Man-machine Interface in TOOL-IR, an On-line Bibliographic Information Retrieval System

Masamitsu NEGISHI* and Takeo YAMAMOTO**

Abstract

The design of the man-machine interface for an on-line bibliographic information system, TOOL-IR (Tokyo University On-Line Information Retrieval System), is described. The main objectives are simple operation and dynamic control over the retrieval process. Considerations for the Japanese environment are discussed. To simplify the operation for the user, a limited, mostly lowershift character set and a simple command syntax are chosen. To give the user control over the retrieval process, all the subcommands are made independent of each other, and no 'phases' or 'modes' are created in the session. Each command is made to have a simple function. The user may store a sequence of retrieval commands in a private query library. He may share other user's private query library, or use the system query library. Other measures for realizing the design objectives are enumerated.

1. Introduction:

The effectiveness of interactive search methods in bibliographic information retrieval has been well known, and several systems are in operation.[1),2)] Techniques for the design of man-machine systems have been reviewed.[3)] However, few large-scale interactive bibliographic systems are in operation outside the U.S. and Europe. We have developed an on-line information retrieval system, TOOL-IR, for the academic community of Japan. In designing the man-machine interface for the system, techniques had to be reevaluated and priorities reestablished, as the man-machine interface is a function of the human, and especially linguistic environment.

In section 2, the outline of the developed system will be briefly described. In section 3, the principles and some details of the TOOL-IR man-machine interface design will be discussed.

2. Outline of TOOL-IR:

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* Faculty of Economics, University of Tokyo.
** Computer Centre, University of Tokyo.

TOOL-IR[4),5)] is an on-line information retrieval system for bibliographic and other scientific information. Currently it is used for:

A. Chemical Abstracts Condensates (CA Condensates) from Chemical Abstracts Service,
B. Crystallographic Data (bibliographic and numerical) from the Crystallographic Data Centre at Combridge University, and
C. INSPEC Computer and Control Abstracts.

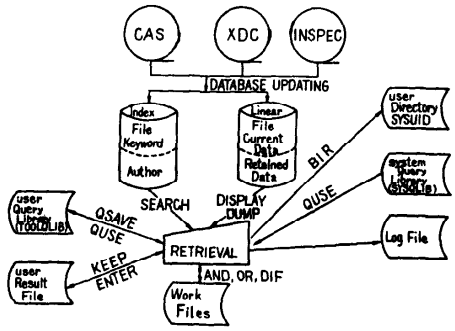

Fig. 1 General Structure of TOOL-IR

The system has been developed and operated on a HITAC 8800/8700 OS7 at the University of Tokyo Computer Centre, which is one of the seven Japanese inter-university computer centers for academic research. The first version of TOOL-IR was completed in August, 1974. After one year of test usage by a limited number of users and program modifications, the system was made available to all the users of the center in July, 1975.

The general structure of TOOL-IR is shown in Fig. 1. Current issues of data tapes from outside information sources are processed into inverted files of keywords (title words, author names, descriptors etc.) and a linear file for each data base. The retrieval may be performed either in TSS or in batch mode. The routing of results of TSS search to batch or remote batch output is also possible.

Table 1 TOOL-IR main commands

syntax	desciption
CAS{LATEST / Vol. No.}	retrospective search of CA condensates bibliographic data
NEWCAS	current awarness search of CA condensates
CODEN	CODEN-jounal name conversion
XDC	retrospective search of Crystallographic Data Centre bibliographic data
XBIB	print/file output of XDC bibliographic data
XDATA	print/file output of XDC numerical data
IEE	retrospective search of INSPEC bibliographic data
GMAIL text, groupname	mailing of a message to the member of a group
GPERMIT filename, groupname	permission of an access to a file to the group member
GINHIBIT	inhibition of an access to a file to the group member
BIR	initiation procedure for a new user of TOOL-IR
EIR	termination procedure

Main commands for TOOL-IR are listed in Table 1. The user specifies the data base to be retrieved with a main command. Retrieval operations are performed by using subcommands shown in Table 2. In the following discussion, 'commands' means subcommands unless otherwise specified.

3. Man-Machine Interface in TOOL-IR:

In the design of the man-machine interface, two goals were set: maximizing the user's convenience by providing him with a simple terminal operation, and securing his authority by giving him an effective control over the retrieval process. For that reason, the system-directed conversation was abandoned in favor of conversation

Table 2 TOOL-IR subcommands

syntax	description
SEARCH {keyword / A. author} {kw / au} [, {kw / A. au} [{kw / au}] [, ...]] ... [{.AND. / .NOT.} {kw / A. au} [{kw / au}] [. ...] ...]	primaly retrieval
AND setno, setno [, setno. ...] OR setno, setno[, setno, ...] DIF setno-setno EXTRACT setno, vol. issue. abstr [--vol. issue. abstr]	secondary retrieval
QSAVE {TOOLQLIB / querylibrary}. queryname [, {1 / setno} [, {previoussetno / setno}]] QUSE {TOOLQLIB / SYSQLIB / querylibrary}. queryname	store/restore query
KEEP filename [, {previoussetno / setno}] ENTER filename	store/restore results of retrieval
DISPLAY [S. {prev. setno / setno}] [, N. {wholeset / number}] [, M. {A / B / C / D}] DUMP vol. issue. abstr	displav data in linear file
REMIND setno [, setno, ...]	remind former command image
KILL	quit-restore
END	end retrieval

directed by user-issued commands. A suitable character set, language and command syntax for the Japanese user community was chosen. Each command was made to have a simple, non-structured function. Here, non-structured means that there are no involved relations such as 'phases' or 'modes' among the commands, and that the commands may be issued independently of each other.

3.1 Terminal Hardware, Language and Command Syntax:

As the average Japanese user is much less used to typewriting than his or her American or European counterpart, reduction of terminal input was the primary consideration. An obvious way might be using special terminals with function keys or light-pen input capability. Although many existing systems have resorted to the use of such terminals, we decided to avoid locking the system into a particular terminal hardware. In view of the rapid change in the variety and the availability of TSS terminal hardware here since the initial development of the system, the decision at that time seems to have been justified.

For the query commands, simple English words were used. The use of KATAKANA (Japanese phonetic characters) in the query language was considered but was decided against although KATAKANA-character keyboards are easily available in most Japanese TSS terminals. It is difficult for a casual TSS user to use KATAKANA terminals because there are more KATAKANA symbols than in alphabets and those symbols are

```
TYPE IN COMMAND
●SEARCH RAT

SEARCH RAT
*OR1*
KEYWORD='RAT      '
DOCUMENT SET #  1 CREATED
CONTAINS  272 DOCUMENTS

TYPE IN COMMAND
●SEA MOUSE,MICE

SEA MOUSE,MICE
*OR1*
KEYWORD='MOUSE    '
KEYWORD='MICE     '
DOCUMENT SET #  2 CREATED
CONTAINS   56 DOCUMENTS

TYPE IN COMMAND
●AND 1,2

AND 1,2
DOCUMENT SET #  3 CREATED
CONTAINS     7 DOCUMENTS

TYPE IN COMMAND
●OR 1,2

OR 1,2
DOCUMENT SET #  4 CREATED
CONTAINS   321 DOCUMENTS
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```
TYPE IN COMMAND
●DIF 1-2

DIF 1-2
DOCUMENT SET #  5 CREATED
CONTAINS   265 DOCUMENTS

TYPE IN COMMAND
●S   GUINEA,AND,PIG

SEA GUINEA.AND.PIG
*OR1*
KEYWORD='GUINEA   '
*OR2*
KEYWORD='PIG      '
*AND*
DOCUMENT SET #  7 CREATED
CONTAINS   22 DOCUMENTS

TYPE IN COMMAND
●S   PIG,NOT,GUINEA

S   PIG.NOT.GUINEA
*OR1*
KEYWORD='PIG      '
*OR2*
KEYWORD='GUINEA   '
*NOT*
DOCUMENT SET #  8 CREATED
CONTAINS   20 DOCUMENTS
```

Fig. 2 Use of retrieval commands

placed on the keyboard in a special arrangement optimized for professional KATAKANA-typists. Use of Romanized Japanese for the command was abandoned as it takes much more keytouches than the corresponding English word.

As for the delimiting characters and special symbols, those characters which are lower (standard) shift characters in most TSS terminals (minus, comma, period) were used*. Parentheses and the equal sign were avoided as they are upper-shift symbols in most terminals.

The command syntax was made simple and easily memorable for the casual user, as shown in Fig. 2 and Fig. 3. In SEARCH command where OR operation among keywords are more common than AND operation, the former was made to precede the latter in contrast to ordinary logic.[6)]

3.2 Simplified Function for Each Command:

To give the user maximum control over the system, each command was made to have a simple function. The primary retrieval command, SEARCH (Fig. 2), accesses the inverted index file and creates a set of pointers to the references (document set) as a temporary file. The secondary retrieval commands, AND, OR, DIF and EXTRACT, operate on already existing document sets and create new document sets. The user may refer to the sets in later retrieval commands, DISPLAY (Fig. 3) the content of the documents or KEEP (copy into his private file) the document set. As the document sets are retained throughout the session, the user may accumulate the effect of simple commands to create a complex query.

```
*DIS N,2,M,D

DIS N,2,M,D
DISPLAY DOCUMENT SET #  1
SET CONSISTS OF      62 DOCUMENTS
DIGESTS OF LAST       2 WILL BE DISPLAYED

V/I/N: CAS VOLUME/ISSUE/ABSTRACT-NO
A:AUTHOR C:CODEN V:VOLUME P:PAGE Y:YEAR
T:TITLE
K:KEYWORD PHRASE

V/I/N:83/02/021312G A:FLOCKHART, B. D.          C:PAYCAL(J)
T:ELECTRON MAGNETIC RESONANCE AS AN ANALYTICAL TOOL
K:REVIEW ANALYSIS ELECTRON MAGNETIC RESONANCE/EPR ANALYSIS

V/I/N:83/02/0219812 A:ROKUSHIKA, SOUJI ET AL. C:ANALBP(J)
T:FLOW ESR DETECTOR FOR LIQUID CHROMATOGRAPHY OF RADICALS
K:ESR DETECTOR LIQ CHROMATOG RADICAL
```

Fig. 3 Use of DISPLAY command

3.3 Storing and Sharing a query:

Storing a query is an essential function in TOOL-IR where a query tends to be a long series of commands because of the above design. During a search session, the user may name and store all or part of the past sequence of retrieval commands into his private file (query library), as shown in Fig. 4. He may recall the named command sequence any time in the session or in later sessions. These private query libraries may be shared among the users through the standard file permit/share procedure. The user may also use the system query library which has been contributed by other users. He may call the query by using QUSE command, or use the system query as a starting

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* An asterisk, which in some cases is an upper-shift character, was also used. However, its use for word truncation is not expected to be too often or too casual.

material for his revised query, copying a query from the system library into his private file and modifying the content with the text editor.

3.4 Other Measures:

Other measures we have taken to fulfill the design goals include the following:

A. Dynamic definition of files. The system dynamically defines all the needed files, both temporary and non-temporary. However, should a user issue a file definition command, it preempts the system definition of the file.

B. Avoiding a system failure by rigorous check of user input.

C. Accepting terminal interrupts and returning the control to the user.

D. Detailed review messages to keep the user informed.

```
TYPE IN COMMAND
*QSAVE KOGAI,2,6

QSAVE KOGAI,2,6
QUERY LIBRARY 'TOOLQLIB' USED

** COMMANDS TO BE SAVED ARE FROM #  2 TO #  6 **
SEARCH    SMOG,FUME,WASTE
SEARCH    HYGIEN*,POLLUT*
SEARCH    CA059*
SEARCH    CA060*
OR        1,2,3,4

THE ABOVE QUERY NAMED 'KOGAI'
PLACED IN QUERY LIBRARY 'TOOLQLIB'
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Fig. 4 Use of QSAVE command

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