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A Case Study of Online Information: Second Generation Systems Design

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Abstract—This article presents a typical online information system and discusses the problems inherent in its use. The problems are addressed by a revised system which provides easier access to the data base for both novice and experienced users. The system is illustrated by a scenario of a typical interaction with the revised system.

IN THE PAST, the Library of Congress distributed bibliographic information to libraries in the United States in paper (or hardcopy) form. However, because of the change to an electronic system in 1982, the Library of Congress now distributes the bibliographic information only in electronic (or online) form. As a result, most libraries are adopting electronic catalogs. In addition, many libraries are eliminating their paper card catalogs because they do not have the financial or human resources to support both an electronic and a paper card catalog.

The increasing use of electronic information systems in libraries and other settings has prompted much recent research in the field of online documentation. However, because this is such a new field, current findings present conflicting evidence as to what constitutes a "good" screen.

To create standards for good screen designs, designers attempt to apply knowledge of printing practices to the new medium (Fig. 1). Although these practices are founded in the graphic arts tradition, they have not been subjected to empirical testing. Furthermore, because of the dynamic aspects of electronic systems, these practices cannot be translated directly from one medium to another. There are decidedly some areas that are applicable, such as basic geometries, but these do not apply to the dynamic interactions, such as time and motion, available in electronic systems. Neither a sound empirical basis nor an adequate graphics model has yet emerged for online information; however, one can discover some consensus from both the research and the graphic arts disciplines that has the potential to create effective online documentation.

This paper was written when all four of its authors were graduate students at Rensselaer Polytechnic Institute. Ms. Basara has since received the M.S. degree and is working as a technical writer for a major corporation. Mr. Burgin holds B.S. and M.S. degrees from RPI; he now works at the Institute's Information Technology Services organization. Ms. Ryan, currently on industrial assignment at IBM-Kingston, has a B.A. in music from SUNY, Buffalo, and is due to receive her M.S. in technical communication from RPI. Mr. Trummel spent 25 years as chief executive of a communications service organization and has been a professor of graphic communication in the Massachusetts university system; he is now a Ph.D. candidate at RPI.

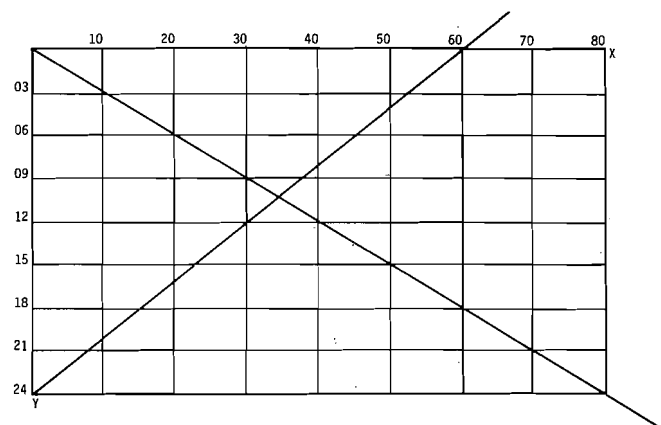


Figure 1. Typical screen geometry for establishing grid layout and positioning image elements.

Generally, research concerning online information focuses on mechanistic problems such as screen dimensions, screen densities, line lengths, and retrieval aids. Kruk and Muter, for instance, have compared screens to pages¹; Tullis has looked at screen densities, the number of characters on a screen²; and Rubens and Krull have examined the use of specific screen areas for various purposes.³

Although much research has been done in the field of online information, we know of no previous attempt to apply these findings to an existing situation. This article presents a case study of a maturing online system.*

DEVELOPMENT OF THE ONLINE CATALOG: AN OVERVIEW

Our example online library catalog, which is available to the general academic community, contains information on most books, periodicals, and media available in the campus library. It can be accessed from dedicated terminals in the library as well as from other hard-wired and remote terminals both on and off campus.

In 1979, the library staff began developing the online catalog. After investigating a number of "turnkey" systems that were available and determining that none of them would meet the library's needs, the staff decided to develop an in-house system that was supported by the SPIRES data base management system.

* Research on this paper was supported in part by funds provided by Reader's Digest Foundation.

The library hired two full-time programmer/analysts to develop the online catalog. However, these programmers were restricted when designing the system. Because the library received bibliographic information from the Library of Congress in the form of electronic tapes, the programmers had to design a system that was compatible with these tapes. In addition, the programmers faced limitations in technology. For example, none of the four types of on-campus terminals which link to the mainframe computer supports graphics capabilities. Therefore, the programmers could not use visual metaphors or icons in their program.

Programmers were also constrained by the software supported by the mainframe computer and by limitations inherent in the SPIRES software. First, SPIRES is supported by the university's operating system, and the programmers believed that they did not have the capability to reassign the programmable function (PF) keys that were controlled by the operating system. Second, because of the way SPIRES structures data, programmers were limited in the ways that information could be accessed. These limitations could have been overcome by driving SPIRES with a new external program. However, because of time constraints, this option of using an external program was not fully explored.

Maintenance of the online system involves changing information in the system and periodically modifying the software. Information in the online system is changed by a staff of cataloguers who update the master record file with the tapes received from the Library of Congress. Changing a few entries in the master record file takes only several minutes.

At present, one programmer/analyst updates the software. He is responsible for merging new information from the Library of Congress tapes, which are released periodically, with current library records. Another staff member devotes about 25 percent of her time to formatting the electronic information for the online system in a three-step conversion procedure:

- First, the tapes are uploaded to the mainframe computer.
- Second, the tapes are converted from ASCII code to a natural language format.
- Third, the formatted information is loaded into SPIRES.

REVIEW OF THE CURRENT SYSTEM

Although our example online catalog provides information more quickly and efficiently than the hardcopy catalog, it has limitations in at least three areas: the actual use of the online catalog, the format and content of the screens, and the mode of interaction.

Concerning the use of the online catalog, library records

indicate that patrons generally perform simple searches of authors, titles, and subjects. Simple searches predominate because many patrons are unwilling or unable to learn the detailed syntax of Boolean expressions (for example, *and*, *or*, and *but not*) that allow a user to construct complex search requests.

Screen formats of the current system are inconsistent. These inconsistent formats make it difficult to locate needed information on the screens. Also, a variety of reporting forms is used. For instance, CALL, BRIEF, and DETAIL are the three methods for displaying results on the screen. Each method displays a different amount of information, given in a different order.

In terms of content, several screens present much unnecessary and irrelevant information. For example, the main menu lists the collections the user may search, but it also presents background information detailing the development and history of the online catalog. This background information does not help the user to perform any tasks, but it confronts the user each time he or she begins a search. Another screen which presents extraneous material is the reporting screen for the DETAIL command. If the user asks for his or her results in DETAIL, the system also provides the OCLC number and the ISBN number. These numbers are important only to the library staff. Too much information not only overwhelms the user, but also results in overly dense screens. Research indicates that overly dense screens decrease the legibility of displayed text.⁴

In addition, many screens contain terms—such as *acquisitions*, *data base*, and *serials*—that are familiar mainly to librarians and confusing to first-time users.

Finally, the current system provides only one mode of interaction. This command-driven interaction is both intimidating to novice users and slow and frustrating for experienced users. Also, the current interaction mode is inconsistent and uses a technique we call *garden-pathing*; it displays several commands, any of which can ostensibly be performed, but some of which cannot always be executed. If the user selects one of these commands, the system responds with an error message. For example, in the current system, these commands are always displayed: FIND, BROWSE, HELP. However, if the user types in BROWSE at an "incorrect" place in the program, the system responds "Not a legal or complete command."

REVISION OF A TYPICAL SYSTEM

Based on this review of the current system, we created a second-generation design that focuses on format, content, and interaction and navigation techniques. We rejected virtually all the concepts found in the current system.

For example, the main menu from the current program (Fig. 2) is a very dense screen. Text is tightly packed

like *books*, *periodicals*, and *collections*. We move background information to HELP screens. To clarify the language, we reduce the library's 12-item index to a list containing the four most commonly used key words. The library staff maintains an internal index of technical terms with which members can continue to search.

We combine sentences wherever possible in order to reduce redundant information. New terms—value-added material—are made into lists. For example, on the main menu from the current program, the word *search* appears in the first three items. We extract this word and use it in a question on the main menu of our program. The remaining items retain the list format.

Interaction

Our suggested interactions reduce the number of key-strokes and simplify the interaction whenever possible. As indicated previously, the current program requires that the user enter complex combinations of keystrokes. In the new program, the user types specific search terms but selects key words by typing a number. By reducing the number of keystrokes, we reduce the chance that the user will make a typing error. In addition, the user is never asked for more than one piece of information at a time, and the program echoes his or her choice of key words and search terms. The user is also provided with a back-up option to return to a previous screen and change a selection.

Context-specific help is provided throughout the program, because a user should not need to consult a manual to conduct a simple search. Furthermore, the user can continue the search directly from the HELP screen. This strategy is referred to as the "sticky yellow pad" or "pass back" strategy. For example, the second HELP screen in our program provides a command line so that the user can continue the search directly from this screen without returning to the main menu.

SCENARIO OF A TYPICAL INTERACTION

To demonstrate the advantages of our revisions, we present a scenario of a typical interaction, which involves a first-time user with minimal computer experience. First, the user conducts a simple search. Second, the user searches *Books*, the most commonly searched collection, for his favorite novel, Hemingway's *Islands in the Stream*. Throughout the scenario, the patron faces several choices. To show a number of options available on the new system, the user requests HELP information. The scenario ends when the system displays the information needed to locate the book in the library.

Screen 1

The main menu is the first screen the user sees when beginning the search (Fig. 4). The user is asked which collection he or she wants to search—*Books*, *Periodicals*, or *Other media*. The user is instructed to type a number and

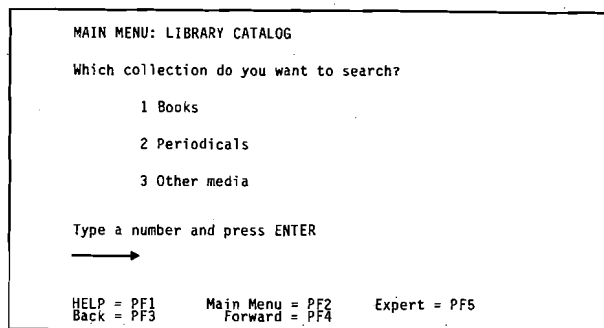


Figure 4. (Screen 1) Main menu of revised system.

press the ENTER key. On this screen, the user can choose one of several actions: enter 1, 2, or 3 to begin a search; receive HELP information on using the catalog; or, if he or she is an expert, press PF5 for a fast path.

Our user presses PF1 for HELP.

Screen 2

This is the first HELP screen (Fig. 5). It describes the collections the user can search. The word *HELP* appears first to reinforce the user's place in the program. Stars replace numbers on the list because the user does not make a selection among the items. The option for HELP disappears because the user is in the HELP facility. The *Expert* key also disappears, because a user who presses HELP on the first screen is obviously not an expert. The user may press PF2 or PF3 to return to the main menu.

The format of this screen is consistent with that of the previous screen section; the running head, the function key descriptions, the list, and the instruction line appear in the same locations.

Our user presses PF4 to continue.

Screen 3

This screen (Fig. 6) describes each collection. The user can move back to the previous HELP screen or return to the main menu. Numbers replace stars because the user must select among the items. This screen is almost an exact overlay of the previous screen. Not only does this maintain a consistent format, but it saves computer storage space. The user can begin a search directly from the HELP screen without returning to the main program.

The user decides to search Books. He types 1 and presses ENTER.

Screen 4

The heading changes to tell the user that he or she is searching the Books collection (Fig. 7). A numbered list shows the user which keywords to use to search this collection. The user can enter one of the four numbers to begin the search, use a function key to get HELP to search the Books collection, return to the main menu, or return to the previous screen and select a new collection to search.

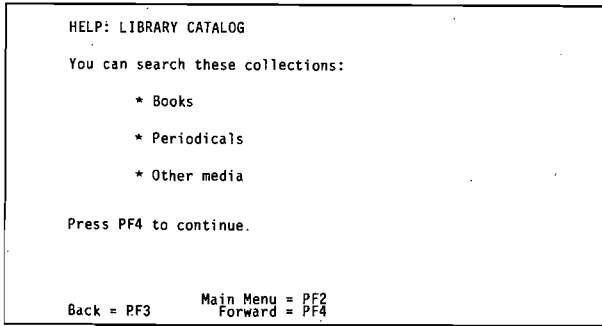


Figure 5. (Screen 2) First-level HELP facility of main menu.

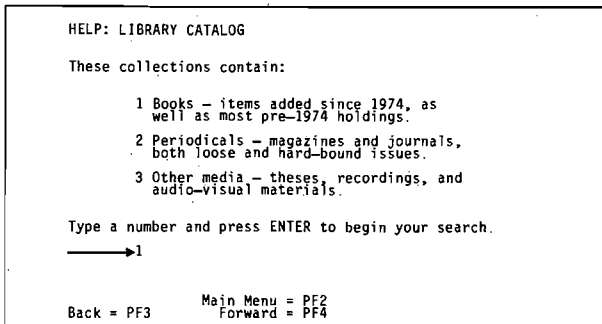


Figure 6. (Screen 3) Second-level HELP facility of main menu.

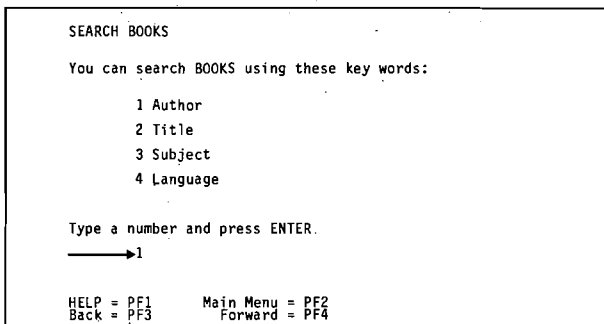


Figure 7. (Screen 4) Key words used to search books collection.

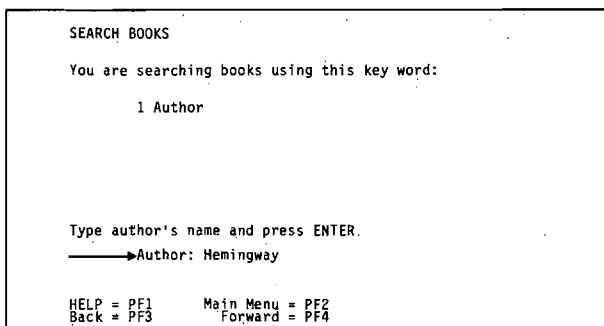


Figure 8. (Screen 5) Using key word *Author* to search books collection.

The user types 1 and presses ENTER to search the Books collection using the keyword *Author*.

Screen 5

The heading of this screen (Fig. 8) remains the same as that of the previous screen. The first line of text changes slightly from *You can search BOOKS* to *You are searching books*. The selected item, *Author*, remains on the screen, and the three other items disappear. The word *Author* appears at the end of the command arrow, and the

blinking cursor appears after the colon to attract the user's attention. The user can type the author's name to continue the search or use a function key to receive specific HELP for entering a name, returning to the main menu to begin a new search, or (if he wants to search a different keyword) going back one screen and selecting a new keyword.

By supplying the word *Author* after the command arrow, we reduce the number of keystrokes needed and also the chance of typographical error. We also reassure the user that he is using the keyword *Author* to search the Books collection.

If the user presses PF1 to request HELP to enter the author's name, a screen appears that provides a starred list describing the three ways to enter the name. Examples are provided for each version. The instruction line is identical to the previous screen, and the cursor remains after the word *Author*. Although this is a HELP screen, the user can continue the search directly from this screen.

Our user types the author's name and presses ENTER to continue the search.

Screen 6

On the next screen to appear (Fig. 9), the heading changes to tell the user that he is now searching Books using the name *Hemingway*. A numbered list describes the tasks a user can do next. We use active verbs to describe these tasks. *Begin* is listed first to accommodate the new user who performs simple searches most of the time. Again, the user can press PF3 to go back to correct a typing error.

If the user presses PF1, a HELP screen appears that explains the options. A numbered list gives brief definitions of each term so that the user is not overwhelmed by excess information. Again, the user can continue the search from this screen without returning to the main program.

The HELP key does not disappear from this screen even though the user is in a HELP facility. If the user again presses PF1, another HELP menu appears to ask the user which term needs to be explained. Pressing PF4 allows the user to page through these HELP screens, where the user finds more detailed definitions of the terms, with examples.

The user types 1 and presses ENTER to begin the search.

Screen 7

At this point (Fig. 10), the system retrieves the information, and the results are displayed in the heading. This heading is indented an extra four spaces to accommodate a possible 9,999 hits. A space is reserved after *BOOK* to accommodate an *s* when more than one item is found. The first two options listed are self-explanatory; number 3 is a bail-out in case the user gets too few or too many hits. HELP is available to describe these options in detail.

```

SEARCH BOOKS: HEMINGWAY

You can begin or change the search using
these options:
  1 Begin
  2 Revise
  3 Narrow
  4 Expand

Type a number and press ENTER.
  → 1

HELP = PF1      Main Menu = PF2
Back = PF3      Forward = PF4

```

Figure 9. (Screen 6) Options available to begin or change search.

```

1 BOOK FOUND: HEMINGWAY

You can now do one of these with the results:
  1 Show them on the screen
  2 Print them
  3 Increase or decrease the number

Type a number and press ENTER.
  → 1

HELP = PF1      Main Menu = PF2
Back = PF3      Forward = PF4

```

Figure 10. (Screen 7) Three actions that can be performed on search results.

```

1 BOOK FOUND: HEMINGWAY

How do you want to show the results?
  1 Author, title, publisher, date and
    call number
  2 Author and title only

Type a number and press ENTER.
  → 1

HELP = PF1      Main Menu = PF2
Back = PF3      Forward = PF4      Print = PF6

```

Figure 11. (Screen 8) Two methods for displaying search results.

```

1 BOOK FOUND: HEMINGWAY

Hemingway, Ernest
Islands in the Stream
Harcourt Brace 1959
PR 4322 H24

Press PF2 to start a new search.

HELP = PF1      Main Menu = PF2
Back = PF3      Forward = PF4      Print = PF6

```

Figure 12. (Screen 9) Displaying the results of the search

Our user types 1 to show the results on the screen.

Screen 8

The heading of the following screen (Fig. 11) remains the same. The user is now asked how the results are to be displayed. If the user decides that there are too many or too few hits, he or she can press PF3 to go to the previous screen to revise the search. The PF6 key appears to allow the user to print the results without first showing them on the screen. HELP is available to explain the two methods of displaying the results.

Our user types 1 and presses ENTER to receive more detailed information.

Screen 9

This is the final screen in our scenario (Fig. 12). The heading remains the same. Four lines of information give the results of the search. The user can now press PF2 to go to the main menu and begin a new search. The PF6 option is still available to print the results. If more than one book is found, the results are displayed one after the other on the screen. The user can scroll through the results by pressing the PF4 key. The user now has the information to find the book in the library.

SUMMARY

A consistent format allows first-time users to learn where information is located and to become comfortable using the system. A user who knows that certain types of information will be located in the same position on every screen does not feel lost when a new screen appears. Nontechnical language is also less intimidating to the first-time user. Uncluttered screens allow the user to locate important in-

formation quickly and easily. Providing two interactive paths, a menu-driven path for novices and a command-driven mode for experts, helps both levels of users feel comfortable using the system. A context-specific HELP facility gives the user HELP information for the present task without overwhelming him or her with excess material. The "sticky yellow pad" strategy allows the user to move easily from the HELP facility back to the main program and to recover from errors easily.

The methods and techniques we posit in this paper work within limits. They are based on traditional techniques and disciplines using current electronic technology and hold considerable promise as a foundation for using these concepts with emerging technologies. Given the tremendous potential of online material for conveying information and creating novel and useful reader/user interactions, we need to develop techniques that will meet the demands of both the technology and its users well into the future.

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