (maximum English). Because of a high correlation among self-ratings in reading, writing and speaking English (average $r(21) = +0.76$; $p < .01$), the

average score of the self-ratings was used in data analyses. Non-E participants rated themselves on average from 5 to 9 ($M = 7.4$; $SD = 1.2$; mode = 8) indicating moderate to excellent English competency.

Two other indicators of English fluency were also tabulated. The number of years non-E participants reported studying English ranged from 2 to 25 ($M = 12$; $SD = 8.4$) and the length of time living in Canada ranged from 2 to 60 months ($M = 22$; $SD = 15.8$). Results showed no difference between Geography and Business non-E students in their self-rating of English competency, years of studying English or time of living in Canada ($t(19) = -.43$; $p = .66$; $t(19) = -1.71$; $p = .10$; $t(19) = 1.32$; $p = .20$ respectively).

Use of Computers. Participants' computer experience was calculated from the participants' answers to questions 8 and 9 of the Background Questionnaire. Most participants reported that they used a computer almost every day; responses ranged from 10 to 80 times during the month prior to the experiment ($M = 35.3$ times per month; $SD = 17.1$; mode = 40).

On average, participants used word processing packages 17.2 times during the previous month ($SD = 9.2$; mode = 30). Although one participant reported not using CUBE in the previous month, all the remaining participants had used retrieval programs such as CUBE or HERMES ($M = 8.9$ times per month; $SD = 7.2$; mode = 5). Also, 30% of the participants had used data analysis programmes ($M = 3.9$ times per month; $SD = 8.9$), and 50% had used other programs such as games in the previous month ($M = 6$; $SD = 8.8$).

In order to determine the differences between E/non-E and Geography/Business students in computer experience, 2×2 ANOVAs were performed on the reported frequency of the types of computer use such as word processing, data analyses, or retrieval programmes during the previous month. There was a significant main effect of major on

using a word processor programme during the previous month ($F(1,36) = 7.4, p < .01$). Business students used a word processor programme ($M = 20.3$ times per month) more frequently than did the Geography students ($M = 13.5$).

A 2 x 2 ANOVA was also performed on reported frequency of using data analysis packages. Results showed no significant difference either for major ($F(1, 36) = .47, p = .49$) or for language ($F(1, 36) = .74, p = .39$). Finally, a 2 x 2 ANOVA was performed on reported frequency of using bibliographic retrieval programmes. Again, results showed no significant difference either for major ($F(1, 36) = .87, p = .35$) or for language ($F(1, 36) = 1.04, p = .31$). However, there was a significant major-by-language interaction ($F(1, 36) = 4.25, p = .04$). Non-E Business students reported more frequent use of bibliographic retrieval programmes ($M = 12.7$ times per month) than did the remaining participants (overall mean = 7.0 times per month).

Library use. Although one of the participants reported she had not used the library during the previous month, all remaining participants reported frequent use of the library during that time ($M = 13.3$ visits; $SD = 10.8$). In order to determine any usage differences between Geography/Business and E/non-E, a 2 x 2 ANOVA was performed on reported frequency of library use. Results show no significant main effects for major or language ($F(1, 36) = 1.39, p = .24$; $F(1, 36) = .60, p = .44$ respectively). There was, however, a significant major-by-language interaction ($F(1, 36) = 4.22, p < .05$). Non-E students in Business reported more frequent use of library ($M = 19.6$ visits in previous month) than did the remaining participants (overall mean = 10.8). This is consistent with the bibliographic retrieval use finding reported above.

Participants' experience with the library was calculated from their answers to background questions 11 through 12. They were asked to report if they had experienced problems finding information at the library, and how they solved the problems they had. The vast majority (80%) reported that they had experienced problems finding information

in the university library. Most of these people (65% of the 80%) consulted librarians in order to solve their problems; the rest sought other solutions such as asking friends or professors. Fifty three percent of those reporting problems were native English speaking students and 47% were non-native English speaking students. Similarly 53% of those reporting problems were Geography majors and 47% were Business majors.

Knowledge of LCCS/LCSH and use. Participants' familiarity with LCCS and LCSH was assessed by their answers to questions 13 to 15 of the Questionnaire. Although, as previously noted, almost all the participants went to the library frequently, they reported low familiarity with the LCCS. On average, participants rated their familiarity 2.2 (maximum scale = 9); 69% rated their familiarity as 0. Only one rated high familiarity with LCCS (8); he worked in the university library. In order to determine any differences between major or language, a 2 x 2 ANOVA was performed on reported rating familiarity with LCCS. Results show no significant difference between Geography/Business and E/non-Es students. Surprisingly, none of the 40 participants had used the LCSH volumes though 30% of them reported they knew it.

Word Association Task (WAT)

Recall that in the WAT, participants were asked to write as many keywords as they could think of for six questions: two in geography, two in business and two in general areas. They were then asked to rate their familiarity with the topic of each question. A number of indicators were derived from their responses.

Familiarity rating. Participants rated their familiarity with each of the six bibliographic subjects on a scale ranging from 1 (minimum familiarity) to 9 (maximum familiarity). As expected, participants' ratings of familiarity were highest in their major, lowest out of their major and moderate for the general questions. On average, Geography students rated their familiarity with geography questions (question 1 and 5) as 4, with

questions out of their major as 2.5, and with general questions as 2.8. Business students, on average, rated their familiarity with business questions (question 2 and 6) as 6.7, with questions out of their major as 3, and with general questions as 4.

Keyword indicators. Writing more keywords for a subject indirectly indicates more knowledge about it (Thorngate & Hotta, 1990). Thus, the number of keywords provided by participants in the WAT was considered as one indicator of familiarity with a subject. Two types of keywords were considered as indicators of both familiarity with subject and competency in English: direct keywords and indirect keywords. A direct keyword refers to the word or its root in the question; an indirect keyword refers to a word different from the words or their roots in the questions but related to them (e.g., synonyms). For example, if a participant writes "desert", "deserts", "desertification", "Africa" or "African" as a keyword for the "How much of Africa is desert?" it is considered a direct keyword; if he/she writes "arid land", "Sahara" or "rainfall" for the same question it is considered an indirect keyword. The number of keywords written in response to a question was assumed to reflect familiarity with the topic. In principle, the type of keyword (direct vs indirect) was assumed to reflect language competence. More indirect keywords indicate a broader vocabulary about a subject and greater language competence. The greater one's vocabulary the more chance of hitting relevant keywords in retrieval programmes.

Analysis of keyword indicators. A total of 805 keywords, direct and indirect, were written by all participants, 407 by Geography students (51%) and 398 by Business students (49%). Of the 805 keywords, 306 keywords were direct (38%) and 499 were indirect (62%). Geography students generated 122 direct (30%) and 285 indirect (70%) keywords; Business students wrote 184 direct (46%) and 214 indirect keywords (54%). Es wrote 113 direct (21%) and 434 indirect keywords (79%); non-Es wrote 193 direct (52%) and 178 indirect keywords (48%). Table 1 shows the average number of keywords and their types written by participants for each of the six questions. In order to determine

any differences among participants on the number and type (direct, indirect) of written keywords, a series 2 x 2 (major by language) ANOVAs was performed. The first was performed on the total number of keywords across the six questions. There was a marginally significant main effect of language ($F(1,36) = 3.95, p = .05$); non-Es wrote fewer keywords ($M = 17.6$) than did Es ($M = 22.8$). A 2 x 2 ANOVA on the total number of direct keywords showed main effects for both majors and language ($F(1,36) = 4.2, p = .04$; $F(1,36) = 4.8, p < .05$ respectively). Business students wrote more direct keywords ($M = 9.2$) than did Geography students ($M = 6.1$); similarly non-Es wrote more direct keywords than did Es ($M = 9.2$, and 5.9 respectively). Finally, 2 x 2 ANOVA on the total number of indirect written keywords was performed. Results showed a significant main effect of language ($F(1,36) = 10.7, p < .01$). Es generated more indirect keywords ($M = 16.9$) than did non-Es ($M = 8.4$).

Because the number of direct and indirect keywords are confounded by the total number of keywords, an additional ANOVA was conducted on the proportion of the total contribution by the indirect keywords. Results showed significant main effects of language and major ($F(1,36) = 11.6, p < .01$; $F(1,36) = 7.4, p < .01$ respectively). E students wrote a greater proportion of indirect keywords ($M = 70\%$) than did non-Es ($M = 45\%$); Geography students wrote a greater proportion of indirect keywords ($M = 67\%$) than did Business students ($M = 47\%$). There was no significant interaction ($F(1,36) = 1.22; p = .27$).

In order to determine any differences among participants on the total number of their keywords for each of the six questions, a 2 x 2 x 6 ANOVA was conducted. There was a significant major-by-subject area interaction on the total number of different keywords ($F(5, 180) = 4.25; p < .01$). Participants provided the highest number of keywords for questions in their major, the lowest number of keywords for questions out of their major and moderate number of keywords in general questions (see Table 2). This

results confirm what previous research found (Thorngate & Hotta, 1990). Participants wrote more keywords about a subject in their major than out of their major.

Table 1.

Average Number of Keywords, Direct and Indirect, for the Six Bibliography Questions

Questions	keywords			
	direct	indirect	total	range*
1) residential mobility	1.0	2.4	3.4	1 - 8
2) rural survival	1.0	2.5	3.5	1 - 9
3) commodity market	1.6	1.2	2.8	1 - 9
4) computer effect	1.0	2.6	3.5	1 - 9
5) news media	1.5	2.0	3.5	1 - 7
6) native education	1.8	1.7	3.5	1 - 7

*The range column shows the minimum and maximum number of keywords or phrases written by participants.

In order to examine the confounding effect of English competence, correlations were performed between English competence indicators (self-rating, years of studying English, and time living in Canada) and the total number of indirect keywords in the WAT. The correlation between self-rating of competency in English and total number of indirect keywords across the 6 questions was not significant ($r(21) = +0.06$; $p > .50$). The correlation between years of studying English and the number of indirect keywords in

WAT for the questions was also not significant ($r(21) = +0.05$; $p > .50$). However, correlation between the length of time in Canada and the number of written indirect keywords in the WAT for the questions being asked was marginally significant ($r(21) = +0.36$; $p < .10$).

Table 2

The Average Number of Keywords For Each Question Written by Participants.

Questions	Majors	
	Geography	Business
Residential mobility	3.7	3.3
Rural survival	3.9	3.0
Computer effect	3.1	4.0
Commodity market	2.6	3.1
News Media	3.8	3.1
Native education	3.6	3.2

The Computer Retrieval Task (CRT)

In the second experimental task, participants were asked to use CUBE to find relevant information about the six questions asked in the WAT. They were asked to do so in order to examine how much relevant information participants can find about a subject with which they are either familiar or unfamiliar using their first or second language. The task also revealed different strategies employed by participants to search information and allowed indirect estimates of their success.

Each participant generated a computer recording of his/her interaction with the

computer using CUBE commands. Everything that appeared on the participant's computer screen was recorded. The data collected in each file included all search commands used by the participant. Appendix 4 shows the CUBE printout of all 14 available commands. Some of these are: t (title), k (keyword), lc (Library of Congress keyword), c (call number), and a (author). Participants could select each command as a CUBE option to retrieve the information of interest.

Development of indicators. In order to examine how efficient and successful participants were in using CUBE to find information about the the six questions, I had to develop indicators of efficiency and success. Most of the indicators were developed from the sequence of different CUBE search commands (see Appendix 4) that participants selected to find information. Each participant provided a file of search behaviors 35-60 minutes in length, revealing every interaction between the participant and CUBE. It includes information about how a participant began an information search, how many references s/he browsed, and how many typing mistakes s/he made. The typing mistakes refer to typing nonexistent commands or to any actions that did not end in the presentation of a menu or a bibliography reference. For example, if one does not type a command such as "t" before a title of interest, CUBE sends a message informing that the action is wrong and the user should try again or consult HELP command. Appendix 7 shows a few pages of one participant's file.

The CUBE options or commands guide a searcher to find information. For example, in order to find information according to the name of authors, a searcher should type the letter "a", then space, then the last name of author of interest (see Appendix 4). Participants used different strategies according to the options offered by CUBE in order to find relevant information for each question. For example, some tried different keywords with the "k" command or titles with the "t" command, some typed one title and then chose the forward "f" and backward "b" commands to browse several titles alphabetically close

to the first title. This latter strategy often saves time and prevents library users from making mistakes such as misspelling or choosing wrong commands.

The first indicators for this task reflected the commands chosen by participants. A computer programme written by Prof. Thorngate allowed me to count the number of different commands chosen by each participant during the search. Thus, the number of typed keywords following commands such as t (title), a (author), k (keyword), the number of commands such as f (forward), b (backward), and i (return to the Menu), and the total number of CUBE options (commands), and also the number of typing mistakes were counted.

Overall results of CUBE commands. The total number of CUBE commands used by each participant was on average 130, and the total number of keywords typed was on average 42. The number of keywords typed included those attached to the commands k (keyword), t (title), a (author), and LC (Library of Congress keyword). The commands f (forward), b (backward), and di (display) do not require keywords. Participants may have seen other keywords on the screen by using the "f", "b", and "di" commands. However, there was no way of recording their glances.

Analysis of the CUBE commands in the CRT. In order to determine the differences between E/non-E and Geography/Business students on the number of commands used such as the number of "f", "t", "k", the number of typing mistakes and total number of search commands, a series 2 x 2 (major by language) ANOVAs was performed. The only significant difference was found for the total number of search commands. Results showed a marginally significant main effect of language ($F(1,36) = 3.9, p = .05$). The non-Es used fewer commands ($M = 114.8$) than did the Es ($M = 146.7$). Results showed no significant differences on the number of use of "f", "t", or "k" commands for major, language or their interaction.

Additional ANOVAs were performed on the proportion of CUBE commands used

by participants in the CRT. Results showed a significant major by language interaction ($F(1,36) = 5.2, p < .05$). Non-E/B participants used smaller proportion of “f” command (Mean proportion = 0.09) than did the remaining participants (average Mean proportion = 0.21). There were no significant differences on the proportion of other CUBE commands.

In order to find differences between E/non-E and Geography/Business participants in the total number of “di” command, an indicator of how often they browsed references, a 2 x 2 ANOVA was performed. Results showed a significant main effect of language on browsing bibliography references ($F(1,36) = 4.64, p < .05$). Non-Es browsed fewer references ($M = 27$) than did Es ($M = 36$). There was, however, no significant effect either for major or for language-by-major interaction ($F(1,36) = .07, p = .78$; $F(1,36) = 1.69, p = .20$ respectively). There is, however, a problem obtaining an accurate count of “di” command use. There is sometimes more than one book for a topic in a menu, and by typing “di” once, a user can browse all the existing books for that topic simply by pushing the return key.

A 2 x 2 ANOVA was also performed on the number of typing mistakes participants made. Results showed no significant differences for either major, language, or for interaction ($F(1,36) = 2.7, p = .10$; $F(1,36) = .93, p = .33$; $F(1,36) = 1.96, p = .16$ respectively). They made on average 25 typing mistakes.

Although I had hoped to find the number of each of the above commands for each of the six questions, it was not feasible. The reason is that participants shifted from question to question during their search in unpredictable ways making it impossible to track with a simple data analysis programme.

The strategies used by participants in the CRT. Participants found information about the six questions through different strategies. Seven participants (17%) tried only one command such as “k”, “t”, or “lc”. Of these seven, three were non-E/G, three non-

E/B and one E/B. In addition, 18 participants (45%) tried a combination of two commands such "k-t", "k-lc", or "t-lc"; six were E/G, two were E/B, five were non-E/G, and three were non-E/B. For example, these participants typed residential mobility following "t" command, then they tried the same keyword with "k" or "lc" commands. Eight participants (20%) tried a combination of three commands such as "k-t-lc" and "lc-c, dk"; three were E/G, two E/B, two non-E/G, and one non-E/B. For example, they typed "native education" following "t" command, then tried the same keyword with "k" and "lc" commands. Finally, seven participants (17%) tried combination of four commands such as "k-t-a-lc" and "k-t-lc-dk"; four were E/B and three were non-E/B. 75% of the participants used "f" or "b" commands to browse similar topics and the remaining used only "di" command to browse the information. Of these remaining, three were E/G, two non-E/G and five non-E/B. It was not possible to test for differences in these small frequencies. But visual inspection suggests no large E/non-E or G/B differences.

Overlap of keywords in the WAT and CRT. In order to determine keyword overlap between E/non-E and Geography/Business students, the number of keywords generated in the Word Association Task and in the Computer Retrieval Task for questions in and out of a participant's major was counted. In addition, the number of the CUBE keywords suggested at the end of some bibliographic references was also counted. CUBE suggests keywords at the end of a reference if one uses "k", "lc", or "dk" commands to search information. For example, if one types "k Brazil, rural" searching information for the topic of question "rural survival in Brazil", the CUBE menu shows a list of alphabetically close topics to the keywords. One can choose one of the topics from the list such as "Brazil, rural conditions" then by using "di" can see a reference ending with the CUBE suggested keywords: "Peasantry--Brasil, Brazil-rural-conditions, Brazil-social-conditions, Brazil--politics and government, Aguiar--Neuma".

Participants generated, on average, 2.3 direct and 5.1 indirect keywords for the

questions in their major in the WAT. On average, they typed 3.9 direct and 3.8 indirect keywords for the same questions in the CRT. The overlap of the direct keywords in the WAT and CRT was 28% and for indirect keywords was 11%. Participants used the CUBE keyword suggestions, on average, 2.5 times. Table 3 shows the average number of written/typed direct/indirect keywords and their overlap in major/out of major questions in the WAT and CRT, and also it shows, on average, the frequency of use of keywords suggested by CUBE by each of the four groups. I should note that some of the participants repeated the same keywords, mostly direct ones, using different commands in the CRT. For example, a participant might type a keyword such as "computer" after both the "t" and "k" commands. But in counting the keywords the repetition of keywords is not included.

There are several features of the results shown in Table 3 that deserve mentioning. First, E students generated a greater proportion of indirect keywords ($6.8/8.6 = 79\%$) in their major than did non-Es ($3.4/6.2 = 55\%$) in the WAT. Both Es and non-Es generated a smaller proportion of indirect keywords in the CRT than in the WAT ($4.3/7.9 = 54\%$; $3.4/7.6 = 44\%$ respectively) for the questions in their major. For the questions out of their major Es generated again a greater proportion of indirect keywords in the WAT (75%) than did non-Es (48%). Again, the proportion of indirect keywords for the same questions became smaller in the CRT for both E and non-Es. Es generated a proportion of 50% indirect keywords for the questions out of their major and non-Es did 34%. These results suggest an influence of the task on the participants' associations.

In order to determine the differences between E/non-E and Geography/Business students in generated keywords for the questions in their major two sets of 2×2 ANOVAs were performed. First, a set of ANOVAs was performed on the number of direct and indirect keywords in the WAT. A 2×2 ANOVA on the number of direct keywords showed no significant main effect for major or language or interaction. A 2×2 ANOVA

Table 3

The Average Number of The Direct/Indirect Keywords in the WAT and CRT, the Overlap Keywords E/non-E and Geography/Business Participants In their Major/Out of Major, and the Usage of CUBE keywords suggested.

keywords	E/G	N/G	E/B	N/B	E total	Ntotal	G total	Btotal
In major								
WAT direct	1.5	1.9	2.0	3.5	1.7	2.8	1.7	2.8
WAT indirect	7.4	4.4	6.3	2.5	6.8	3.4	5.9	4.2
WAT total	8.9	6.3	8.3	6.0	8.6	6.2	7.6	7.1
CRT direct	4.1	3.4	3.0	5.0	3.6	4.2	3.7	4.1
CRT indirect	3.8	2.6	4.8	4.1	4.3	3.4	3.2	4.5
CRT total	7.9	6.0	7.8	9.1	7.9	7.6	6.9	8.6
WAT/CRT direct overlap	1.2	1.0	1.2	2.0	1.2	1.5	1.1	1.6
WAT/CRT indirect overlap	0.4	1.1	1.5	0.7	0.9	0.9	0.7	1.1
WAT/CRT total overlap	1.6	2.1	2.7	2.7	2.2	2.4	1.8	2.7
Out of Major								
WAT direct	1.7	2.2	1.6	3.2	1.7	2.7	1.9	2.5
WAT indirect	5.0	2.6	5.4	2.4	5.2	2.5	3.8	3.8
WAT total	6.7	4.8	7.1	5.6	6.9	5.2	5.7	6.3
CRT direct	3.7	4.5	3.7	4.7	3.7	4.6	4.1	4.3
CRT indirect	4.6	2.8	2.7	2.1	3.7	2.4	3.7	2.4
CRT total	8.3	7.3	6.5	6.8	7.5	7.0	7.8	6.7
WAT/CRT direct overlap	1.2	1.4	0.6	1.9	0.9	1.6	1.3	1.3
WAT/CRT indirect overlap	1.2	1.0	0.5	0.1	0.9	0.5	1.1	0.3
WAT/CRT total overlap	2.4	2.4	1.2	2.0	1.8	2.2	2.4	1.6
CUBE suggestions used	3.3	1.0	4.0	1.8	3.6	1.4	2.1	2.8

on the number of indirect keywords in the WAT showed, however, a significant main effect for language. As seen in Table 3, Es generated on average of 6.8 indirect keywords in the WAT and non-Es 3.4 ($F(1,36) = 8.6, p < .01$). Second, a set of ANOVAs was performed on the number of direct and indirect keywords generated in the CRT. There was no significant main effect for major or language on the number of direct keywords in the CRT. There was, however, a significant major by language interaction on the number of direct keywords in the CRT. Non-E students in Business typed, on average, five direct keywords in their major, and the remaining participants, 3.5 ($F(1,36) = 9.4, p < .01$). A 2×2 ANOVA on the number of indirect keywords in the CRT showed no significant main effect for major or language or language-by-major interaction. Es/non-E and Geography/Business students typed on average 3.8 indirect keywords in the CRT task.

Results showed no significant difference among participants in overlap of direct keywords for the questions in a participant's major in the WAT and CRT. As calculated from Table 3, of the 2.3 average direct keywords in the WAT, and the 3.9 average direct keywords in the CRT, only 1.4 words overlapped (29%). A 2×2 ANOVA on the overlap of indirect keywords in the WAT and CRT showed a significant major-by-language interaction ($F(1,36) = 4.5, p < .05$). E/Gs had, on average, less overlap of indirect keywords ($M = 0.4$ words) than did the remaining participants ($M = 1.1$ words). Of the 4.2 average indirect keywords in the WAT and the 2.9 average indirect keywords in the CRT, only 0.9 words overlapped (11%). Thus, direct keywords tended to be repeated much more often between the WAT and CRT than did indirect keywords. This is probably because participants could copy words directly from the questions more reliably than they could think of indirect associations.

In order to find the differences among participants in generating keywords for the questions out of their major in the WAT and CRT, two sets of 2×2 ANOVAs were performed on the number of out-of-major direct and indirect keywords (lower half of Table

3). The first set was performed on the number of keywords in the WAT. A 2 x 2 ANOVA on the number of direct keywords in the WAT showed a marginally significant main effect of language. Es wrote, on average, 1.7 direct keywords in the WAT and non-Es wrote 2.7 ($F(1,36) = 3.98, p = .05$). There was no significant main effect of major or major-by-language interaction. Results of a 2 x 2 ANOVA on the number of indirect keywords in the WAT showed a significant main effect for language. Es generated, on average, 5.2 indirect keywords and non-Es 2.5 ($F(1,36) = 9.87, p < .01$). There was, however, no significant main effect for major or major-by-language interaction ($F(1,36) = .03, p = .86$; $F(1,36) = 1.01, p = .32$ respectively). The second set of 2 x 2 ANOVAs was performed on the number of direct and indirect keywords in the CRT. However, results did not show any significant difference among participants on the number of typed direct and indirect keywords for the questions out of their major in the CRT.

The overlap of direct keywords from the WAT and CRT for the questions out of the participants' major was 1.3 words (26%) and the overlap for indirect keywords was 0.7 (10%). In order to determine the differences in the overlap of the keywords from the WAT and CRT, 2 x 2 ANOVAs were performed. Results showed a significant main effect for language ($F(1,36) = 4.7, p < .05$); non-Es had more direct keyword overlap ($M = 1.6$ words) than did Es ($M = .9$ words). Results showed also a significant main effect for major on the overlap of indirect keywords ($F(1,36) = 8.7, p < .01$). Geography students had greater overlap of indirect keywords (M times = 1.1) than did business students (M times = .3).

Taken together the differences in direct and indirect keyword usage and overlap suggest that there is a general tendency to use fewer indirect keywords in the CRT than in the WAT. The tendency to use fewer indirect keywords in the CRT is greater when participants search for information about an unfamiliar topic. The low overlap of keywords

suggests that participants were not reliable in generating the same keywords, especially indirect keywords, from one time to the next. The task by language interactions suggest that Es are more affected by the task than are non-Es.

Speed of task completion.

Although, as previously noted, non-E participants listed significantly fewer associations in the WAT and fewer references in the CRT, they did not take significantly less time than E participants to complete either task. Es completed the WAT in 10.8 minutes and non-E in 11.4 minutes ($F = (1, 36) = .06, p > 0.50$); Es completed the CRT in 50.0 minutes and non-Es in 50.5 minutes ($F = (1, 36) = .02, p > 0.50$). This suggests that non-Es were slower in reading or writing or thinking of associations. The CRT results did not allow me to estimate relative contributions of reading, writing and thinking speed to the difference in E/non-E association rates, simply because the more a participant wrote (typed), the more CUBE gave back to read. However, because the WAT required minimal reading (6 questions = 35 words), the difference in the rate of WAT keyword production suggests that non-Es were either slower at writing or at thinking of relevant words or phrases.

The results of the speed in completion of the Questionnaire Background showed a significant difference for both major and language. G participants completed the questionnaire in 7.5 minutes and B participants in 5.7 minutes ($F = (1, 36) = 4.14, p < 0.05$); Es completed the questionnaire in 4.5 minutes and non-Es in 8.4 minutes ($F = (1, 36) = 16.07, p < 0.001$). This may attributed to the non-Es' slowness at reading or thinking of words or phrases, but I do not have any explanation for the difference between Gs and Bs except the stereotype about business students as people eager to do things fast!

In order to examine the relation between language competency and speed, correlations were performed. The correlation between the non-Es' years of studying

English with their time to search information using CUBE was significant ($r(21) = -0.62$; $p < .01$). The more competency in English, the faster they searched information.

Analysis of the books recorded in the CRT

Other indicators of search performance in the CRT came from the Call Number Sheet. Recall that participants were asked to write down the call number of each book found in their Computer Retrieval Task they believed relevant to the six questions. The space provided in the Call Number Response Sheet allowed them to record the call number of about eight books for each question. Some participants recorded fewer than eight books and some wrote more than eight books for each question (Appendix 8 shows two examples of the Call Number Sheet). The number of recorded books for each question and the total number of books for the six questions were counted. The higher the number of books listed, the greater a participant's chances of success in finding relevant information.

A total of 1363 books were recorded by the 40 participants. On average, each participant recorded 34 books, almost six for each question. In order to determine the differences between E/non-E and Geography/Business students in the number of retrieved books per question, a $2 \times 2 \times 6$ ANOVA was performed. Results showed a significant main effect for language ($F(1,36) = 4.6$, $p < .05$). Es recorded more books ($M = 6.5$) than did non-Es ($M = 5.4$). There was no significant main effect for major ($F(1,36) = .34$, $p = .55$) and no significant major-by-language interaction ($F(1,36) = 2.3$, $p = .13$). There was, however, a significant main effect for questions on the number of the recorded books ($F(5, 180) = 4.4$, $p < .001$). Participants retrieved, on average, the most books for the "Residential mobility" question (7.2 books), and the least for the "News media" question (5.1 books). The average number of retrieved books for the remaining questions: "Computer effect, Native education, Rural survival in Brazil, Commodity market" was in

order 5.3, 6.1, 5.5, 6.3.

In order to determine the difference between E and non-Es in the number of books recorded for the questions in and out of their major, a 2 x 2 (language by in/out of major) repeated ANOVA was performed. Results showed a marginally significant main effect for language ($F(1,38) = 3.9, p = .05$). Es recorded more books for the questions in and out of their major ($M = 13.1$ & 12.7 books respectively) than did non-Es ($M = 11$ & 10.8 books respectively)

Relevance of the recorded books in CRT. The number of books recorded was taken as an indicator of success in finding relevant information. A recorded book or document, however, does not necessarily contain an answer to the question. There are many titles that do not represent the contents of the book as relevant information to the question being asked. Thus, the CUBE references a user judges as relevant (by their title, keywords, author, etc.) may in fact contain no relevant information, and those judged irrelevant may in fact contain much relevant information. There are several reasons for this. For example, the title may be misleading (e.g., the Persian book "The Third Line" and the English book "The Silent Spring").

As a final analysis of my results, I attempted to estimate how much material in the books that participants recorded from CUBE was actually relevant to the topic of one of the six questions I asked them to research. This proved to be a very difficult task. Ideally, one should go to the stacks and read each book selected by participants in order to judge its relevance. In practice, this would require that I read over 1,000 books! I did not have the time, so in consultation with my advisor, I perused a small sample of these books, looking for large language and major differences in the amount of relevant material.

Because this analysis was exploratory, I randomly selected five participants from each of the four groups (E/non-E, Geography/Business) then I selected at random just one title listed in their Call Number Response Sheets under the question about "rural survival in

Brazil". I took the resulting list of 20 call numbers, went to the library, found each book and looked for relevant material. My criteria for judging relevance of material was fairly loose. I reviewed the Table of Contents, scanned the chapters, and looked at the index of a book to see how many pages existed in the book related to the topic of the question (e.g., see Appendix 9 as samples of process of book review). For example, I looked for chapters and pages (index) talking about peasantry, rural life, farming, agriculture, or land reform. The number of pages related to the topic of the question was counted as indicator of relevance. Then a 2 x 2 ANOVA on the pages was performed. Despite the language and major differences found in the number of books retrieved, the results did not show any significant differences among the participants; $F(1, 38)$ for major was 2.8 ($p = .11$), for language 1.61 ($p = .22$) and for major-by-language interaction 2.7 ($p = .22$). The average number of pages related to the topic was 70.

Discussion

The major purpose of the present study was to determine the extent to which four variables affected the search process and search success of computer bibliographic system users: knowledge of English, knowledge of the search topic, knowledge of the bibliographic classification system, and familiarity with computers. Search processes divided into two classes: linguistic (e.g., direct vs indirect keywords) and strategic (e.g., use of "Title" "Author" "Keyword" commands in CUBE). The Word Association Task (WAT) allowed some assessment of linguistic processes. The Computer Retrieval Task (CRT) allowed assessment of added strategic processes.

Results of the Word Association Task indicate that native English speakers generate more keyword associations to a search topic than do speakers whose first language is not English. Furthermore, more of the keywords used by native English speakers are indirect or remote, reflecting greater familiarity with abstract linguistic categories like those of most

bibliographic classification schemes. Results also indicate that users generate fewer keyword associations to a search topic with which they are unfamiliar than to a search topic with which they are familiar. When searching a familiar topic, both native and non-native English speakers generate proportion an approximately equal number of direct and indirect keywords. However, native English speakers continue to generate an equal proportion of direct and indirect keyword associations for an unfamiliar topic while non-native English speakers resort to direct keywords for these topics. Unfortunately, because all participants in the study were familiar with computers and only one was familiar with the Library of Congress classification system, there was insufficient variability in these variables to test their relation to search processes or success.

Taken together, the native language results and the topic familiarity results of the Word Association Task point to the importance of vocabulary and knowledge of special word meanings in generating potentially useful keywords. Thus the present results confirm previous conclusions of Furnas, Landauer, Gomez, and Dumias (1983) and of Thorngate and Hotta (1990). Yet the present results also qualify previous findings. When searching a familiar topic, general English language limitations may be of little consequence, simply because familiarity implies knowledge of a topic and its contexts which in turn imply a vocabulary of direct and indirect associations sufficient to make use of hierarchical and associational classification schemes. Thus, for example, a Chinese graduate student with limited English studying social psychology in Canada will probably still know that research on "conformity" may be found under "conform/conforming/conformity" (direct associations) and under "social comparison," "social pressure", "compliance", "obedience," "Asch, Kretch, Crutchfield," etc. (indirect associations) because learning these associations was part of the student's undergraduate education in China. In such familiar territory, the only relative disadvantage that a non-native English speaker might have would come from a slower rate of recalling such

associations. But the slower rate might be overcome by extra patience and perseverance.

Of course, the potential of extra direct and indirect associations for increasing bibliographic search success can only be realised if the associations are used with appropriate bibliographic search strategies. Just as there is no advantage to use the "k" or "a" commands of CUBE without knowing relevant keywords or authors, it is also of no advantage to know relevant authors or keywords without knowing how to use the "k" or "a" commands. Here almost participants fell short regardless of their native language or their major. As a result, it is difficult to argue that native English speakers would be more successful than non-native speakers.

Especially striking was the popularity of using the commands "f" (show next 10 lines of keywords) and "b" (show previous 10 lines) rather than "k" (keyword) and "lc" (Library of Congress subject heading). Perhaps the most common strategy among all groups of participants was first to use the "t" or "k" command with a direct keyword, then to browse the resulting references (often over 100) using the "f" and "b" commands repeatedly, or to browse the references from the alphabetically neighboring keywords. Thus, for example, after typing "t residential mobility" in search of book titles relevant to the "What drives residential mobility" question, a typical subject would next examine the resulting three references using "f" and "b" (after "di" for display title), then browse references under the neighbouring headings of "residential development," "residential migration", and "residential planning". Following unsatisfactory searches of these neighbours, a typical participant would then type "k residential mobility" looking for references by keyword rather than title. Further browsing of alphabetically neighbouring keywords would then occur. The participant would write the call numbers of the ones sounding most relevant. And a search for information about one of the remaining five questions would begin.

There are two interesting implications of this typical strategy. First, because users

switch CUBE commands more often than they switch keywords, an ill-chosen keyword can multiply its failures. I should note that because of the structure of CUBE, it is possible for the same keyword to browse different references with different commands. Some of the references found by "k residential mobility," for example, are not same as those found by "t residential mobility" so the two searches are not entirely redundant. It would be interesting to determine empirically if the alternative strategy of continuing with a command and changing the keyword would produce more new references and a higher success rate.

The second interesting implication of the typical CUBE search strategy concerns the method of browsing. The alphabetical neighbours that are typically browsed do not necessarily reflect conceptual similarities. Thus, for example, even though "urban mobility" and "urban migration" are alphabetically close, they are very different topics than the more alphabetically distant "urban mobility" and "residential shifts." Some of the participants commented that their favourite search strategy was to find just one relevant-sounding reference using CUBE, then walk to the stacks to find the reference and browse the books nearby. Judging from their files, none of the participants realized that the same strategy can be accomplished using CUBE: write down the call number of the one reference, then use the "c" (call number) command with the call number to show it again on the screen surrounded by the books that are neighbours on the shelves following "f" and "b" commands. Indeed, this use of CUBE can be preferable to the walk, because the titles of checked-out books can be seen this way too.

Another striking aspect of the participants' information search is the small overlap of keywords between the WAT and CRT. This suggests that the associations, especially the indirect ones, are not fixed but rather are susceptible to many influences. Some of these influences are surely related to the task. The WAT asked participants to generate keywords on their own. In contrast, the CRT confronted participants with the CUBE way of doing

things, which could result in several influences on their search process. For example, if a CUBE user sees "Brazil, social conditions" on a menu while looking for information about the economy of Brazil, he/she might mimic the example by typing "Brazil, economic conditions". The CUBE-suggested keywords can also be a popular source of influence. The extent of these influences suggests that designers of bibliographic search systems pay close attention to the human-computer interface.

The small overlap of selected books recorded on the participants' Call Number Response Sheets reflects the results of previous studies (Furnas et al, 1983; Thorngate & Hotta, 1990; Tinker, 1966), and the participants' different associations to words and ideas. Not surprisingly, the overlap is greater within one's area of expertise; this probably reflects knowledge of a common vocabulary that comes from study in the area. Outside their areas of expertise, many of the participants seemed to be guessing wildly at keywords. For example, while geography majors were typing seemingly relevant keywords such as "rural life in Brazil", "social conditions in Brazil" and "rural geography in Brazil" to find information about rural survival in Brazil, one business major attempted to find information by typing "animal preservation, Brazilian animals".

Of course, it is reasonable to ask just how often a business major would want to find information about rural survival in Brazil. It may be that whatever disadvantages and extra difficulties nonexperts face are rarely encountered because people rarely look for information about unfamiliar topics. There are many people who repeatedly look for new information about familiar topics. Sports fans, for example, repeatedly look for game scores. When this happens, previous tactics for finding new information may simply be recalled and repeated. On the other hand, many students are required to write several papers each year on topics about which they know almost nothing. They will frequently face the difficulties and disadvantages of searching as a nonexpert. It would be interesting to survey library users about their familiarity with the topic they are searching in order to

estimate how often users go far from their areas of expertise.

Perhaps librarians would suggest that users of all kinds, and especially those far from their field of study, make more use of the Library of Congress classification system. Because all of the participants reported making frequent use of the library and CUBE, it was surprising to observe how few of them used CUBE's "lc" command that can be very helpful in finding information as it is catalogued in the library. This suggests that they have not been well-trained in CUBE use.

Better training in CUBE and the use of its commands would probably be helpful, but so might a modification of the Library of Congress classification system. The hierarchical classification scheme of the LC makes it sensitive to the order of searching. For example, a user looking for information about education in Canada will find nothing by typing "k Canada, education" but will find much by typing "k education, Canada". To make matters more confusing, the "topic, Country" hierarchical order changes for different topics. A user will find nothing about rural life in Brazil by typing "rural life, Brazil" but will find something by typing "Brazil, rural life"!

My perusal of the small sample of books selected by 20 subjects to find information about "rural survival in Brazil" suggests that despite significant differences in search processes and in the number and titles of books retrieved, most participants would still uncover a large amount (on average, about 70 pages) of information. Libraries as large as the one at Carleton University often have many books about the same topics. This redundancy seems to counterbalance the inefficiencies of users' search strategies and the variety of books they retrieve. However, purchasing more books with different titles that say the same thing seems to be an expensive way to create redundancy. I think a less expensive way is to provide more information on CUBE about each book, for example, about chapter titles and abstracts. Many participants in the experiment told me that they

preferred the bibliographic CD-ROMs to CUBE because the CDs provide much more complete bibliographic information (e.g., abstracts). This makes it easier for them to judge the relevance of a reference without leaving the terminal to search for it in the stacks.

The large amount of information that most participants were able to retrieve about "rural survival in Brazil" does not necessarily imply that most of their searches were successful. I did not determine whether the sections of books they retrieved were really relevant to answering the question "rural survival in Brazil?" But the relevance would presumably vary with the goal of their search. A student assigned a one-page essay on the topic for a course assignment may consider the search quite successful. In fact, if only a short summary of "rural survival in Brazil" was wanted, the amount of information retrieved might be judged to be excessive. Perhaps that is why many students often look only for one reference rather than for as many as possible. In contrast, a student attempting to write a dissertation on "rural survival in Brazil" might consider the search unsuccessful because it resulted only in previously known information, summary information or information out of date. It would be worthwhile to conduct more research on the strategies and problems faced by library users having such different search goals.

Judging from the number and type of typing errors made by participants, the efficiency of information searching could be improved by modifications to CUBE. Some of these would be quite simple. For example, it was common for participants to forget to type a command letter ("t" "t" "a" etc.) before typing a keyword, and especially common when they were using the same command repeatedly ("k rural" "k Brazil" "k migration" etc.). Perhaps CUBE could be modified to use the previous command by default. At the moment, CUBE responds only with "It is an invalid option, use HELP menu for more information." If the previous command can't be used by default, then perhaps the error message could be more meaningful (e.g. "Gee, CUBE doesn't understand the command 'Brazil'. Maybe you forgot to type a command. Here is a list of them:").

The "c" command can be very useful for browsing on CUBE as one would in the stacks, but it can be made more useful with a simple modification. Participants discovered that CUBE recognizes only upper case letters for call numbers. Thus, "c BF934.J9" works fine, but "c bf934.j9" produces a completely different reference (e.g., see Appendix 10). Those who tried the "c" command with lower case letters usually became intimidated by the wrong references and stopped using it. Perhaps the CUBE programmers could modify it to accept lower case letters.

Though these and similar minor modifications to CUBE would probably help users to search for books in the library more easily, they may not be as important as providing more information on CUBE about each book and more training for users. As mentioned previously, participants appreciate the annotations to references usually provided by CD ROMs. Ideally, similar annotations would appear on CUBE for each book in the library. But it would be very time consuming to enter these annotations, and someone would have to read all those books! As a compromise, perhaps it would be worthwhile to provide chapter titles for each book. But it would be time consuming to enter as well. Before entering them, it would be important to determine how often users would make use of the chapter titles and keywords that are at the end of each reference, and what use they make of them. Results of the present study suggest that users sometimes copy the existing keywords to modify their next CUBE search command. Research is needed to determine how often users may use the keywords and chapter titles to decide whether or not they will bother to look at the book.

Because information on CUBE is structured by the Library of Congress information classification system, it would probably be helpful to users to know more about the system and how to use it as Chan and Dhar (1988) recommended. At the moment, users must leave the CUBE terminal and walk to the LCSH manuals at the Library information desk in order to find terms relevant to a search. It would be much more

convenient if the LCSH contents were available on CUBE. Training in its use could also be provided on CUBE, perhaps with training modules and exercises that could be run as an additional CUBE command. This might also be a way to provide training about different search tactics. It would be interesting to conduct additional experiments on the design and use of such online CUBE training programmes.

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Appendix 1

Background Questionnaire

Thank you for your participating in this experiment. Please answer the following questions:

1. Your sex ☐ male ☐ female
2. Your birth day ____/____/____ (day/ month/ year)
3. What is your major? ☐ Business ☐ Geography ☐ Other
4. Your academic status ____ year in ☐ B.A ☐ M.A ☐ PhD
5. Is English your first language? ☐ yes ☐ no

If YES please go to question 7; if NO please answer question 6, 6a to 6c.

6. What is your first (native) language? _____

6a. How well do you think you read, write and speak English? Please circle a number that represents your rating on the scales below

I read English: poorly 1 2 3 4 5 6 7 8 9 very well

I write English: poorly 1 2 3 4 5 6 7 8 9 very well

I speak English: poorly 1 2 3 4 5 6 7 8 9 very well

6b. How many years have you studied English? _____ years

6c. Where have you studied English? _____

7. How long have you lived in Canada? _____ years

8. In the past month how often have you used a computer? _____ times

9. How often have you used the following kinds of computer applications in the past month?

<u>Application</u>	<u>number of times in the past month</u>
* word processing (e.g., MS Word, Word Perfect)	_____
* data analysis (e.g., SPSS, systat)	_____
* Information retrieval (e.g., CUBE, CD-ROM, Hermes)	_____
* other (please state which) _____	_____

10. About how many times did you go to the library in the past month? _____ times

11. What was your main purpose for going to the library in the past month?

☐ to check out specific books

☐ to search information about a topic

☐ to find a quiet place to study

☐ other, please explain _____

12. Have you ever had problems finding information in the University Library ?

☐ yes ☐ no

12a. If YES what have been the most common problems?

12b. If YES what did you do?

☐ asked friends for help

☐ asked professors for help

☐ asked librarians for help

☐ other (please explain) _____

13. How familiar are you with the Library of Congress Catalogue System? Please circle appropriate number.

completely unfamiliar 0 1 2 3 4 5 6 7 8 9 very familiar

14. Do you know what is meant by the Library of Congress Subject Heading?

☐ yes ☐ no

15. How many times in the past month did you consult the Library of Congress Subject Heading Manual? _____ times

Appendix 2**Word Association Task**

Please write down all keywords and phrases you believe would be useful to find information about the following topics in appropriate blank below.

1. What drives residential mobility?
2. How do computers affect employees?
3. How can we provide a better education for native people in Canada?
4. News media in the Third World.
5. Rural survival in Brazil
6. What is a commodity market?

Appendix 3**Rating Familiarity Sheet**

How familiar are you with each topic? Please circle the appropriate number for each topic.

1. What drives residential mobility?

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

2. How do computers effect employees?

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

3. How can we provide a better education for native people in Canada?

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

4. News media in the Third World.

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

5. Rural survival in Brazil

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

6. What is a commodity market?

completely unfamiliar 1 2 3 4 5 6 7 8 9 very familiar

Appendix 4**CUBE DIRECTORY**

Commands: T	title	e.g. T Studies in European politics
A	author	e.g. A Porter John
LC	LC subject heading	e.g. LC housing and health
DK	document keyword	e.g. DK mining companies
K	keyword/subject	e.g. K biochemistry
C	call number	e.g. C FC2041.G75
RSV	course no./prof's name	e.g. RSV 45.324 or RSV LAIRD

DI or DI # to display records from the index

GET # to display a specific record from a group of hits

B to browse backwards

F to browse forwards

I to display the current index

Keys: RETURN (with no input) - displays the directory

(CR TO GO) - means press RETURN

For assistance in using any command, enter HELP followed by the command.

For additional commands enter HELP MENU or HELP MENU2 or HELP MENU3

Appendix 5**Instruction**

Thank you again for your participating in the second session. This session will be about 60 minutes. The purpose of the second session is to determine some of strength or weakness of CUBE (Carleton Library Bibliography Inquiry). Before we continue let me ask you do you know what CUBE is.

[explain what CUBE is, if subject says NO]

In a moment I am going to ask you to search for books in the library on six different topics. These six topics are the same topics I asked you to give keywords in first session.

[put Call Number Response Sheet in front of subject and explain it]

Now i want to remind you of how to use CUBE.

[put CUBE Directory in front of subject and explain]

Let's try a few searches.

[show subject how to find "studies in European politics" and "mining companies"]

Before we continue do you have any questions about how to use CUBE. Here is the six topics. In the next 60 minutes I want you to find as many books on these topics as you can. You may search in any order you wish. You can find how much time you have spent so far by looking at upper left corner of the screen.

When you find a book that you believe is relevant to one of the six topics please write down its call number in an appropriate blank space on your Call Number Response Sheet. For example...

[show example of call number and where to write it on response sheet]

You will probably find more books for some topics than others. Write down the call number of those books that you think to be worth to go to the library to review them. Before you begin do you have any questions?

Appendix 6**Call Number Response Sheet**

Please write down the call number of any references you believe is relevant to the following topics in appropriate blanks below.

What drives residential mobility?

How do computers effect employees?

How can we provide a better education for native people in Canada?

Rural survival in Brazil

News Media in the Third World

What is a commodity market?

Appendix 7

Attached are a few pages of a participant's CRT file

a igbaru[0][0][0]

1. IGARSS.....	1
2. Igbafe, Philip Aigbona.....	1
3. Igbalu, F. Chidozie.....	1 (-
4. Igbozurike, Martin.....	1
5. IGCC.....	1
6. IGCP.....	1
7. IGCP Project 158.....	1
8. Igel, Regina.. ..	1
9. Igenbaev, Akyzhan Abdykarimovich.....	1
10. Iger, S.....	1

TO DISPLAY, enter DI # (entry no. on left, e.g. DI 8) or DI (entry at (-)

TO BROWSE, enter B for backwards or up, enter F for forwards or down.

OPTION: a igbaria

1. IGARSS.....	1
2. Igbafe, Philip Aigbona.....	1
3. Igbalu, F. Chidozie.....	1 (-
4. Igbozurike, Martin.....	1
5. IGCC.....	1
6. IGCP.....	1
7. IGCP Project 158.....	1
8. Igel, Regina.....	1
9. Igenbaev, Akyzhan Abdykarimovich.....	1
10. Iger, S.....	1

TO DISPLAY, enter DI # (entry no. on left, e.g. DI 8) or DI (entry at (-)

TO BROWSE, enter B for backwards or up, enter F for forwards or down.

OPTION: k end-user computing

1. END-USE MARKET.....	1
2. END-USE MARKET--NONFERROUS METALS--UNITED STATES.....	1
3. END-USER COMPUTING.....	6 <-
4. END-USER COMPUTING--CASE STUDIES.....	1
5. END-USER COMPUTING--CONGRESSES.....	2
6. END USER COMPUTING--ONTARIO--GOVERNMENT DEPARTMENTS.....	1
7. END-USER COMPUTING TECHNOLOGY.....	1
8. ENDANGERED.....	38
9. ENDANGERED PLANTS.....	3
10. ENDANGERED PLANTS--CANADA.	1

TO DISPLAY, enter DI # (entry no. on left, e.g. DI 8) or DI (entry at <-)

TO BROWSE, enter B for backwards or up, enter F for forwards or down.

OPTION: di 3

1. END-USER COMPUTING

End user searching in the health sciences. 1986

Z699.5.M39E53

FLOOR 1: 1 copy

INFORMATION STORAGE AND RETRIEVAL SYSTEMS--MEDICINE

INFORMATION STORAGE AND RETRIEVAL SYSTEMS--PUBLIC HEALTH

MEDICAL LIBRARIES--AUTOMATION

PUBLIC HEALTH LIBRARIES--AUTOMATION

LIBRARY CATALOGS AND READERS

CATALOGS, ON-LINE

INFORMATION RETRIEVAL

ON-LINE BIBLIOGRAPHIC SEARCHING

END-USER COMPUTING

Press RETURN to continue, enter any alphabetic character to stop display.

2. END-USER COMPUTING

Ontario. Ministry of Revenue. Exploiting end-user computing
technology. Rev. ed. 1988

DOC CA20N RU5 24.S02 .ENG

FLOOR 2 DDV: 1 copy

END USER COMPUTING--ONTARIO--GOVERNMENT DEPARTMENTS

Press RETURN to continue, enter any alphabetic character to stop display.

3. END-USER COMPUTING

Public access CD-ROMs in libraries; case studies. 1990

Z711.P83

FLOOR 1: 2 copies

REFERENCE SERVICES (LIBRARIES)--AUTOMATION--CASE STUDIES

OPTICAL DISKS--LIBRARY APPLICATIONS--CASE STUDIES

INFORMATION RETRIEVAL--CASE STUDIES

DATA BASE SEARCHING--CASE STUDIES

END-USER COMPUTING--CASE STUDIES

CD-ROM--CASE STUDIES

4

Press RETURN to continue, enter any alphabetic character to stop display.

4. END-USER COMPUTING

Library Instruction Conference (14th : 1986 : Eastern Michigan University). Bibliographic instruction and computer database searching. 1988

Z711.2.L7325 1986

FLOOR 2 RED: 1 copy

LIBRARY ORIENTATION--CONGRESSES

COLLEGE STUDENTS--LIBRARY ORIENTATION--CONGRESSES

BIBLIOGRAPHY--METHODOLOGY--STUDY AND TEACHING--CONGRESSES

DATA BASE SEARCHING--STUDY AND TEACHING--CONGRESSES

LIBRARIES, UNIVERSITY AND COLLEGE--AUTOMATION--CONGRESSES

END-USER COMPUTING--CONGRESSES

Press RETURN to continue, enter any alphabetic character to stop display.

5. END-USER COMPUTING

I.F.I.P. W.G. 8.2 Working Conference on Desktop Information Technology and Organizational Worklife in the 1990's (1989 : Ithaca, N.Y.). Desktop information technology. 1990

QA76.9.E53153 1989

FLOOR 1: 1 copy

END-USER COMPUTING--CONGRESSES

INFORMATION TECHNOLOGY--CONGRESSES

Press RETURN to continue, enter any alphabetic character to stop display.

6. END-USER COMPUTING

Haydon, Kelly A. S. (Kelly Anne S.), 1962- Attitudes towards end
user computing: a comparative analysis by job category. 1990

M.M.S. 1990.H39

FLOOR 1 STORAGE THS: 1 copy

FLOOR 1 THS: 1 copy CHECKED OUT; DATE DUE 17 March 93

END-USER COMPUTING

Circulation information displays for all items that have been checked out.

Serials, documents and REF material do not circulate.

OPTION: b

1. END-USE MARKET--NONFERROUS METALS--UNITED STATES

United States. International Trade Administration. Office of Metals,
Minerals, and Commodities. Nonferrous Metals Division. End-use
market for thirteen nonferrous metals. 1986

DOC US1 DC368 86.E55 .ENG

FLOOR 2 DDV: 1 copy

NONFERROUS METALS--UNITED STATES--CONSUMPTION

END-USE MARKET--NONFERROUS METALS--UNITED STATES

OPTION: f

1. END-USER COMPUTING

End user searching in the health sciences. 1986

Z699.5.M39E53

FLOOR 1: 1 copy

INFORMATION STORAGE AND RETRIEVAL SYSTEMS--MEDICINE

INFORMATION STORAGE AND RETRIEVAL SYSTEMS--PUBLIC HEALTH

MEDICAL LIBRARIES--AUTOMATION

PUBLIC HEALTH LIBRARIES--AUTOMATION

LIBRARY CATALOGS AND READERS

CATALOGS, ON-LINE

INFORMATION RETRIEVAL

ON-LINE BIBLIOGRAPHIC SEARCHING

END-USER COMPUTING

Press RETURN to continue, enter any alphabetic character to stop display. d

OPTION: k resistance to change

1. RESISTANCE MOVEMENTS--NICARAGUA--ECONOMIC ASSISTANCE.....	1
2. RESISTANCE OF VECTORS.....	1
3. RESISTANCE (PSYCHOANALYSIS).....	6 <-
4. RESISTANT.....	81
5. RESISTENCE.....	3
6. RESISTERS.....	8
7. RESISTORS.....	5
8. RESMETHRINS.....	2
9. RESMETHRINS--ENVIRONMENTAL ASPECTS.....	1

10. RESMETHRINS--HEALTH AND SAFETY GUIDES..... 1

TO DISPLAY, enter DI # (entry no. on left, e.g. DI 8) or DI (entry at <-)

TO BROWSE, enter B for backwards or up, enter F for forwards or down.

OPTION: t MI.S. quarterly

1. Mi Rumba:.....	2
2. Mi ruta.....	1
3. Mi salon de otono.....	1 <-
4. Mi Santander, mi cuna, mi palabra.....	1
5. Mi scaglio la prima pietra.....	1
6. Mi sendero.....	1
7. Mi senoria comedia en tres actos.....	1
8. Mi sentir y mi cancion.....	1
9. Mi ser y el tuyo.....	1
10. MI six.....	1

TO DISPLAY, enter DI # (entry no. on left, e.g. DI 8) or DI (entry at <-)

TO BROWSE, enter B for backwards or up, enter F for forwards or down.

OPTION: t m.i.s. quarterly

1. M.I.S.:Management dimensions.....	2
2. M.I.S.; Middle East intelligence survey.....	1
3. M.I.S. quarterly.....	2 <-
4. M.I. six.....	1
5. M.I.T. dissertations on management of technology.....	1
6. M.I.T. East Asian science series.....	6
7. The M.I.T. introductory physics series.....	4
8. M.I.T. monographs in economics.....	10

Appendix 8

Attached are the Call Number Response Sheet of two participants.

Call Number Sheet

Please write down the call number of any references you believe is relevant to the following topics in appropriate blanks below.

What drives residential mobility?

HD 7305. T68A85
HD 7267. 96. Q4DA7
M.A. 1973. K75
HD. 7305. A3M525
HB. 1969. N67
HB. 1989. C69

How do computers effect employees?

DOC UN9 LA122 86. P68. ENG
DOC CA1 014 85. H23. ENG
RA569. 3. B75

How can we provide a better education for native people in Canada?

DOC CA1 M150 91. P17. ENF
DOC. CA2AL DE800 91. S26. ENG

Rural survival in Brazil

HD 496. F64
✓HN 283. S77
✓ESI. I58 N. 44
HN 290. 29 V57

News Media in the Third World

PN 47316 BIBL. B75
AN2 BIBL. N42
DOC US1 A300. D165. ENG
etc.

What is a commodity market?

DOC UN9 FA. F12. ENG
DOC UN/TD/B/C. V299
DOC UN9 MF4. P61 ENG

Call Number Sheet

Please write down the call number of any references you believe is relevant to the following topics in appropriate blanks below.

What drives residential mobility?

DS 755. B1.7
BA 1973 G35
BA 1973 H35
BA 1973 W37
SS8 A8 N. 13
HD 7287.5. F77
HD 7287.5. M63
HD 7287.5. R6.

How can we provide a better education for native people in Canada?

B 53 L39 1968
B 105 E94 37
BA 1972
LC 3734 C85
LC 3734 B54
BA 1975 K47
E98 R3M3 1971
P57 F5 R56.

News Media in the Third World

DS 91 W24
HD 9000 5. L29 1977
DN 4784. T4515
P96 T47T46
P96 T47S3
NT 733 H63
HX 450. A6R24

How do computers effect employees?

DA 95 L6323
DA 76.72 A8 M69
DA 76.5. W486
DA 76. B1B1. M55
LC 149.5. C65
HV 99 50 L38
HF 5549.5 M63 N37
HF 5549.5. C35 L65

Rural survival in Brazil

HN 283.5. C5
FN 2521 P58 1968
FN 2521 P58 1973
HC 165 F68
HC 165 F68 1969
HC 187 E84
HC 187 H45
HC 187 L3355

What is a commodity market?

HF 1428. N36
HS 6046. L23
DOC UNTD/273
DHD. 1989 B68
HG. 4910. T38
HD 1927 H67

Appendix 9

Attached are the samples of the process of reviewing the books to judge relevance of the content of the books. The first sample representing as a relevant reference and the second one representing an irrelevant reference for one of the six questions in the experiment: "News media in the Third World".

THE FOLLOWING MATERIAL HAS BEEN REMOVED DUE TO COPYRIGHT RESTRICTIONS.

PLEASE CONTACT THE UNIVERSITY LIBRARY.

LE MATERIEL SUIVANT A ETE ENLEVE DUE AU DROIT D'AUTEUR.

S.V.P. CONTACTER LA BIBLIOTHEQUE DE L'UNIVERSITE.

NATIONAL LIBRARY OF CANADA
CANADIAN THESES SERVICE

BIBLIOTHEQUE NATIONALE DU CANADA
LE SERVICE DES THESES CANADIENNES

Fatemeh Bagherian has given permission to
microfilm her thesis leaving out Appendix 9.
Please add note to your cataloguing.

Appendix 10

Attached is an example of the result of using c (CUBE command) with upper and lower cases.

OPTION: C F1408.A52

1. F1408.A56

Alexander, Robert Jackson, 1918- Today's Latin America. Garden
City, N.Y., Doubleday. 1962 263p.

FLOOR 5: 1 copy

LATIN AMERICA

135125

OPTION: F

1. F1408.A56 1968

Alexander, Robert Jackson, 1918- Today's Latin America. 2d rev.
ed. New York, Praeger. 1968 261 p.

FLOOR 5: 1 copy

LATIN AMERICA

135126

OPTION: f

1. F1408.A5618

Alexander, Robert Jackson, 1918- America Latina, Hoy. Buenos
Aires, Plus Ultra. 1968 1v.

Trans. of today's Latin America.

FLOOR 5: 1 copy

LATIN AMERICA

135127

OPTION: c f1408.a52

1. D.P.A. 1970.D64

Doering, Ronald L. Governmental control of the crown corporation;
the case of Air Canada. Ottawa. 1970 53 leaves.

Research essay (D.P.A.) - Carleton University, 1970.

FLOOR 1 STORAGE THS: 1 copy

CORPORATIONS, GOVERNMENT--CANADA

AIR CANADA

Carleton University. Dissertation. Public Administration.

31173

OPTION: f

1. M.A. 1955.G6

Gosse, Frederick Paul, 1915- The Air Transport Board and regulation
of commercial air services. Ottawa. 1955 131 leaves.

Research essay (M.A.) - Carleton University, 1955.

FLOOR 1 STORAGE THS: 1 copy

FLOOR 1 THS: 1 copy

AERONAUTICS

Carleton University. Dissertation. Public Administration.

31174

OPTION: f

1. M.A. 1956.B58

Bissett, James Byron, 1932- Democratic government and
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DEMOCRACY

Appendix 11**Statement of Informed Consent**

I hereby agree to participate in the study entitled "Fluency in language, expertise and information searching in the library" conducted by Fatemeh Bagherian, a student in Psychology at Carleton University, as a thesis for M. A. degree under the supervision of Professor W. Thorngate. I understand that my participation will be limited to completing a questionnaire about my general background and about my experience in language, computer, and library search, doing an association task on six topics, rating familiarity with the topics, and searching information through a computer. I also understand that my responses to the experiment will be anonymous, and that I may end my participation at any time. I also understand that I will be paid \$10 for completing all three tasks.

signed,

participant: _____

researcher: _____

date: _____

Paid to _____ \$10 for participation

Participant: _____

researcher: _____

END

2 9-05-95

FIN