Information access or information anxiety? — an exploratory evaluation of book index features

by Corinne Jörgensen and Elizabeth D Liddy

The authors conducted a controlled user study in both print and electronic environments, and present here a subset of results from index use in the print format. They suggest some implications for commonly-held assumptions about index design.

This paper presents a subset of research results from a project which had several major goals:

1. to empirically investigate book-index usage behaviors
2. to investigate the extent to which specific print index features affect a user's search for information
3. to examine these same features in an electronic environment.

The overall purpose of the research is to gather data which can guide specifications for index construction that will facilitate a user's search for information in a typically constructed index.

Back-of-the-book indexes are a ubiquitous information access tool which is both familiar and taken for granted by users. They do not receive much recognition or praise when well done, yet they are easily criticized when they function in a less than useful way. Academic librarians frequently encounter faculty who will not request a book if it is not well indexed, yet few index users can describe what they need from an index or the qualities that make an index a "good" one. While there are standards for index construction and professional societies (American Society of Indexers) and journals (*The Indexer*) devoted to their creation, many decisions about index features are based upon introspection and personal experience. Until the current study, there has been little empirical evidence upon which to base guidelines for index construction. It appears that construction and use of book indexes is considered so obvious a process that no one has conducted either a functional analysis of index use or an empirical study of whether the typical features of book indexes actually assist users in accomplishing their goals.

Currently, large amounts of text are migrating to electronic formats, and search techniques such as keyword and Boolean searching are being substituted as access mechanisms for more traditional indexing. However, even with powerful text searching software users are often uneasy about their ability to fully retrieve what is needed from an electronic file. While computerized search techniques are indeed powerful, we do not know whether they can adequately replace traditional indexing because we do not have an understanding of the functionalities of specific index features. The migration to electronic formats does not necessarily eliminate the "old ways" of doing things, but rather creates an urgency for a better understanding of user needs and behaviors in searching for a piece of information.

important. The most important benefit that editors see is that the computer saves any re-keying and so saves time. This is closely followed by a reduction in mistakes by the typesetter and allowing submission of the work on disk. The editors then appreciate the accuracy which the computer allows, which conforms to their view that accuracy is one of the most important qualities in an indexer.

Conclusions

The results were divided into three main sections.

- Information on indexers and working practices
- Information on editors and working practices, as they relate to indexing
- The process of producing an index.

The results highlighted below show some of the areas which are worthy of further consideration and investigation and perhaps action.

The results show that indexing is not a full time occupation for the majority of indexers but that, coupled with other work, most indexers do work full time. Indexers are, on average, in their 50s with a skew towards the older age groups. This is perhaps worrying for the future of indexing.

Training and qualifications are important issues but there seems to be a lack of consensus amongst editors as to the role and nature of the two SI qualifications; Accredited Indexer and Registered Indexer. There is also some variation of views on how the SI can best fulfil its role as a professional body.

Editors seem positive about indexing and seem to value their indexers and the work they do. There is an encouraging amount of loyalty amongst editors to a small number of indexers which they regularly use. There is, however, a difference of opinion as to what qualities a good indexer should have. Editors see dependability, giving and meeting deadlines as the most important elements in offering good service.

Computers are almost a pre-requisite now for indexers. Editors expect indexes on disk and feel they improve the accuracy of the final printed product.

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Rather than simply following established methods for index creation in database environments as represented by current indexing and abstracting services, or directly transferring the contents of back-of-the-book indexes to online records for retrieval purposes, the authors felt that it was time to step back from technology and tradition-driven system design and research more fundamental questions such as the functionalities which index users need and how they actually use indexes.

Previous research

The literature demonstrates a continuing interest in the process of indexing, and is composed primarily of discussions on the art and methodology of indexing and on the nature of a "good" index based on reasoning and intuition. An overview of some of these is provided by Thomas (Thomas 1989). A thorough review of the literature turned up no previous studies of actual book index use, and there are a few empirically based index studies. Gratch, Settel and Atherton (Gratch 1978) quantitatively measured various book index features in a study of the possibility of adding book index entries to card catalog records, Wittman (Wittman 1990) provides a quantitative evaluation of index subheadings. Diodato and Gandt (Diodato 1990) studied differences between author and nonauthor produced indexes and present a quantitative description of a range of index characteristics in these. Bishop, Liddy, and Settel (Bishop 1991) provide a quantitative description of book indexes. Diodato has analyzed several index features quantitatively in back-of-book indexes: cross-references (Diodato 1991), duplicate entries versus see cross-references (Diodato 1994a), and a survey of user preferences for features in back of book indexes (Diodato 1994b).

However, none of these studies addresses how individuals actually use a book index or the relationship between specific index features and usage. And although standards for construction and evaluation of book indexes have been established, these are not based on empirical evidence (ANSI 1984) (BSI 1988), but rather introspectively on human expertise and experience. Our earlier Index Quality Study (Liddy 1991) examined current book indexes and indexing practice in great detail and indicated that, while most recent book indexes follow recommended format and style reasonably well, they fail to meet many of the criteria that indicate adequate depth of analysis of content and adaptability to the needs of users. The book indexes varied in their breadth of selection of index entries, depth of intellectual analysis of book content, means of vocabulary control, and intellectual and physical arrangements which facilitate retrieval. These index features have long been assumed to be related to index quality, but there is little empirical evidence indicating which specific features affect the reader's search for information and the relative importance of these different features.

The need to know which index features facilitate information retrieval is relevant in both print and electronic environments. A recent investigation reopened the question of whether book index entries ought to be included in USMARC records (Library of Congress, 1990), and inclusion of book indexes may enable OPACs to more completely meet the information browsing needs of users (Belkin, 1991). Researchers are now beginning to understand the importance of the structure of knowledge to information access (Albrechtsen, 1993). However, without a more basic understanding of the functionalities of an index, progress will be slow. This research seeks to provide data which will inform our understanding of the interactions between users and indexes, and to suggest ways that access through traditional indexes can be facilitated.

Project methodology

In order to study users' behaviors and actions in index use, we asked a team of three qualified indexers to create what we termed the "Basic Index," an index which followed generally accepted index construction guidelines and met basic standards for index parameters such as density and depth. The researchers then created several versions of that index, varying a range of index features shown to be most neglected in current book indexes by our earlier studies of index quality, as well as features that, in the researchers' experience, users frequently seem to misunderstand or have difficulty interpreting. The variations concerned questions of intellectual access (e.g., provision of cross-references), and also formatting of information (e.g., capitalization of headings).

Results from three of the variations are presented; data from other variations are still being analyzed. One of the variations reported upon here tested formatting (a divided index format), while two of the variations reported relate to the following index functions:

- Provision of entries for all pertinent concepts and elements
- Indication of relationships between concepts and elements
- Correlation of the reader's language with that of the indexer

Sixtynine students pursuing undergraduate and graduate degrees at Syracuse University volunteered for this research. Subjects were from all levels of classes and programs in the School of Information Studies, from first-year undergraduate to PhD students. Subjects were motivated to participate in the study by several factors: extra credit was offered to volunteers from some classes, some were interested in the process of indexing, and some were intrigued by being a part of a research project

Subjects participated in a naturalistic searching situation in which they attempted to answer questions using either the Basic Index or one of the variations of the Basic Index. There were ten subjects per index test set; five used the Basic Index and five used the index variation. Subjects were asked to talk aloud as they used the index, and they were encouraged to do so by means of neutral questions from the researcher. The sessions were tape-recorded.

Subjects were told that this was research concerning back-of-the book indexes. However, aiming towards a more naturalistic search experience, subjects were not restricted to the index in their search for information, but were able to use all parts of the book. In addition to the tape-recording of the sessions, the researcher kept a written log sheet of actions for the print index. Subjects were asked to fill out a post-test questionnaire and to provide demographic information as well as information regarding their familiarity with the text used. Scaled responses to the questionnaire were used to gauge subjects' perceptions concerning their satisfaction with the search and the perceived quality of the index. The questionnaire also allowed subjects to make comments to explain their answers

if they so wished.

Each subject attempted to answer a set of two questions designed for each index variation. In addition, subjects were asked to answer a control question which was the same across index variations and subjects. The specific index variations reported upon here are:

- A divided index (Name/Title & Subject)
- An index with no see/see also references
- An index with few concept words

Data analysis

The data were transcribed from the tapes and information about the following variables was coded from the search transcripts and the researcher's log sheets:

- number of attempts to find information
- amount and correctness of information found
- task completion and search time
- number and source of errors

An attempt is defined as a group of index actions which represent the pursuit of one search focus in the index. An attempt may be composed of one or more index actions, such as looking up a heading and from there following a see also reference, two index actions.

The researcher evaluated and coded the amount and correctness of information found, and this data was compared to information collected on the questionnaire about subjects' perceptions concerning the amount of information found, their satisfaction with the search, and their perceived quality of the index. Types of errors were also classified and coded.

Results

There were approximately five subjects using each index variation and five subjects answering the same question using the Basic Index. These are small data sets and our analysis at this stage is quite exploratory. However, the number of subjects using the Basic Index was larger (fifteen), and this data indicates some important trends in index use.

In terms of the general characteristics of the data, there were a high number of completed, successful searches, and subjects appeared to want to please the researcher. Scaled responses indicated the subjects were satisfied with the index and pleased with their performance. However, subjects were also satisfied with answers that were only peripherally related to the question and with incomplete answers.

Major categories of errors include stopping short of where the information could be found, problems understanding headings and format, general problems with comprehension, and problems with finding correct entry terms. Problems with entry terms included the subjects' use of adjectives or verbs as headings and finding the right level of 'granularity' (i.e., not knowing how to choose between 'design' or 'graphics' for a question about designing good graphics).

A divided index (name/title and subject)

The Basic Index was divided into two indexes, a Subject index and a Name/Title index. The Basic Index contains a large number of proper names and thus seems a good candidate for a divided index, as a divided index is considered to aid in ease and speed of searching when there are a large number of proper nouns. The danger of a divided index is that searchers will not discover that there is more than one index, and therefore good

practice suggests providing pointers between the indexes. The question then becomes whether these pointers do in fact work. The divided index variation included prominent pointers to the existence of the other index. Our results show that:

- Users generally don't expect more than one index
- Users may not find the other index, even with pointers provided
- Subjects assume the index is in error when they fail to find the second index
- Subjects did not look for an explanatory note
- Finding the other index didn't ensure success

Failure to discover the other index did not necessarily mean that the subject failed to find the answer (one person used the table of contents, one person used the bibliography), nor did finding the other index ensure success (one person failed to find the answer even after discovering the second index because of a lack of understanding of see/see also references).

Comparing the Divided Index to the Basic Index, the Divided Index required slightly more attempts to find information, had a higher overall error rate (one half of the subjects did not find the other index), and required more time to find the answer. The failure rate (correct answer was not found) was quite a bit higher (30% vs. 12.5%).

Those who did not discover the presence of the second index rated the index as being poor; for those who did discover the other index, the ratings are high.

It is often stated that indexers must consider the typical user of an index; a divided index may be more appropriate for a more sophisticated audience or one with specialized needs. Subjects who were undergraduates generally exhibited confusion and frustration when using the Divided Index. The high percentage of those who did not discover the other index indicates that providing a divided index has the potential to seriously affect the retrieval of information. While a divided index may be more convenient once its presence is recognized (and was appreciated by subjects as being 'efficient' once it was discovered), there seems to be a danger that a large number of users will not discover the second index, as techniques widely used to guide the user to the second index are not consistently successful. Indexers should not make broad assumptions about their audience and should proceed with caution when deciding to create a divided index.

An index with no see/see also references

See/see also references are considered to be one of the critical attributes in a good index. The Basic Index was created with a number of see/see also references, bringing together related terms for concepts such as design, an important topic discussed throughout the book but for which there are no entries in the original index. The No See/See Also version stripped out these see/see also references.

The Basic Index, containing see/see also references, outperformed the No See/See Also version for most variables.

In the No See/See Also version subjects needed more attempts to find the answer, made more errors, and took longer to find the answer. The amount and correctness of information found for successful searches was similar across both indexes. It appears that providing see/see also references speeds up the process of searching, perhaps by reducing errors.

However, the overall success rate for task completion was

lower in the Basic Index (80% success rate vs. 89% success rate), because subjects often stopped short of where the correct answer could be found, resulting in search failure. The fact that this also resulted in faster search times should serve as a cautionary note when interpreting such data.

Scanning is an index action which the researchers observed comprising much of the time during which a user interacts with an index. In the No See/See Also index version, the number of index actions identified as "scan" was five times higher than in the Basic Index. This, combined with the fact that the searches in the No See/See Also version were longer, could indicate that increased scanning behavior is required to compensate for the lack of guidance that see/see also references provide. There were also five times as many synonym generating actions in the No See/See Also version, indicating that users attempt to compensate for deficiencies in indexes.

There were some common errors in using see/see also references: reading the see/see also as part of a main heading, part of a subheading, running separate references together, or reading a heading and subheading as part of a see also. Across all uses of the Basic Index, many users did not understand the structure or the function of see also references, and many exhibited an openly hostile reaction to them: "This thing is so trivial. (Why?) Because it keeps going back and forth and it doesn't ever give you a page for what you're looking for. It says go back to 'Access Guides' but there's no page that tells you to go, they never bother giving you a page." The test indexes were formatted in the conventional way, using indentations to set such information apart, and these results call into question assumptions about formatting of indexes.

Evidence for other theoretical functions of see/see also references was also displayed during the searches. One subject used the see also reference to confirm that "organizing" information and "classifying" information were the same concept, and that therefore information found in different places in the text were dealing with the same subject: "The ways of organizing information. Organizing, classifying, same thing. That's what they, that's what it says in the index," (inferred because of a see also reference). Conversely, a subject using the No See/See Also version asks the same question: "Boy is organizing information classifying information? Classifying, organizing, would that be the same?" but receives no clues from the index because there are no see/see also references.

An index with few concept words

Providing index entries not just for nouns or elements but for concepts as well is considered a distinguishing characteristic of good indexes, providing access to the content and intellectual structure of a book.

Earlier studies (Bishop 1991) (Liddy 1991) reveal that subject terms are the minority of terms in indexes, with some variations noted by discipline group. The Basic Index was created with particular attention to inclusion of concept terms; the Few Concept Words index was created by stripping the Basic Index of a number of its concept terms. The Basic Index contains 60% subject/concept terms and the Few Concept Words Index contains 50%.

Interpreting the results for this pair of indexes is more problematic than for the others and illustrates the complexity of interaction among index features. In the Few Concept Words

Index subjects required fewer attempts to find information, the failure rate was slightly lower, subjects made fewer errors, and subjects took less time to find the answer. However, the Few Concept Words Index required more scanning behavior to find the answer.

Subjects seem to have been more restricted in their search strategies in the less dense index, and it could be that since there were fewer terms in the Few Concept Words Index, there was less room for error. In terms of sources of errors, the Basic Index was considerably higher in problems concerning interpretation of see also references.

Additionally, subjects seemed to stop searching when they found peripheral information rather than the targeted answer more often in the Basic Index, and this contributed to the higher failure rate.

Subjects expressed similar levels of confidence for both indexes as to whether they had found all the information.

In an index with fewer concepts, it seems that subjects tended to feel that they had explored a topic as much as in an index with more concepts; this indicates that subjects relied on the index to reveal the amount of information on a particular topic contained in a book.

Satisfaction with the searches was also similar, yet when asked to rate the quality of the indexes, the Basic Index clearly rated higher, which appears inconsistent with the poorer performance of the Basic Index as evaluated by the test measures. However, some searches in the Basic Index resulted in retrieval of extensive information. Thus it seems that users' ratings of the quality of the Basic Index were not necessarily based on factors such as ease of use or speed in finding an answer, but were perhaps more affected by the extent to which the index facilitated exploration of a topic.

Conclusion

This initial analysis of three index variations indicates that index use is not a straightforward and clear-cut process.

Index features which theoretically should facilitate searching may have complex effects and index features may interact together in unexpected ways. Search strategies of users are unpredictable and not necessarily logical.

However, index users are also creative and can draw upon internal knowledge to develop a search strategy or to make up for a deficiency in an index.

Additionally, learning effects are present in index usage. Subjects often became more efficient in search strategy in later questions, as they learned the structure of the index. However, there is a good possibility that subjects stayed with index searches longer in the experimental setting than they would have normally, out of a desire to get the 'correct' answer.

While data analysis of the other four index variations is incomplete, some tentative conclusions can be reached based upon the current data and familiarity with the unanalyzed records through the process of transcription. There are indications that several of the most important assumptions upon which indexers base their work may in fact be incorrect. These assumptions are:

1. A typical back-of-the-book index is an intuitive structure which most people readily grasp.
2. The user of a back-of-the-book index thinks about accessing information in similar ways as a professional indexer organizes that information for access.

3. Syndetic and classificatory structures are the most important means for indicating relationships among concepts in an index; format is secondary.

Many people in the study did not understand the basic structure of a back-of-the-book index, nor the formatting conventions typically used in them. Of the errors made across the indexes evaluated for this study, one third (36%) had to do with problems in understanding headings, subheadings, see/see alsos, or index notation. One subject had no comprehension at all of index structure.

Another twenty percent of errors involved finding the "correct" index entry term, and scanning the index seems to be a method often employed to overcome this type of difficulty. More effort and thought needs to be put into making scanning an index an easy task, particularly in the area of distinguishing between headings and subheadings.

Many indexers already capitalize headings, and comments from some subjects in this study indicate that this could reduce confusion and aid searchers in scanning and understanding an index.

In terms of format, there are serious questions about what is successful. Users seem more keyed in to what they have learned from Madison Avenue advertising than to the traditional accepted format of an index. Rather than relying on intellectual mechanisms such as syndetic structure for intellectual access, indexers need to rethink the use of layout and typestyles to communicate such information. For instance, these could be used effectively to indicate levels or amounts of information (users in this study interpreted text in bold print as being more significant).

Users do not seem to read introductions to indexes, thus for a divided index or for special symbols, there needs to be another way to call a searcher's attention to these, perhaps a note in the middle of each page, set off in a distinctive way.

Additionally, attention needs to be paid to the other functionalities of locators than simple provision of a lookup tool; many users interpret them as indicators of the amount of information present on a topic. While there does seem to be an upper boundary on what is useful (some Basic Index users found certain sections cumbersome to scan), if we artificially limit their quantity, we may be sending the wrong message to index users about the extent of information on a topic within a particular text.

Future research

One of the researchers is continuing analysis of the data from the rest of the print index variations and analysis of use of the Basic Index and index variations in an electronic version as well. More research is needed to further specify the index features and optimum combinations which aid information retrieval in back-of-the-book indexes.

Similar types of assessments need to be conducted with other indexes and other questions. Additionally, research aimed towards understanding the actions and cognitive processes of index users would benefit not only indexers in striving to create better indexes, but would also add to our general knowledge of the process of information retrieval. By studying the interactions of users with such a fundamental tool (and one that has been around for quite some time) as a back-of-the-book index, we may garner new insights into the process of human information seeking which will not only inform indexers, but contribute to

the development of a comprehensive model of information seeking.

Research is also necessary to define the intellectual functionalities which indexes serve, such as the extent to which they communicate knowledge structures of particular domains or topics. Just as there is a difference between an OPAC, with its lack of an overall "knowledge structure" which organizes its records, and a reference librarian, who has knowledge not only of sources but of the uses of sources and their appropriateness for different stages within the research process, there is a difference between the information a keyword search can provide and the knowledge structure of a topic which a good index can communicate.

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