Experimental Evaluation of CONIT
in DGIS Gateway Environment

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Abstract

Experiments were devised and run to test, in the DGIS Gateway environment, the effectiveness of the retrieval assistance techniques found in the CONIT search intermediary system. Analysis of the experiments demonstrated that there is a large need and demand for improved retrieval capabilities of the kind found in the existing CONIT and in designs for future CONIT systems. However, it is clear that the *current* version of CONIT has only limited possibilities for providing enhanced service for the DGIS community for three reasons related to the incomplete nature of the current system with respect to the design for an expert retrieval assistant: (1) correction of system bugs and smoothing of wording and other assistance features is evidently sorely needed; (2) many of the more advanced retrieval functions have not yet been incorporated; (3) in particular, modern interface techniques (e.g., windowing) and a more automatic assistance mode involving less user interaction appear to be critical to the promised achievement of new, higher, levels of retrieval assistance effectiveness. Recommendations for future directions center on (1) additional experiments of the kind performed in this project to delineate particular techniques most useful and cost-beneficial in the DGIS environment and (2) pursuit of expert techniques of the kind to be found in current CONIT and in designs for the completed expert version of CONIT.

1. Background

1.1 The DGIS Gateway

The DoD Gateway Information System (DGIS) has been developed by the Defense Technical Information Center (DTIC) to enable users to gain easier access to, and make more effective use of, various computer based information resources. For purposes of this investigation we focus on access to and use of document retrieval systems such as Dialog, Orbit, and Elhill of the National Library of Medicine (NLM). The primary assistance provided by DGIS for document retrieval systems has been, until recently, in the nature of easier *access* ; while connection and login protocols were automatically handled for the user, the user still had to contend with learning the basic search operations of each different system and database. This kind of assistance, then, tended to help only information specialists who were already expert in the use of these systems.

1.2 Improvements to DGIS

To provide additional assistance to DGIS users of document retrieval systems DTIC has commenced a program to study how certain so-called *front-end,* or intermediary system, techniques could be applied. In one manifestation of this program the SearchMaestro front-end module -- which provides simplified, menu-based access to the retrieval systems -- has been incorporated into DGIS. While SearchMaestro does make it possible for end users to perform simplified search operations, it provides little in the way of sophisticated assistance for developing effective and comprehensive search strategies of the kind a human expert searcher could be expected to perform. Attention has now been given to how to further improve DGIS so as to incorporate more sophisticated assistance. One aspect of this effort has been the project, sponsored by DTIC in conjunction with contract MDA903-85-C0139 with the Logistics Management Institute (LMI), for which this is the final report: the investigation of how effective techniques of the kind found in the CONIT experimental intermediary retrieval assistance system might be in the DGIS context.

1.3 Advanced User Assistance

CONIT, an acronym for "COnnector for Networked Information Transfer," includes such advanced facilities as a common command language combined with a menu oriented interface mode, automated procedures for converting a user's natural language phrase topic description of his or her problem into an effective search strategy, and other mechanisms for assisting users develop effective search strategies. The version of CONIT around which these studies were conducted can be described as a partial implementation of an "expert" version of CONIT whose design incorporates quantified evaluations of search effectiveness as well as automated search strategy modification techniques based on *a priori* retrieval models and *a posteriori* application of user relevance inputs to determine optimized search modification procedures.

2. The Experimental Program

The basic idea of the current study was to provide a limited number of DGIS users with access to CONIT and to analyze the resultant operation of CONIT as it was employed by the users to perform searches in the bibliographic databases on topics of their current interest. An experimental design was developed with the assistance of Marjorie Powell of DTIC and Cynthia Shockley of LMI.

2.1 Experimental Materials

Materials of several kinds were prepared to disseminate to experimental users. Two questionnaires were devised: one to obtain information from the user *before* system use and a second one to obtain information *after* CONIT use. (See appendix for questionnaires.) A two-page explanation of how to access CONIT was also prepared (see appendix). In addition, users were provided with two lengthy CONIT instructional documents. The first was the CONIT Reference Manual. This 99 page document gives some general information about CONIT plus detailed explanations of how to use each command (presuming one is using the command mode). The second was the CONIT Guide which is an 88-page document showing examples of CONIT use in the menu (new user) mode.

2.2 CONIT Presentation

For some of the users a presentation on CONIT was given. This presentation included a lecture of about one-hour's duration in which the general nature of the CONIT research project, the CONIT experimental system, and the current DTIC/LMI experiments was explained. There followed a live online demonstration of the CONIT system. This demonstration lasted approximately one hour and was viewed by projecting the video from the terminal onto a wall screen.

2.3 Access Mechanisms

Users could access CONIT, which lived on the MIT Multics mainframe computer, in several ways. First, the user could initiate the access from a simple terminal or from a computer, assuming either had telecommunications hardware; in the experiments both methods were employed. Second, communication could be established via direct (possibly long distance) telephone, or by calling through either the Telenet or Tymnet networks (both of which had Multics as a host computer) via a local call to a node on one of these networks, or by establishing a computer-to-computer link via X-25 protocols through one of these networks or via the ARPANET network which also had Multics as a host; the first two of these three options were employed in the experiments. Third, connection between user's terminal or computer could be direct to the networks or mediated by another computer; both kinds of connection were used -- the latter via the dialout (CONNECT) mechanism on the DGIS computer.

Any of the possible combination of access mechanisms appeared feasible. In a few cases noisy lines and line drops did interfere with the reliability of the connection to the detriment of the user and the session. We did not determine that any particular combination of access mechanisms was particularly prone to this kind of unreliability.

2.4 User Types

The user population for the experiments may be categorized in several respects. One categorization is by whether the user actually viewed the presentation. A second categorization has to do with the type of user. Two broad categories were established: (1) end users (do searching for their own needs); and (2) intermediary searchers (do searching for others). More refined categorization of users is possible by considering how much actual searching experience each user has had as well as several other factors. Such categorization will be considered in the analysis of the experimental results.

3. Overview of Experimental Statistics

3.1 User Groups and Individuals

Potential experimental users were identified as coming from several groups: information scientists and information specialist intermediary searchers at DTIC and LMI and engineers and scientists at DTIC, LMI, and two organizations that were currently users of DGIS. The above-described information about CONIT and the experiments was given to about 8 individuals in these groups who were encouraged to run experimental sessions. A few initial sessions were run at the end of July and the first two weeks of August. The bulk of the sessions were run in the last two weeks in August (following the August 18 CONIT presentation) and the first three weeks in September. A final session was run on October 13, 1988.

A total of 33 sessions were recorded in the course of the experiments. These 33 sessions were identified as being run by 10 different users. The 10 users can be categorized as follows: 2 information scientists, 3 expert (intermediary) searchers, and 5 (other) engineers/scientists. The two information scientists did not regularly do searching for others and so, along with the 5 engineers, may be classified as end users. The 3 intermediary searchers had a wide spectrum of experience in this activity. A detailed summary of each user and each session is included in Appendix A of this report.

3.2 Summary of Session Statistics

Some of the 33 sessions were only of a tentative or preliminary character. It appeared that most of these tentative sessions were attempts simply to verify that connection to CONIT could be accomplished successfully. In these cases the session was stopped, often by simply dropping the line, after no more than a successful login and a few requests for general information about CONIT as can be made in the early session dialog. Two users had sessions of *only* this limited kind. There remains a total of 18 sessions of a more substantial nature run by the other 8 users. Of the 18 substantial sessions 13 can be characterized as *productive* by virtue of the fact that relevant documents were retrieved. Seven of the eight users with "substantial" sessions had productive sessions. The five "substantial" but "non-productive" searches were scattered among 4 different users. Reasons for non-productivity are given in the appendix descriptions and further analyzed in the body of the report.

The 33 sessions lasted a total of a little more than 18 hours, mostly derived from the "substantial" sessions. It was observed that for each minute of connection online users averaged about 3 interactions with CONIT (i.e., 3 inputs to the system). Therefore, the 33 sessions included about 3,000 inputs from users (and, of course, a like number of responses from the CONIT system).

4. Analysis of Experiments

4.1 Overview of Analysis

While there was too little data collected in these experiments to derive *detailed* answers on all questions one would like to address on DGIS enhancements, many trends appear quite clear. The overall conclusion is that there is a large need and demand for improved retrieval capabilities of the kind found in the existing CONIT and in designs for future CONIT systems. However, it is clear that the *current* version of CONIT has only limited possibilities for providing enhanced service for the DGIS community for three reasons related to the incomplete nature of the current system with respect to the design for an expert retrieval assistant: (1) correction of system bugs and smoothing of wording and other assistance features is evidently sorely needed; (2) many of the more advanced retrieval functions have not yet been incorporated; (3) in particular, modern interface techniques (e.g., windowing) and a more automatic assistance mode involving less user interaction appear to be critical to the promised achievement of new, higher, levels of retrieval assistance effectiveness.

4.2 Recall Effectiveness

A major parameter for judging the effectiveness of searching is *recall:* the number of relevant documents retrieved. There were 7 users who advanced in their sessions to the point where searches were actually performed. Four of the users performed searches on two topics each making a total of 11 topics searched among those 7 users. Relevant documents were retrieved in every one of the 11 topics as outlined in Table 1.

Recall was clearly quite high in several cases: greater than 100 for user U3 and for topic 2 of user U7 and greater than 50 for topic 1 of user U1. In one case (U4) a more moderate recall (about 10-15 moderately to highly relevant documents) was achieved. In a few cases, although there were some definitely highly relevant retrievals, the *absolute* value of the recall was low (topic 2 of U1 and topic 2 of U5). In two cases, while the actual number of relevant documents was not determined with any degree of accuracy, it appears that relevance was minimal (topic 1 of U5 and U6). In other cases *raw* recall was of an intermediate value but we did not get accurate relevancy judgements. In the single case of topic 1 for U2, where a *particular* journal article was sought, *that* article was not found (it was later determined that it was not entered into the online database) but several articles on the given topic *were* found.

4.3 Evaluation of Results

In order to derive definitive conclusions about the effectiveness of CONIT techniques in the above circumstances we would need three additional kinds of data: (1) additional *numbers* of users, topics, and sessions; (2) more detailed analysis (e.g., of the kind we have previously done in which *fractional* recall, in addition to absolute recall, is determined); and (3) more *comparative* analysis (e.g., to compare search results for the same topics with other searchers and retrieval assistance systems). While the present project did not permit as much analysis of this kind as we would have desired, we do have definite trends and suggestive indications to report.

On the positive side one may be impressed by the fact that searching in every one of the 11 topics yielded relevant documents and, in about a third of the cases, a sizable recall was

achieved. The affirmative nature of these results is emphasized by positive comments made by a number of the users on the value of the retrieval results and by the fact that some of the *best* results were obtained by some of the *least* experienced users (more on the reason for this apparent anomaly below). One user, U3, made favorable comments on the utility of CONIT compared with SearchMaestro.

4.4 Useful Techniques

It is worthwhile to analyze which techniques in CONIT contributed to the relative success achieved. Clearly, a major CONIT advantage for the users, especially those not experienced in retrieval systems, is the ability to negotiate with the systems without having to learn any complicated command languages; in fact, of course, with the menu mode no commands need be learned at all. Users U1 and U3 explicitly mentioned this advantage. Users also indicated that they felt this was particularly valuable where *several* retrieval systems could be accessed; a feature that could be quite valuable even to expert searchers.

Another major advantage of CONIT, one not yet shared by other retrieval assistance systems, is its ability to take a user's natural language phrase and apply an all-fields, keyword-stem approach to the automatic translation of the user's search request into a search strategy for any database and system. Examples of the effectiveness of this technique were numerous as for U7 topic 2 where the phrase "digitized document retrieval" was broken down into the three stems "digit:", "document:", and "retriev:", permitting matches on words such as "digital", "documents", and "retrieved" as well as the original words input by U7. A second example is the truncation of the author search on "Donald A. Waterman" to the last name plus the first initial of the first name in one search for U3; this truncation plus CONIT's translation into the appropriate format for each database, permitted more comprehensive retrieval than would have been possible without the user knowing and applying a great deal of knowledge about formats in the different databases. A third example was for topic 1 of U1 where his 11-word phrase was cut down to 9 significant words (by dropping two function words) and the stemming of those 9 words permitted good retrieval in at least the one full-text database searched. (Retrieval of any sizable number of relevant documents using the coordination of 9 [single term] factors would be highly unlikely except in a full-text file using the CONIT-style all-fields word-stem matching scheme.)

The above general facets of CONIT probably account for most of the special effectiveness exhibited by CONIT during these experiments. However, several other facets had *some* utility here and have potential for higher utility in other contexts and with presently planned enhancements. The CONIT module for assisting users identify potentially relevant databases was employed in a number of cases to find files that they would not otherwise have known about. Also, CONIT's ability to set up a file list of *several* files at one time and then search a number of them with one command, even if in different systems, was used to advantage on several occasions. Additionally, users were able to make use of those CONIT features whereby the full search history is kept in a *virtually* active state so that (1) searches could be run in multiple databases without the users having to name them specially for that purpose; (2) they would be automatically rerun when users asked to see documents from searches no longer in active memory at the remote retrieval system; and (3) search combinations could be built from existing searches, even if they were originally run in different databases, so that the combinations could be run in any database while avoiding unnecessary regeneration of any already-run search components.

4.5 Limitations

While there were many positive results in the experiments, as outlined above, there were also a number of results that indicated difficulties with the present version of the intermediary assistant system. The negative results are, to a considerable extent, the opposite side of the coin from the positive results; that is, in many cases, while results could be described as _good,_ they could have been _better_ -- in a number of cases, _much_ better. Thus, for users U5 and U6 recall was quite low and even for cases like topic 1 of U1 and topic 2 of U7 where recall was high, it could have been higher.

Another objective indication that difficulties abounded was the length of time the users required to achieve their results. Table 1 shows that for the 11 productive topics session times ranged from 35 minutes to 117 minutes. While such times need not be considered excessive, especially for comprehensive searches of difficult topics by inexperienced searchers, not all such conditions obtained in these experiments. Further objective indications of difficulties are the actual system bugs recorded and clear difficulties users had in following explanations in some situations (see details in summaries in Section 6). Subjective data along these lines is also recorded in the summaries; many users found the CONIT human-computer interface less than optimally user-friendly, especially in comparison with some other assistance systems like EasyNet or ProSearch. The primary complaint users had with the CONIT interface, expressed by most of the users, was what was perceived as the over-wordiness of the explanations.

5. Future Directions

The results from these experiments are consistent with results from other experiments we have run -- as well as with the experience of other researchers, developers, and system operators -- to the extent that they clearly point to the need for computer assistance in making access to and operation of retrieval systems in a gateway environment. Without such assistance inexperienced end users simply cannot make access to the vast array of resources in any reasonably effective way. With such assistance even expert searchers can be aided to be more efficient in certain operations as well as enabled to search many systems and databases for which they would otherwise not have the experience and practice to engage comfortably.

5.1 Questions to be Clarified

The question for DTIC is how best to pursue a policy of development of additional user assistance capabilities for DGIS. The first point to be made is the need to continue with, and expand, the testing of various techniques in a controlled and realistic environment. Analysis and design in the abstract simply are not sufficient to determine what are the critical factors and how actual users react to assistance techniques and interface features in realistic situations. Experiments of the kind we report on here show what works and how well as well as what doesn't and what directions are best to pursue. What is needed is more comprehensive experimentation in terms of numbers of users, comparisons with different search modalities, and depth of analyses in order to provide more detailed and precise conclusions.

It is illuminating to pose some of the questions we could answer better with more experimentation and analysis: How pervasive is the experienced user's attempt to employ native language (e.g., Dialog) constructs (cf., especially, U2 and U5, topic 2) and how much should an intermediary system cater to this tendency? In that regard, would more experience with CONIT lead easily to a greater utilization of commands (relatively few attempts at using commands, not all successful, were made by users in the experiments) or are basically different tutorial modalities (see Section 5.2) needed to enable users to switch from menus to commands? How valid is the suggestion (cf U2) that CONIT, even as it currently exists, could be highly valuable as an instructional tool by serving as a basis, in a more elaborate instructional environment, to teach would-be searchers the theory and practice of retrieval? Does not the limited use, but user-stated need for, printed instructional materials reinforce previously revealed desirability of a *combination* of a *full range* of online, printed, and human instructional facilities?

Other questions that need further investigation: What are the best ways to increase the rather limited usage made in these experiments of assistance for search strategy modification (and almost no usage of evaluations -- although the several recall estimations that *were* done seemed to give reasonable results): smoother and more concise explanations or, as we indicate in the following section, fundamentally more efficient and appealing interface modalities and/or more automated search control? On a meta level, to what extent are the problems and difficulties witnessed a manifestation of lack of user motivation? We saw many indications in these experiments that users were searching more to "play the game," as encouraged by the organizers of the experiments, than they were to pursue searching of topics of high immediate importance.

5.2 Advanced Techniques

The addition of SearchMaestro to the repertoire of assistance capabilities in DGIS is clearly a step toward making retrieval functionality accessible to inexperienced users. However, as these experiments showed, there is much more that can, and should, be done to enable truly *effective* searching by inexperienced users as well as more effective searching by experienced users. Other assistance systems -- e.g., SciMate and ProSearch -- each have particular features that would be useful in addition to the features found in SearchMaestro. DTIC has wisely taken the position that, instead of simply making *incremental* improvements to the assistance functionality, efforts should be directed toward making a quantum leap in capabilities by investigating *expert* assistance through so-called intelligent techniques. Recent directions in the CCL (Common Command Language) project at DTIC (KUHN87) are evidence of this kind of activity.

CONIT already has implemented, or has designs for, expert retrieval assistance techniques of the kind needed to enhance DGIS capabilities. It is particularly appropriate for DTIC to consider such enhancements to DGIS in that CONIT is now being converted from its PL1 Multics mainframe implementation to an implementation in the C language under the UNIX operating system, a combination that would make it compatible with, and relatively easy to move to, the DGIS environment. The conversion effort is now approximately two-thirds complete. In order to facilitate planning efforts for DGIS we outline below some of the current or planned CONIT features that would permit a new, higher level of retrieval assistance.

The design for the expert version of CONIT calls for an implementation of the human-computer interface incorporating a windowing modality. Together with new, more automated interface dialog capabilities, the enhanced CONIT interface should not only answer the complaints of some of the users in these experiments, but also lead to a new level of interface effectiveness for more complicated retrieval operations.

The enhanced interface techniques should permit easier selection of files, avoiding the problems some users encountered in these experiments. In addition, more automated techniques for selecting potentially relevant files based on previously tested CONIT techniques not incorporated in the current system ([MARC81] and [MARC83a]) are planned to be re-introduced. Both the already implemented file selection assistance and the advanced plans in this area should be useful in the further development and online use of DGIS' Directory of Resources (JACO86).

Search evaluation will be made much more precise with the introduction of new estimation procedures based on user's relevance judgements on retrieved documents. These same relevance judgements, expanded by virtue of having the user select from pre-defined *reasons* for *irrelevance,* will be used to automate the selection of search strategy modifications for improving retrieval results. Furthermore, a model of search precision as a function of degree of exactness of retrieval match will enable *ranking* the documents retrieved by their likely relevance. Such ranking, in effect, provides a kind of *pre-processing* evaluation that, in many respects, may have greater utility than the *post-processing* evaluation some have proposed The overall result of these several advanced techniques may very well be to lead the retrieval process to a new, higher level of effectiveness based on a rational, decision-making process with the aid of the computer assistant as opposed to the present, more-or-less intuitive mode of searching that even expert human searchers are forced to resort to.

6.   Conclusions

These experiments demonstrated that there is a large need and demand for improved retrieval capabilities of the kind found in the existing CONIT and in designs for future CONIT systems. However, it is clear that the *current* version of CONIT has only limited possibilities for providing enhanced service for the DGIS community for three reasons related to the incomplete nature of the current system with respect to the design for an expert retrieval assistant: (1) correction of system bugs and smoothing of wording and other assistance features is evidently sorely needed; (2) many of the more advanced retrieval functions have not yet been incorporated; (3) in particular, modern interface techniques (e.g., windowing) and a more automatic assistance mode involving less user interaction appear to be critical to the promised achievement of new, higher, levels of retrieval assistance effectiveness. Recommendations for future directions center on (1) additional experiments of the kind performed in this project to delineate particular techniques most useful and cost-beneficial in the DGIS environment and (2) pursuit of expert techniques of the kind to be found in current CONIT and in designs for the completed expert version of CONIT.

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Table 1

Session Time and Recall for Productive Topics

User	Topic	Session(s)	Total Time	Recall
1	1	1.1	115	57
1	2	1.2	68	1+
2	1	2.2,2.3	50	0-3
2	2	2.4,2.6	54	?
3	1	3.5,3.6	199	100+
4	1	4.5	41	12+
5	1	5.2	62	3
5	2	5.3	117	1
6	1	6.1	35	?
7	1	7.2	61	?
7	2	7.3	42	100+

APPENDIX A

Session Summaries

A.1 User U1

User U1 has master's degrees in engineering and management. He uses computers most days and had previously used the NLM online Medlars system with help from others. He spent 10 minutes on the CONIT Guide and a like amount of time on the CONIT manual. He received some help from previous CONIT users in the login phase and in setting up and printing out the session audit files locally, but no help (other than from CONIT itself) on actual searching.

Session U1.1

This session lasted 115 minutes, had 215 interactions, and had connections with 4 databases on 2 systems. U1 spent considerable time (up to m21 [m21= minute 21 after start of session]) getting logged in and looking at preliminary menus before asking to get started on actual search preparations. (He later stated he was confused about money limits and was getting help in setting up audit file). Rather than wait for system menu help on obtaining file information, U1 issued the commands "E FILES" and "E MEDLINE" which connected him to the NLM system and led to display of NLM's general information on the MEDLINE database. This caused a 6 minute diversion in the session. (The selection of MEDLINE was likely the result of that being given as an example in the "E FILES" explanation -- there is no indication U1 had any interest in it for this session.)

At m27 U1 asked to go on with the problem description and invoked "WHY SET TITLE" explanation. At that point U1 noted on audit typescript that he was interrupted at the terminal for 15 minutes. This caused some confusion when he returned to the session in that he tried to enter a comment on what happened which CONIT took as the TITLE of his search and there were 3 intervening "time-out" messages from CONIT warning U1 that the NLM system was still connected and he should consider disconnecting it to save on charges. U1 pressed on and in 6 minutes finished the (initial) problem description. Because the interruption confusion led to incorrect problem title and abstract (description) settings, U1 chose the option to modify those elements of the overall problem description. A couple of system bugs in CONIT's problem editing routines caused this to take longer (11 minutes) than should have been necessary. The revised problem description then had title (and abstract) set to "Strategic Management", the estimated relevant (ER) parameter at 50 and no specification for known relevant (KR) and recall desire (RD).

At m59 U1 finally requested the the regular (menu) assistance for file information. Despite another couple of system bugs and user mistakes (or, looked at in a different perspective, inadequate CONIT explanations) U1 looked at files in the Universal and Business areas and selected three (Management Contents [BMC], Harvard Business Review [BBH], and NTIS [UR]) in 13 minutes. The difficulties here involved (1) another HOST IDLE message which the user finally responded to with the DIS [disconnect] command which, unfortunately was given when CONIT was looking for a memo response; and (2) the user giving comma separators (instead of spaces) between the file names.

By m72 U1 had selected to run a topic search and, instead of using the title as a search phrase, had chosen the (keyword??) phrase: "focus on strategic management aspects how

to utilize technology more effectively. " When U1 requested s10 (the intersection of the 9 searches on the 9 significant keywords of the above phrase) be run the failure to properly disconnect NLM and several other bugs caused an attempt to run in MEDLINE. This search was aborted due to an undetected drop of the NLM system. U1 saw that the search execution had been attempted in MEDLINE and asked that the search be run in the 3 REST of the 4 files on the search file list. Remnants from the previous bugs further sullied the waters and the search was run only in BBH (twice) yielding 57 documents. In three steps U1 requested, and received, the standard output for all 57. U1 comment: "useful information, thanks!"

U1 then asked that s10 be RUN NEXT (i. e. , on the last file, UR). The 9 component searches were run and the combination was being run when U1 gave up waiting for the search to conclude and finally answered "no" to one of the many CONIT questions asking if "the user wanted to wait for further responses. " (U1 later commented that he had probably been too impatient and wondered how close he was to completing the search. As indicated above, he was *very* close, but as we discuss in our analysis, the result would likely have been null for this strange search strategy.)

Because U1 did not let the search run to conclusion, when he asked for help on what search to run next, CONIT suggested, among other things, that he consider the last search that was *run* -- inadvertently, due to failure to run strategy to conclusion in UR -- which turned out to be s39 (find effect:) instead of s40, the combination search. U1 accepted this suggestion and the search was run on the currently connected file (UR) yielding an overflow result for search s41 of more than 100,000 documents. U1 looked at the standard info on the first 5 of these (SD) and, understandably, concluded that these were not very relevant and so this file was not very good (probably a good conclusion even if the *proper* searches have been run).

U1 then took option to have CONIT consider evaluating his searches but all he did was ask for a listing of the evaluation techniques and then asked to do something else (other than continue evaluation).

By this time (m109) the user entered the online comment (improperly -- without getting to COMMENT command or menu) to the effect that he felt the search now lacked focus and he needed to "rescope" it. After a few unproductive attempts to review his status and options (e. g. , SHOW STATUS and SR and SET NEW PROBLEM) the session was terminated by Multics because the daily limit for the Coniti account had been exceeded. (This was due to *several* Coniti sessions being run that day; we subsequently raised the limit for all 3 experimental accounts to avoid this happening again.) U1 erroneously thought that it was CONIT limits he had exceeded; in fact, he was *close* to that, and had been so *warned* by CONIT, but it was the daily Multics limit on Coniti that caused the termination.)

Session U1.2

U1 took 13 minutes to set up his problem description which had title "videodiscs on customer relations" and ER and KR not specified, recall desire = 20 and max time limit = 15. By m21 the search file list was set with 4 files: UM [Magazine Index], UMT [Magazine ASAP], UC [Conference Proceedings], and UR [NTIS Government reports].

By m25 U1 had requested a search be run on the keyword phrase: "training using videodisc for customer relations." Not surprisingly, this 5-concept factor search retrieved

no documents in UM. At m31 U1 then asked to run search in next file (UMT) which yielded 6 documents (UMT is full text database). At m35 U1 asked to see standard information on all 6. His annotations on audit printout: "finally got something good; this [output from SHOW DOCUMENTS EVERY] should be in bold face type."   At m38 he asked for titles of all 6 [a questionable request since he had already seen them; maybe he was trying out ways to get full text which banner at connection to UMT indicates is available (altho not thru CONIT commands as such); U1 questioned whether full text was available in another annotated comment]. At m40 U1 asked to look at ALL info on D4. [Descriptors included "employees, training of" and"video discs" so that match on "videodisc:" must have been in full text.]

At m41 U1 initiated a dialog on search modification which led through: HELP stages for: modification of search; rerunning searches; broadening search; replacing terms; finding new terms; (back to) replacing terms; and then to modification by looser phrasing proximity operations. CONIT then explained that this broadening technique was inappropriate in the current situation since U1 had never generated a search with other than the default (loosest) WORDS proximity operator. U1 indicated with an annotation that he had not wanted to do that kind of operation anyway -- rather, he had wanted to "just change some words." [This difficulty is clearly due, in part, to some injudicious wording on CONIT's part in explaining what this technique is for: "changing phrasing of multiword searches".]   U1 at m48 then went back to general help on broadening and this time selected MORE ALTERNATE TERMS technique which he applied to the *whole* search strategy with the phrase "employee videodisc training". [NB, this is not "authorized" CONIT way to make a new search out of subset of old terms and some new ones but, pragmatically, it works in this case where old strategy when ORed with new is perfectly acceptable.]

At m52 U1 asked to run new strategy on REST of files. [Not optimum, he should have started with CURRENT file, UMT.] This retrieved no documents in (non-full-text) UC and system bug prevented running in UR. Bug probably confused U1 who went back to help in setting files and reset next file to UM. At m53 running in UM yielded no documents.

At m67 U1 requested STOP and offered online comment: "frustrated [trying to modify search and select files]; found only one real good document." [Apparently, U1 refers to D4 in S6, altho D3, which he didn't peruse for ALL info, also described videodisc training and, presumably, all 6 in S6 *might* have been relevant if ALL info had been considered.]

A.2 User U2

User U2 has a doctorate in physics. He uses computers most days and regularly uses DIALOG on his own. He has also used an experimental retrieval system (CD-SCI). He did not read Guide or Manual at all. He got some instructional information after and during some searches from Marcus.

Session U2.1

This session ran only 7 minutes and was terminated after several instances of line noise caused CONIT to question the inputs.

Session U2.2

This session ran 22 minutes with 66 interactions a involved searching 2 files. U2 was aggressive in attempting to use commands. This caused some problems in that he did not

get explanations of use before hand and merely guessed on the proper construction and usage. Also he sometimes used DIALOG formats. For both reasons CONIT was at times confused and this lead to some difficulties. Nevertheless, as is often the case with computer-experienced users, U2 guessed fairly well, and persevered so as to get CONIT to do approximately what he wanted.

After HELP at m4 U2 tried command SEARCH DIALOG [a reasonable guess, but incompatible with CONIT format requiring a *file* name for argument.] U2 recovered by m11 and quickly completed problem description by m12: ER and KR not specified, RD=1, TITLE= "expert assistants for information retrieval" [apparently a somewhat frivolous response, mimicking the CONIT example], ABSTRACT: searching for recent article on particular drug causing zombie condition in Haiti.

At m12 U2 asked HELP FILES and said he *knew* what files he wanted but, apparently erroneously, gave the numeral "1" as input to which files which led to putting CONIT file number 1, ERIC, on search file list. U2 realized this was wrong and gave command SEARCH. When prompted for file names he responded with command: SEARCH MAGAZINE INDEX. CONIT threw out the extraneous term "search" and accepted the phrase "magazine index" and added it (CONIT abbreviation: UM) to file list. [An example of how smart handling of erroneous inputs from user can still lead to proper actions on system's part.]

By m16 U2 had decided on topic search on single term "zombie" and requested search be run. Search was run on first file, ERIC, retrieving 6 documents. U2 wanted to run in UM and asked HELP RUN. The option to run search in next file was available but CONIT did not explicitly state that UM *was* the next file and U2 asked HELP FILES at m19. Rather than select appropriate option to review file list, U2 commanded: SELECT FILE. After seeing "illegal command" response from CONIT, U2 went on to go through several HELP FILES menus and, at m22, the connection to CONIT was dropped.

Session U2.3

Twenty minutes after U2 got dropped in Session U2.2 he reconnected to CONIT and resumed the Multics CONIT process. Rather than continue where he left off in the search, however, he chose to start anew. Again, after another improper use of SEARCH command, he asked for HELP and by m11 had re-entered a problem description; this time: ER=KR=RD=1, SWL=$30, TITLE null, and ABSTRACT: want search on keywords zombie, Haiti, and Davis.

He again asked to set the file list directly and this time properly responded with "magazine index" when prompted. This time he asked for topic search on phrase "zombie drugs" which retrieved 58 documents on term zombi: but none on combination of two terms.

After running search U2 asked at m18 to modify but, strangely, asked to re-run search and got same results. He then asked help in broadening the search. He chose help for replace terms option but then chose option 2 for help on truncation technique. [This may have been mistaken attempt to select search s2 to modify.] U2 then asked to [return to] BROADENING help. He then asked for (detailed) HELP and was led to wrong menu (CONIT bug) when he asked to return to BROADENING menu.

U2 then got to general HELP DO menu from which he selected STOP option. He commented that "can't find particular American Scientist article and couldn't find it in DIALOG either." Session ended at m28. [Later analysis showed that *particular* article searched for was not in Magazine Index although several other articles discussing Davis' work on the *toxin* (not *drug* as such) found in certain fish that cause zombie condition *were* in the set of 58 on zombies in that file.]

Session U2.4

By m15 U2 had set up problem: ER=200, KR and RD not specified, TITLE="soviet superconductor research". U2 spent 13 minutes trying to edit abstract; the time was excessive due to 3 difficulties: two CONIT editing inadequacies (replacing with a null string does *not* delete as it probably should and CONIT has to be brought into a special mode to properly handle the case distinctions) and a Multics output peculiarity (a wrapped line starts with the "\c" string which, to the uninitiated, looks like a typo).

U2 took 4 minutes more to browse through the Physical Sciences files and select three: Science Citation Index (PSC), INSPEC (PSA), and Soviet Physics (PGSS); unfortunately, he input the 3 file names separated by commas instead of spaces and CONIT failed to recognize them. At m32 U2 recovered to the extent of putting in just PSA on file list. At m36 U2 entered topic search phrase "soviet high temperature superconductors" and ran the 4-component search in PSA. After several delays due to highly posted terms U2 gave up the search as it was about to be concluded.

U2 tried to narrow the search with the proximity operator but was foiled by his failure to follow directions about selecting *two* component searches to operate on and a couple of bugs in CONIT causing inadequate explanations (although at one point CONIT *did* point out that selecting a *single* component search -- as opposed to a pair or a combination search -- was improper for this search modification technique. As U2 continued to pursue help on search modification, his connection to CONIT dropped at m56.

Session U2.5

U2 again tried to use commands with mixed success. He did use SEARCH to get PSA on file list but tried "CH DESC" [change description??] and spent a few minutes getting general information on commands from EXPLAIN and LIST commands. He then got back to menus and at m7 constructed topic search "soviet superconductors" and at m8 ran search in PSA retrieving 25 documents. Line dropped at m11 as U2 was getting help for document display.

Session U2.6

As in U2.5 U2 skipped problem description but this time eschewed commands and properly answered menu request for file name at m4 with "inspec." He then entered two search phrases: "superconduct?" and "high(w)temperature" [note use of DIALOG truncation and proximity symbols]. U2 tried to combine the two searches but ran afoul of a couple of CONIT format requirements (first used "representation" instead of "search" nomenclature and then explicitly using "and" where CONIT asked for just a series of search names). At this point (m14) he used COMMENT command to indicate his frustration.

U2 then ran each search separately and retrieved in PSA 3961 on s1 and 25,206 on s2. [Note that these searches ran _despite_ the fact that DIALOG format was used. Because there were no spaces in the S2 expression, CONIT passed it along as a single term which DIALOG recognized as a proximity request (note that CONIT actually retrieved somewhat more than one would normally get with that request since it appended the truncation symbol allowing retrieval on "high temperatures" as well as "high temperature"). In s1 CONIT again simply appended a truncation symbol and did a search on "superconduct??"; this is a legal Dialog request but narrower than the one intended, namely requiring a match on _exactly_ two characters after the stem -- i.e., match on "superconductor" but not "superconduct", or "superconductors", or "superconducting", etc.]

U2 then asked to narrow by adding the factor "superconduct? and high(w)temperature" to s1. This is somewhat redundant but it worked and was run at m23 yielding 229 documents. U2 then continued to try to narrow the strategy by ANDing the factor "and russian or soviet". Because of the extraneous "and" in U2's input, CONIT (erroneously) warned U2 that "4 words ANDed together usually yield null results (actually, CONIT should ignore the two function words in counting here). U2 paid heed to the (misplaced) warning and ANDed the phrase "and russian" instead leading at m28 to running the modified search yielding null results. (If U2 had let the original 4-word phrase be used, it would have resulted in a successful search -- the "and" would have been dropped and the "or" would have led to the proper OR combination search.)

U2 made a minor attempt to ask for more modification help and then asked about evaluating the search. He got as far as seeing a list of the 3 recall estimation techniques but did not go any further toward actual performing an evaluation. In closing comments at m34 U2 wondered why his superconduct? search yielded less than when done directly in DIALOG (explained above) and suggested that a true "expert" system might have recommended that the search on "russian" might also be done on the LANGUAGE field. [Actually, as explained to U2, CONIT where possible does an ALL FIELDS search; this works in ORBIT but not DIALOG which does not support such a search modality.]

(Other) answers to questionnaires:

5- Probably more appropriate for naive user (but bugs would frustrate such).

6- somewhat hard

7- Potential for training new to on-line, do-it-yourself,searches. May be only system if need to access many data bases.

8- Not as helpful in really doing research as, say, reading DIALOG's user guide. But if need to cover many data bases, it might be a good start.

9- For what they do, Pro-Search and DGIS are easy to use -- although would prefer to be able to use Pro-Search in DGIS.

10a- no

10b- probably

10c- probably

10d- more direct suggestions as to using indexes and other file capabilities.

A.3   User U3

U3 was a novice intermediary searcher of bibliographic retrieval systems. She had more extensive experience on "scientific" (numerical?) databases. She did attend the CONIT demonstration.

The first two sessions were short (10 and 6 minutes, respectively) and simply tested connection, signon, and logout. The third session lasted 32 minutes and had 78 interactions. In U3.3 U3 looked at CONIT news and by m17 had set up a problem description. By m26 she had reviewed files in categories E and U and set the file list to contain SUPERTECH (EGST) and INSPEC (PSA). At m31 U3 asked to STOP noting she had to break off to "do my job". Session U3.4 lasted 6 minutes with 41 interactions; the problem description was completed by m5 but then there was a line drop causing disconnection.

Session U3.5

Session U3.5 lasted 76 minutes with 195 interactions. She completed the problem description by m10 with ER=50, KR=25, and RD=25 on the topic: "building tools for expert systems". By m15 she had set up the file list with 7 files: MAGAZINE INDEX (UM), MAGAZINE ASAP (UMT), FEDERAL RESEARCH PROJECTS (UPF), EGST, PSA, MICROCOMPUTER INDEX (ECMI), and MICROCOMPUTER DATABASE (ECMG). By m17 she had made two involved reorderings making the revised file list order: EGST, PSA, ECMI, ECMG, UPF, UM, and UMT.

At m19 U3 asked that the problem title be used as a search phrase and that it be run in EGST. the first file. The search strategy devised by CONIT from the 5-word title retrieved 24 documents in EGST.

U3 went through the HELP SHOW menus and requested (in 5 separate requests) to see the standard output on all 24 documents. Her comment was that these documents looked "very good".   U3 then asked to have the same search strategy run in the next file, PSA. All 4 component searches were successfully run but U3 gave up waiting for the results after several time delays on the final combination search.

At m34 U3 sought help in narrowing the search and chose the AND NOT operation with argument "tool" on search on "system" which had overflowed in time and space (>100,000 postings) in PSA. At m37 she tried the FEWER ALTERNATES technique but CONIT explained she had no search with alternates so she went on to replace the term "system" with c"computer system" and ran the revised strategy in PSA. Unfortunately, similar time delays occurred and U3 failed to wait for the final results.

At m48 U3 looked at some other narrowing techniques (e.g., proximity operations) but this exploration was marred by some line noise and a couple of system bugs in listing the searches.

At m56 U3 gave up on further attempts to modify search and ran original strategy on next file, ECMI. This resulted in retrieving 3 documents which U3 looked at: first the standard information and then ALL info). [All three were clearly highly relevant.]

At m62 U3 looked into narrowing techniques again but again ran into the listing bug. She abandoned the session at m72 after either the line dropped or her keyboard locked up.

Session U3.6

This session lasted 123 minutes with 436 interactions. By m10 U3 had entered the same problem as in U3.5 with the slightly altered title: "expert system toolboxes".

By m15 U3 had set 3 files on file list (PSA, ECMG, UPF) and had requested a search on problem title which yielded just one document in PSA. U3 looked at standard info on that document. [Relevance unclear from title.]

U3 then asked help in broadening search and got to HELP RUN menu about which she commented "nice options". She chose the option to run the last run search in the next file. This was done at m23 (requiring CONIT to logout out of DIALOG and onto ORBIT) and resulted in no documents being retrieved in ECMG on the combined search.

U3 then asked for more broadening help, this time on alternate search terms and she commented that the HELP SHOW INDEX menu was a "helpful message". She asked to SHOW INDEX on the term "toolbox" and selected the term "toolbox" itself as a search term yielding another search with, along with the previous component search, that retrieved 91 documents. At m33 U3 asked for standard info on first 5. (This file will often bunch a series of reviews on a software product together and in this case the first 5 happened to be reviews on a "business toolbox" software program.)

At m35 U3 asked to broaden the strategy through applying the WORDS operator but was told by CONIT that the operator already applied. She then got help in replacing the term "toolboxes" with the phrase "building tools", recreating in effect the strategy of U3.5, which was then run in ECMG retrieving 7 documents. She then looked at first the standard info and then all info on these 7 (6 were highly relevant, 1 moderately).

At m55 U3 sought help in evaluating the latest strategy and was told that the estimate of recall by comprehensiveness calculation was 32%.

After considering, but declining, other search modifications U3 ran the revised strategy in the final file, UPF, which retrieved 6 documents. U3 asked to see standard info on the 6. (Some relevance but, as is true of this file, mostly on medical projects -- only one on information science, _per se._

At m66 U3 asked to see titles of that component search of the one previously run which retrieved 49 documents on the intersection of searches on "build:" AND "tool:'.
(I would judge there were about 5 documents of low to medium relevance in the 49.)

Marcus had been observing this online session through periodic display of the audit file and, mistakenly thinking that U3 was not getting good results and was being confused by several system bugs, offered a few "hints" through online messages to U3 between m48 and m55. These were (1) you could try the explicit command HELP RUN if you get system error on HELP PROXIMITY; (2) you might try to search on phrase "expert tools"; and (3) if you don't plan to search further on ECMG [connected via ORBIT from which CONIT does not automatically disconnect after 5 minutes of idle time, as it does with DIALOG], please DISCONNECT.

Hint 2 may have hastened the switch to UPF and Hint 3 apparently led U3 to request new search topic for which the phrase "expert tools" was used and run in UPF retrieving 43 documents. U3 asked to see standard info on first 15. (As with other searches in this file, most documents were of low to medium relevance with one or two being "classics" in expert systems with higher relevance.)

From m73 on U3 got warnings that she had exceeded the $120 warning level set for the user GCotter for a single session.

At m74 U3 asked to run "expert tools" search on "next" file (which, at this point, was the first file, PSA) retrieving 1229 documents. She looked at standard info on first 5 (relevance from low to medium -- none on expert shells, as such). U3 at m76 asked to run this search on "rest" of files which retrieved 48 in ECMG and redid the UPF search as well. U3 at m80 asked to see standard info on first five in ECMG [requiring CONIT to logout of DIALOG and onto ORBIT to regenerate search and request output; all were at least somewhat relevant, possibly highly, but titles was insufficient by which to judge.]

At m83 U3 asked for an evaluation of the most recent search strategy ("expert tools") for which CONIT give the recall estimate based on comprehensiveness calculation of 49%. U3 asked to see details of how this was calculated [explanation showed a slight logical error: 4 files were used in number of files searched where the redundant search in UPF shouldn't have been counted; with 3 files searched the correct estimate based on CONIT's formula for a simple two-word-phrase search should be 48% instead of 49%.

At m88 U3 asked to set up a new problem. She skipped the problem description (from the strategy it is clearly just a subset of the original problem) and by m92 had set 3 files on the file list: BOOKS IN PRINT (Bowker, UBP), WILEY'S GENERAL CATALOG (UBW), and NTIS REPORTS (UR). An author search on "waterman, donald a" was requested and run in the first file, UBP, retrieving 5 documents. U3 at m101 asked to see all info on these 5 [all books by this expert on expert systems are clearly at least moderately, and some highly, relevant to this problem).

At m103 U3 asked to run author search in rest (last 2) of the 3 files yielding no documents in UBW and 31 in UR. U3 asked to see all info on first 5 in UR. [Three of the 5 were by D.A. Waterman and were highly relevant; 2 of the 5 were not relevant, being by a different author, D.D. Waterman -- NB., unless user asks for an "exact" author search, CONIT searches only on first initial of first name -- this actually enabled retrieving a number of documents where Donald Waterman was listed under variants such as "Don Waterman" or "D. Waterman" which would not otherwise have been retrieved.]

At m107 U3 asked to set up a third problem. She again skipped problem description and this time simply copied the previous search file list. She asked to see explanation of citation searching but did not follow through on that. At m109 she constructed the topic search using phrase "expert assistance in information retrieval" and, after unsuccessfully attempting to combine that with an earlier search, ran it on the file UBP yielding a null result. After a preliminary attempt at getting additional broadening help U3 stopped session.

U3 did not fill out a questionnaire but gave a number of online comments which we have reported above plus the following 3-paragraph written commentary:

As a novice user, not only of CONIT but of bibliographic data bases, my first reaction to CONIT was, "Geez, I don't want to read all this stuff!!" Perhaps users in an academic environment are more willing to plow through this information, but I found it to be tiring. On the positive side, I did manage to actually run searches and get information back, which is more than I can say I was able to do using DROLS, for example, in the same amount of time. I was lost a few times, and I am still confused by some of the processes, but I can see where a few sessions would clear up a good portion of my confusion.

I don't know if I was a very good subject because my background is from a purely scientifically oriented database that was created in-house for a specific set of geologic data. This background had not prepared me for searching bibliographic databases, so I do not know if my searches were food or not. In my amateur opinion, I did retrieve a few citations that I would like to pursue further, which indicates to me that I was successful in my search. This isn't to say that I might not have been able to retrieve many more documents if I were more experienced, but I was pleased with the results I did manage to achieve. Perhaps as a subject, I was not very successful (I don't really know how you gage these things) but from a personal standpoint, I was pleased.

I would have found it easier to begin using the commands as opposed to punching the current option number from the menu if the command was displayed along with the option rather than displayed after I chose an option number. I think perhaps if the command for the option could be displayed on the same line in parentheses [NB, often, where it can be done simply, it _is_ --- RSM], I would have been able to begin to use the commands. Since the help session is so verbose, I was inclined to use the command mode as quickly as possible; however, I couldn't remember the commands easily enough when I needed them.

A.4   User U4

User U4 was an intermediary search specialist on the DIALOG and DROLS systems and used computers most days. She had an MLS in Library Science. She attended the demo but did not read CONIT documentation before (or during) her searching.

Session U4.1 was stopped after 9 minutes due to online noise. Sessions U4.2 and U4.3 are really one session interrupted by a line drop. By m13 of U4.2 U4 had set up her problem description (ER, KR, RD not specified, title = "technology insertion") and set 3 files on file list (BUSINESS [INFORM, BBG], MANAGEMENT CONTENTS [BMC], and ECONOMIC LITERATURE [BEL]). At that point on her typescript she noted question "is BN and ST the code?" [yes, they are listed on the topmost B category as letter codes representing the _subareas_ BUSINESS NEWS and MARKETING]. At that point the line dropped.

After 62 minutes U4 reconnected to CONIT and resumed her session (which we name U4.3). U4 then got caught in a loop trying to complete the file list and go on with the search. She apparently did not see or understand the option to "proceed with the search" and noted she was "going around in circles" and asked to stop the session. [We note that the line drop probably led to this confusion in two ways: (1) the first time the proceed-with-search option was to be shown it got by-passed because of the drop and (2) the original explanation to the user that this option would eventually be required was over an hour removed in time when the connection was finally re-established.] The total online time (discounting the 62 minutes of drop time) in U4.2 and U4.3 was 27 minutes with 92 interactions.

Session U4.4

By m6 U4 had restated the problem as above but this time gave ER=50. By m11 U4 had successfully entered 3 files on the file list: ENGINEERING INDEX (COMPENDEX, EGEI), SUPERTECH (EGST), and AEROSPACE (ETAD). This was accomplished even after U4 first entered the code names mistakenly separated by commas. By m13 U4 had modified the file list by adding the file BBG to end of list.

By m14 U4 requested that the title be used as a search phrase which was then run in EGEI resulting in 403 documents being retrieved. U4 then asked help in narrowing the search and looked at the option to restrict by changing ANDs to ORs and was told by CONIT that this was not appropriate in the present context since there were no ORs. U4 then went on to consider and actually apply the proximity (adjacency) operator to the search on the two terms. Unfortunately, when this was run a bug led to a system error message and U4 stopped the session due to this problem after 29 minutes and 106 interactions.

Session U4.5

U4 rushed through the problem description and by m3 had defaulted all questions except to repeat the title as before. By m7 she had set the file list to the 2 files: EGEI and EGST. By m16 she had used title to search in EGEI and retrieved 408 documents (5 more than in U4.4 which had been run 6 days earlier, presumably before the most recent update). U4 then requested narrowing through the adjacency proximity operation, as she had done in U4.4, and this time it worked retrieving 13 documents at m20.

U4 then requested display of the standard info in 3 steps (SD, SM, and SM again) on the 13 documents and then ALL info on just the first document. The first document was strictly a false drop but still had some relevance in discussing updating of technology. The other 12 could possibly have had up to high relevance but the title information was insufficient to judge.

From m25 to m32 U4 ran through a series of evaluation screens but did not actually ask for any recall estimation but rather just took the default option each time.

At m32 U4 asked to run her (revised) search in the next (and last) file, EGST, and retrieved 2 documents. She had ALL info on both documents displayed.   The first had low relevance and the second moderately high.

At m35 U4 asked to run the same search on the next file. She was surprised that this re-ran the search on EGEI even though CONIT explained what it was doing. Possibly U4 had been confused and believed mistakenly that indicating the file BBG in the memo would put it on the file list. On this note of confusion U4 ended the session after 41 minutes and 143 interactions.

Questionnaire Responses

5- No -- I found the line-by-line advance and the abundance of verbiage difficult to follow.

6- Somewhat hard.

7- It went through the steps needed to prepare one's thoughts for performing an online search in a logical progression.

8- LOGOFF command should be more prominently displayed.

A bug prevented running search [U4.4].

My first reaction to seeing questions concerning relevancy and recall desires was "I don't know; that's why I'm doing the search."

Got into loop in U4.2 and U4.3 because I just kept doing default option which is not always correct. The reason for choosing default was I found the "busy-ness" of the screens difficult to follow.

I feel the system handles the question of cost a bit too loosely. Some databases are extremely expensive, and to leave a user connected for five minutes after the last interaction is, I feel, a bit excessive. If the system can log the user off after 5 minutes, why not after 1 or 2? [It could be so set, of course, at the expense of additional time and cost to re-login and recreate the searches -- unless a logoff hold is available.] I particularly don't understand the need for this since CONIT does not re-use searches where possible [actually, it usually does; U4 ran into one situation (running the proximity operator) where that efficiency has not yet been implemented].

9- I have used DGIS and In-Search whose screen formats I much prefer.

10a- Maybe

10b- Probably

10c- Definitely

10d- I expected CONIT to provide suggestions, based on my keywords, on which databases to search. I found the lack of this capability especially disturbing since so little information is provided on the contents of files.
[More detailed info *is* available though not requested by U4. A form of database selection based on user's keywords has been successfully demonstrated on some versions of CONIT.]

A.5   User U5

U5 was an intermediary retrieval specialist with experience on DIALOG, ORBIT, BRS, NLM, DROLS, and NASA/RECON. She used computers most days and had an MLS degree. She did attend the CONIT demo and spent 15 minutes with CONIT manual before using CONIT.

Session U5.1

By m20 U5 had set up problem: title = "affect [sic] of jogging on emotional and mental health"; ER=35, RD=10, KR not specified. On the HELP FILES memo U5 entered "mbt mmm mmb" for the 3 files: BIOTECHNOLOGY, MEDLINE, and MEDBOOKS (CATLINE), respectively. She thought the memo entry *was* the selection of the file list and got confused. At m41 she issued command CONNECT MBT which nicely circumvented her confusion over file setting. Unfortunately, at m44 when U5 asked HELP SEARCH, CONIT went on to ask about files without explicitly recognizing that a user already

connected to a file might prefer to go ahead and search that file before worrying about others (one fix might be to have a CONNECT operation cause the connected file to be entered on to the file list, if not already there, and, of course, have the current file on the list set to that file.) At any rate, this confused U5 further and she commanded CONNECT MBT again. Because of a system bug, instead of merely informing the user that the file was already connected, a system error message ensued and U5 aborted the session. Total session time 54 minutes with 86 interactions.

In a debriefing by telephone Marcus explained the problem with setting the search file list. U5 complained about the large amount of text to read in the CONIT explanations and she said that was a particular problem for her due to a condition she described as a "sensory information dysfunction".

Session U5.2

By m17 U5 had set up problem with slight variants from U5.1: this time the word "mental" was left out of title and KR set to 35. U5's annotation on typescript was KR setting was a mistake and she used editing module of CONIT to reset KR to 5. At m21 U5 asked HELP FILES and this time correctly set up file list but with different files than in U5.1: ZOOLOGICAL RECORD (MBZ), MMM [as before], and CLINICAL ABSTRACTS (MMC).

At m28 U5 asked to construct the search phrase "jogging and emotional health" and run it in MBT. This retrieved no documents on resultant set (only 3 on emot: and none on jogg:). U5 then asked help on broadening and remarked that the options appeared to be "overlapping techniques" [that is true to a certain extent]. U5 selected MORE ALTERNATES technique. When CONIT warned about mounting costs due to ORBIT being connected and not used for 5 minutes U5 took suggestion and issued DIS command.

At m46 U5 selected the resultant, 3-component search, s4, to add the alternate terms to and entered the following expression: "or (jogging or running or exercise or aerobics) anal [sic] health or mental health or well-b)ng"

U5 commented that this was "a DIALOG formulation". Actually, not counting the typos, this expression could have been a reasonable search statement and, as applied as an *alternate* for a null search, would in fact, *replace* it. However, the combination of typos and the fact that CONIT does not yet handle parentheses, led to some weird parsing and when the new search was run at m54 it retrieved 130 documents, mostly from the single component on "runn:".

At m58 U5 asked to see standard output on the first 5 of the 130. Needless to say, because of the combination of improper parsing and poor file for this search, the relevance was dismal. U5 then stopped this session. The session lasted 62 minutes with 110 interactions.

Session U5.3

By m12 U5 had set problem description: title = "universal AIDS testing and bioethical considerations"; ER=RD=5, KR not specified. By m26 U5 had entered 2 files on list: BIOETHICS (MEDETHICS, MBE) and MMM. U5 asked for title to be used as search phrase and with the 5 (significant) title words as factors the result in MBE was, not surprisingly, null.

U5 then asked for for MORE ALTERNATES help in broadening the search and selected the component search on AIDS to which she gave the (alternates) phrase:

"aids or auto [sic] immune deficiency syndrome or autoimmune deficiency syndrome"

CONIT warned (a little too severely, in this case) that more than 3 words intersected usually gives null results and U5 gave up on this modification technique (even discounting the use of "auto" for the intended "acquired", this modification would not have overcome the excessive coordination).

At m48 U5 asked to construct a search on the phrase "bioethics and aids testing" which she had run in MBE with 1 document retrieved. U5 had the standard info displayed on that document and stated its relevance "looks good".

At m54 U5 ran this revised search in MMM with null results and she stopped the session which lasted 59 minutes with 117 interactions.

U5 offered these comments on the typescript of Session U5.3:

(1) SearchMaestro wasn't so good on this search either; even with SOS -- the online consultant said not to use term "testing" since this wasn't in thesaurus.

(2) Since she was "burned" on use of commands in U5.1, she hesitated to to use them again.

(3) Explanations were tedious and got bogged down on search modification with options that were repetitious and not mutually exclusive.

Questionnaire Responses:

5- Not really, on a gut level; on a thinking level I knew it could be valuable and kind of neat!

6- Not a question of "hard" or "easy", but _tedious_.

7- Setting up a search and then using it in more than 1 file without reconstructing it. "Potential" to change a search.

8- Too much reading. Terminology not always clear. Categories on menus not always mutually exclusive.

9- There are similarities and differences with each one and some points are good in each system.

10a- maybe

10b- definitely %

A.6   User U6

User U6 worked in a group that does management of engineering, particularly in the management of spare parts inventories. We do not have specific details of the background of this user directly from himself but he has been described as a novice searcher with limited experience with DGIS. His group was *not* given CONIT instructional materials.

Session U6.1

U6 completed his problem description by m8: title = "ongoing acquisition process improvements" and recall parameters not specified. By m14 U6 had modified his original spending level of $50 to $150, selected the one database FEDERAL RESEARCH PROJECTS (UPF) for the file list, and chosen the title to serve as a search phrase.

At m15 this search was run in UPF with null results for the combination of the 4 component factors. U6 sought help in narrowing {??} his search by the FEWER ALTERNATES technique and was told by CONIT that this was not an appropriate technique in his case because there were no ORed searches.

U6 then constructed the new search with phrase "improvements acquisition" which at m24 was run in UPF yielding 40 documents. U6 asked to display ALL information in 4 steps on the first 20 documents (SD ALL, SM, SM, SM). The connection to CONIT dropped after D16 was shown. There appeared to be some, mostly low, relevance to the topic for these documents but it appears that the file was not particularly good for this topic and, in any case, it would be difficult to develop a precise search strategy for this topic. U6 did not provide any post-search analysis.

A.7   User U7

User U7 was an information scientist who has done analyses on bibliographic retrieval systems and is a regular computer user but not a regular user of retrieval systems. She attended the CONIT demo and had seen the printed CONIT materials prior to her searches.

Session U7.1

This session was only a test of connecting to CONIT and lasted only 5 minutes with 12 interactions.

Session U7.2

U7 completed a problem description by m12: title = "international STI services/systems"; ER=100, KR=25, RD=50. The single file INFORMATION SCIENCE (HIS) was put on the file list at m34 after considerable difficulty caused by a problem in CONIT where the code for this file, HIS, is recognized as the abbreviation for the HISTORY command. U7 managed to circumvent this problem eventually by typing "HIS" in upper case instead of lower case, somehow by-passing the abbreviation expansion routine.

At m35 U7 constructed the search phrase "international science technology information" and ran it in HIS retrieving 718 documents. She then sought narrowing help and chose the MORE FACTORS option adding the factors "information and service". The modified search was run at m46 retrieving 39 documents. U7 looked at other help for

narrowing briefly and stopped the session. Total online time 61 minutes with 153 interactions.

<u>Session U7.3</u>

By m10 U7 had entered problem title = "integrated systems for retrieving digitized documents"; ER=10, KR=0, RD=5. Some time was wasted trying to "fix" the description which only *looked* peculiar because of the special line wrap format of Multics (cf. U2). By m13 U7 entered the 3 files on the file list: SUPERTECH (EGST), INSPEC (PSA) and COMPUTER DATABASE (ECG). At m15 U7 constructed the search phrase "digitized document retrieval system" and had it run in EGST retrieving 2 documents.

By m19 U7 asked to see ALL info on both documents. She commented that the relevance to the *stated* topic was high but that the utility for her was only medium because the emphasis was on engineering drawings instead of text.

U7 then had the search run in PSA; after a number of long waits due to searching on highly posted terms, U7 gave up further waits and the search was terminated while in the intersecting phase.

After being told by CONIT that narrowing by fewer alternates was not applicable to the current situation U7 chose to enter the new topic search phrase "digitized document retrieval" which was run in PSA yielding 102 documents. U7 had the first 10 shown in standard format (SD, SM) and remarked that relevance for 9 of the 10 was "pretty good".

U7 then had the revised search run in the last file, ECG, retrieving 56 documents. She looked at standard info on first 5 and commented that they were relevant but shallower and of a newsy character.

At m32 U7 went through a number of screens on evaluation and obtained one estimate of recall by comprehensiveness calculation on a component search followed by details on how the estimate of 0.66 was arrived at.

At m38 U7 asked to stop the session which lasted 42 minutes and had 143 interactions. U7 commented that this session went much better than the previous one and yielded "lots (greater than 100) good stuff". We did not get a formal questionnaire response from U7 but she let it be known that she thought the capabilities being developed in the CONIT project were of high potential value.

A.8   User U8

U8 was an information scientist who was experienced in the analysis and use of computer systems but did not regularly do searching. She attended the demo and had access to the printed CONIT documentation. She had a few sessions to test connecting to CONIT and one session in which actual searching was attempted.

<u>Session U8.1</u>

U8 spent about 20 minutes browsing through general explanatory information about CONIT. By m29 she had set up problem description: title = "video disc technology in training"; ER=50, RD=20, KR not specified. Some time was spent fixing a typo in

description and trying to "fix" the perceived line wrap string (see U2) until an online message from Marcus advised her to ignore the problem.

At m45 U8 started getting help on file selection and put 2 files on the list: LISA (HIL) and INFORMATION SCIENCE (HIS). At m54 U8 asked to run title as search phrase but the search was aborted when it developed that CONIT had the wrong account number for DIALOG for the given user ID. Total session time was 64 minutes with 154 interactions.

U8 did not complete a formal questionnaire but is known to have stated, as did U7, that the functional capabilities represented in the CONIT design are needed for improvements to gateway technology.

A.9   User U9

User U9 was an engineer for whom we have no detailed background data. He did not attend the demo. He connected to CONIT once but did not try to pursue the session because he felt the plethora of explanatory information was "overwhelming".

A.10   USER U10

User U10 was an engineer in the same management group as U6. He did not attend the demo or have CONIT documentation. He made one connection to CONIT but the line dropped after 3 minutes and 5 interactions.

Appendix B

Forms and Questionnaires Used in Experiments

1. Explanation of Experiment and CONIT Access Mechanisms

2. Pre-search Questionnaire

3. Post-search Questionnaire

DTIC-CONIT EXPERIMENT OVERVIEW
August 1987

CONIT is an experimental system designed to investigate ways to make a user's access to retrieval systems easier and more effective. CONIT currently provides access to over 300 databases in 3 systems: DIALOG, ORBIT and the National Library of Medicine's ELHILL. Through these experiments we seek your help in testing and evaluating CONIT.

You will be asked to fill out a short pre-search questionnaire. A full record of your search session will be kept and printed on CONIT's computer. We ask that you generate a printed copy of your search session as well. After each of your computer sessions you will be asked to comment on the general and particular features you found good and bad. These comments will be recorded in several ways: filling out the post-search questionnaire; making annotations on your printed copy of the search sessions; and, orally in the debriefings that will be conducted by MIT. You may also make additional comments during your search session on paper or by using the CONIT COMMENT command.

NOTES:

(1) You will have confidentiality. Your name will not be used in any report on these experiments without your permission.

(2) CONIT will report on computer costs which are covered for these experiments. A typical comprehensive search may take a new user 2 to 4 sessions of about an hour each.

(3) A CONIT Guide to menu operations and a Reference Manual of commands can be made available. Note, however, that it is not necessary to read either one in that all the explanations given in them are also available online and will given to you by CONIT as needed.

(4) Please remember that CONIT is an experimental system. It has bugs and is designed more for testing certain advanced features than for operations. You can help by pointing out which features and functions you think may be useful (when fully debugged and smoothed).

(5) If you have any problem connecting to or using CONIT, please call Richard Marcus at MIT: 612/253-2340, or Marjorie Powell at DTIC: 202/274-5367, or Cynthia Shockley at LMI: 301/320-2000.

INSTRUCTIONS FOR ACCESSING CONIT
FOR THE DTIC EXPERIMENTS

General

General instructions for accessing CONIT appear on page A3 of the CONIT Manual. Additional particulars are given here.

Computer/terminal communication mode settings that usually work best are: full duplex (as opposed to half duplex), even or no parity (as opposed to odd parity), and 120 CPS (1200 baud) or the slower 30 CPS (300 baud).

General instructions are provided below for using the Telenet and Tymnet networks for connecting to the MIT Multics computer on which CONIT resides. The following telephone numbers can be used in the Washington, DC metropolitan area:

	TYMNET	TELENET
VA	691-8200	435-1800
MD	652-0800	(below)
DC	(above)	429-7800

You may also use the DIAL command (2.5) from DGIS to establish the connection.

Telenet Connection

In brief, for Telenet, when the telephone connection is established (as indicated, for example, by the terminal/modem "online" light going on), type the RETURN key twice. After Telenet responds with four lines ending with "TERMINAL=" (for most connections), type the RETURN key once more. When Telenet prompts you with a line with just "@" type:

C 617 138 (Please note the space after the "C" and between the numbers!)

to request connection to Multics.

Tymnet Connection

When connected to Tymnet, you will get the message "please type your terminal identifier" or some line of garbage characters. In either case you then type "a" for most connections ("e" for slow terminals). When Tymnet then says "please log in:", you type:

mitmul

Then type just a RETURN after it asks for the Tymnet password.

CONIT PRE-SEARCH QUESTIONNAIRE

1. Name: _____

2. Organization: _____

    Address/Phone: _____

    _____

3. Job Title: _____

4. Educational Background — highest level:

    High School ___ College (degree/major): _____

    Graduate School (degree/major): _____

5. Computer experience — what is your use of computers?

    Never: ___   Less than once/month: ___
    Several times/month: ___   Most (working) days: ___

6. Retrieval system experience — have you used such systems before?

    No: ___   On my own: ___
    With help from others: ___

    Which systems have you used (with or without help)?

    DIALOG: ___   :   BRS: ___
    ORBIT: ___   National Library of Medicine (NLM): ___

    Others (please name):

    _____

    _____

    _____

7. What will be the subject of your first search planned for CONIT? This answer
    should be a general description, you will be asked for further details later.

    _____

    _____

    _____

CONIT POST-SESSION QUESTIONNAIRE

1.   Name: _____

2.   Date(s) of CONIT Sessions: _____

3.   How many minutes, if any, did you spend reading:

     CONIT Guide: _____ minutes
     CONIT Manual: _____ minutes

4.   Did you get any other help (besides from CONIT online assistance) in using CONIT? If yes, please explain:

     _____

     _____

5.   General reaction -- did you like the system?

     _____

     _____

     _____

6.   How easy (or difficult) was it to use -- generally?

     Very easy: ___   Fairly easy: ___
     Somewhat hard: ___   Very hard: ___

7.   What did you like about CONIT?

     _____

     _____

     _____

8.   What didn't you like about CONIT (bugs, difficulties, inadequacies)?

     _____

     _____

     _____

9. If you have used retrieval systems or other retrieval assistance systems (for example, DGIS, EasyNet, Pro-Search, etc.), how would you compare them to CONIT?

    _____

    _____

    _____

10. Do you think a retrieval assistance program of this kind could be useful as is?

    Definitely: ___   Probably: ___   Maybe: ___   No: ___

    Would it be useful if it had no bugs and was smoother?

    Definitely: ___   Probably: ___   Maybe: ___   No: ___

    Would it be useful if it had additional functions?

    Definitely: ___   Probably: ___   Maybe: ___   No: ___

    Which additional functions?: _____

    _____