Let's get usable!

Usability studies for indexes

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The article discusses a series of usability studies on indexes from a systems engineering and human factors perspective. The purpose of these studies is to establish a set of user requirements that indexes need to satisfy. The results from the first set of studies are presented and suggestions made as to how these can be applied to improve the usability and quality of indexes.

Over the past few years, when I explained my new indexing career, a common thread kept surfacing. Most people I spoke with referred to indexes as 'confusing' for accessing information. Not wanting to perpetuate 'confusing' indexes, I started researching index user requirements. Features and capabilities of products (indexes) are usually derived from specific user requirements. I expected to find these user requirements or some sort of usability testing to point me away from 'confusing'. What I actually found in my research was a number of opinions on indexing, but no set of user requirements and very little usability testing. Elizabeth Liddy and Corinne Jörgensen have done outstanding work in this area (Liddy and Jörgensen, 1993, 1996), but I was still unable to find a set of index requirements. I became concerned that we may have fallen into the trap of indexing for indexers at the expense of our users.

In systems engineering, the most critical factor for ensuring quality products is user involvement throughout the life-cycle of that product.[1] In the best of all circumstances, conducting formal usability tests on all aspects of a product is the ideal. But this can very rapidly become overwhelming. Sophisticated equipment is required to track and record study participants. Human factors experience is necessary for designing and interpreting tests. On occasions, bypassing usability testing is rationalized in various ways: we assume we understand what the user wants, we claim lack of time or money, or we believe that usability tests are just too complicated to conduct. However, whenever user involvement is bypassed, whether it be formal usability tests or usability studies, the product is only marginally accepted or is rejected outright by the user.

As professional indexers we cannot afford to use such rationalizations to avoid conducting some sort of usability testing on our indexes. We are continually striving to improve our indexing skills by attending workshops and conferences, studying books and articles, and querying experienced indexers. Usability studies are just one more tool for learning how to improve our indexes. If we do not take advantage of this tool, we run the risk of perpetuating incorrect assumptions of how people access information using indexes.

My background in systems engineering and my human factors experience give me a unique perspective of how to study access and use of information. In order to validate whether index features and capabilities satisfy actual user requirements, a 'reverse engineering' approach was adopted. A method for discovering any unmet user requirements was also developed. The following sections detail the study plan, the study packages, the study participants' profile and the study results from the usability studies on back-of-the-book indexes.[2] The study results are translated into a practical rule-set for indexing.

Study plan

The primary purpose of an index is to support the user in practical application of knowledge. Indexes accomplish this by providing the most efficient access map to information – or data plus context – contained within the material.

The search for index requirements was begun by assessing the impact of the following index features on efficiency:

- run-on versus indented style;
- sub-entries beginning with prepositions or conjunctions;
- access paths.

One of the most straightforward methods for measuring efficiency is to time the completion of a task. The challenge was to develop tasks that tested the entire index without 'leading' the study participant.

Experiments with a question list simply resulted in a keyword search, since the answer was contained within the question; the user would merely use a term from the question to access the index. Experiments with detailed task statements also resulted in keyword searches, with the task statement 'leading' the study participant to specific areas of the index. For example: 'Sales from your website have been disappointing. How would you redesign your website, increase repeat traffic to your website, improve lead generation and qualification, and advertise offline and online?' This kind of task statement 'leads' the study participant to 'website design', 'traffic generation', 'lead generation and qualification' and 'advertising'.

In order to delve much deeper into access paths than just keyword searches, task statements were generalized. To complete the task, the study participant would have to test the index fully. The following tasks were developed to test each index:

- You want to compete in endurance riding events. How would you select a horse suitable for endurance riding? Develop a conditioning plan for you and your horse.
- You have finally decided to leave the city and move into the country. What business options are available? Choose one and develop a plan for implementing that option.
- Sales from your Web Site have been disappointing. What steps will you take to remedy this?

To gain a better understanding of how an index is used in order to discover any unmet user requirements, it was necessary to capture the access paths taken during task completion for later analysis. This had to be accomplished without actually tracking the study participants' eye movements. Several months of experimenting with different methods led to the use of 'finger pointing'. Each study participant was asked to use their index finger to indicate where they were looking. Dragging the index finger indicated scanning; moving it back and forth indicated reading. Access paths were then recorded, together with any comments made as the study participant completed the task. After this timed portion of the study was completed; each participant was asked why he or she had chosen particular access paths.

Study packages

The study was based on three indexes with indexing densities of 8–14 entries per page. Each was modified to reflect the variable being studied. Each study consisted of a total of 126 indexes: 63 (3 indexes, 21 copies of each) with the variable being studied, 63 (3 indexes, 21 copies of each) without the variable being studied. Each study package consisted of:

- Instructions:
  This is a study to determine how people access information. You will be asked to complete a task using the material provided. Please use your index finger to point to where you are looking, slide your index finger in a downward motion whenever you are scanning, and move your index finger back and forth whenever you are reading. I will record your finger movements, any comments you wish to make, and will time the task completion.
- Table of contents, front matter, page proofs, and index (in three-ring binder)
- Task to be completed (timed portion of study)
- Index usefulness ranking (circle one):
  - Useless
  - Neutral
  - User-friendly
- User subject matter experience (circle one):
  - Novice
  - Familiar
  - Expert
- When selecting a book for purchase, list 3 factors that influence your decision.

Study participants' profile

The characteristics of the study participants are shown in Table 1. The same group of 126 study participants were used for each of the three studies. Representing a good cross-section of index users, they were assembled from friends and friends-of-friends-of-friends. The majority were uncompensated; only 8 percent received engineering work, horseback riding lessons, or horse-training sessions in return for their participation. Each study participant used each index only once to prevent 'learning' of tasks.

Table 1. Characteristics of study participants (%)

Age	17–20	15
	21–40	35
	41–60	35
	61–80	15
Education	High-school graduates	100
	College graduates	50
	Advanced degrees	20
Profession	Students	10
	Home-makers	20
	Blue collar	30
	White collar	35
	Retirees	5
Race	Caucasian	54
	Minority	46

Results

The results from each study are translated into a practical rule-set for indexing at the end of this article; the numbers in brackets in the following sections provide traceability to the rule-set.

Study 1. Measure the impact on efficiency of run-on versus indented style

Run-on example:

> Water supply, 35–50: chlorination, 45; emergencies, 47; feeding and, 22; filtration systems, 36–38; pump use, 35–37; shows, 100; sources of, 41–42; testing quality, 46; traveling with, 95–96

Indented example:

> Water supply, 35–50
> chlorination, 45
> emergencies, 47
> feeding and, 22
> filtration systems, 36–38
> pump use, 35–37
> shows, 100
> sources of, 41–42
> testing quality, 46
> traveling with, 95–96

Indented-style indexes had overall higher efficiencies and higher usefulness rankings compared to run-on-style indexes (Table 2), the overall efficiency gain of indented style being 60 percent over run-on indexes [1.1].[3] Indented indexes were ranked as user-friendly (90 percent of indexes) while run-on indexes were never ranked in this category [1.2]. Indented-style indexes were never ranked as useless; conversely, 70 percent of run-on indexes were ranked as

Table 2. Relative efficiency of run-on and indented index styles (%)

		Run-on	Indented
Efficiency			+60
Usefulness ranking	Useless	70	
	Neutral	30	10
	User-friendly		90
User subject experience	Novice	25	19
	Familiar	45	43
	Expert	30	38

useless [1.3]. Comments about run-on indexes included frustration about being forced to read rather than scan, confusion about sorting and confusion about which page references went with which sub-entry. There appeared to be no correlation with user subject experience.

Study 2. Measure the impact on efficiency of sub-entries beginning with prefix words

Sub-entries with prefix words example:

Water supply, 35–50
chlorination, 45
in emergencies, 47
and feeding, 22
filtration systems, 36–38
using pumps, 35–37
at shows, 100
sources of, 41–42
testing quality, 46
when traveling, 95–96

Sub-entries without prefix words example:

Water supply, 35–50
chlorination, 45
emergencies, 47
feeding and, 22
filtration systems, 36–38
pump use, 35–37
shows, 100
sources of, 41–42
testing quality, 46
traveling with, 95–96

Indexes that did not begin sub-entries with prefix words (prepositions or conjunctions) had higher efficiencies and higher usefulness rankings (Table 3), the efficiency gain being 50 percent [2.1]. Indexes were ranked (80 percent) as user-friendly when they did not use sub-entry prefix words compared to only 40 percent for those indexes that did use sub-entry prefix words [2.2]. No index was ranked as useless.

Comments about prefix words included frustration about being forced to read rather than scan, confusion about sorting (users did not realize that prefix words were ignored in sort), and confusion about their purpose (did not clarify the main entry/sub-entry relationship). Again, there was no correlation with user subject experience.

Table 3. Relative efficiency of entries beginning with prefix words (%)

		Subentries beginning with prefix words	Subentries not beginning with prefix words
Efficiency			+50
Usefulness ranking	Useless		
	Neutral	60	20
	User-friendly	40	80
User subject experience	Novice	22	30
	Familiar	50	50
	Expert	48	20

Study 3. Access path analysis and study

Study participants were encouraged to use anything in the study package for completing the tasks to prevent bias toward index use over using other parts of the material. The instructions simply stated: 'This is a study to determine how people access information. You will be asked to complete a task using the material provided.'

After the completion of the first two studies, 252 access paths were available for analysis. Three main patterns of access were taken in completing the tasks.

1. If the study participants knew what term they were looking for, they would go directly to that specific term or concept [3.1]. These participants classified themselves as *familiar* or *expert* with the subject area.
2. If the participants did not know the specific term, they would rely on past experience with similar material to select a main entry, and scan the sub-entries until they found a term that seemed to jog their memories. If they were unable to find a familiar sub-entry, they assumed the information was not there [3.2]. These participants classified themselves as *familiar* with the subject area.
3. If the study participants had no idea how to complete the task, they would first look for a main entry that reflected the title of the book. For example: if the book title was *Internet marketing made easy*, they would look under 'Internet' or 'marketing', much as one might use a Table of Contents. Although a Table of Contents was available for their use, they tried to find this type of information in the index. After they were unable to find this information in the index, they then went to the Table of Contents for clues. These study participants classified themselves as *novice* or *familiar* with the subject area.

Indexes should support all levels of user subject experience. This study appears to suggest that an unmet user requirement has been identified: a table-of-contents-like main entry to help users adopt more focused searches. The next stage of the investigation was to determine whether a table-of-contents-like main entry with a *see* or *see also* refer-

Table 4. Efficiency of indexes with table-of-contents-type main entries (%)

		Indexes with table-of-contents main entry	Indexes without table-of-contents main entry
Efficiency		+55	
Usefulness ranking	Useless		
	Neutral	25	65
	User-friendly	75	35
User subject experience	Novice	27	20
	Familiar	33	50
	Expert	40	30

ence to the other primary main entries (usually chapter titles) would help the novice and familiar users.

Table-of-contents entry example:

> Internet marketing, 28-47. *See also* Advertising; Customer service; E-mail; Events and meetings; Fulfillment; Lead generation; Newsgroups; Offline and online marketing; Search tools; Selling online; Web sites

Indexes that used a table-of-contents-like main entry had both higher efficiencies (55 percent efficiency gain) and higher usefulness rankings (Table 4) [3.3]. Indexes were ranked (75 percent) as user-friendly when they used a table-of-contents-like main entry, compared to only 35 percent of those indexes that did not [3.4]. No index was ranked as useless. Users with all levels of subject experience, from novice to expert, commented that the table-of-contents-like main entry helped them to define their search.

Other comments from users

The following comments from the 378 index tasks studied are potential index requirements.[4] Usability studies are continuing in these areas to determine if these index requirements really are based on actual user requirements.

- 90% stated that the index adequately covered the subject matter [A].
- 60% stated that combining all sub-entry page references for every mention of that sub-entry was misleading [B].
- 55% stated that main entries that used undifferentiated page references plus sub-entries looked 'unfinished', wasted their time by forcing them to check these page references, or these page references were ignored and the study participant possibly missed information [C].
- 45% stated that main entries with chapter spreads were helpful because they indicated a primary discussion [D].
- 40% stated that undifferentiated page references (more than three) wasted their time by forcing them to check all page references [E].
- 35% stated that commas in entries were confusing, that they expected page references to follow a comma [F].
- 30% stated that turnover lines were confusing [G].
- 20% stated they did not like entries that continued for more than three columns [H].
- 15% stated that three index columns per page was too 'busy' [I].
- <1% stated no sorting preference (the indexes were a mixture of letter-by-letter or word-by-word sort).
- <1% stated no preference for cross-entry use or cross-entry placement (the indexes were a mixture of cross references run-on from the main entry or as the last sub-entry).
- <1% stated no preference for capitalization of main entries.
- <1% stated no opinion on the use of bold or italic page references to indicate charts or illustrations.

Translation of study findings to rule-set

As professional indexers, it is our responsibility to suggest improvements and increase awareness of usability factors, but ultimately the editor or publisher defines what a quality index is. Whenever I see a potential conflict with my rule-set, I diplomatically explain my rationale, but if required I always follow the editor's or publisher's specifications. Line-limited indexes will also impact the rule-set, but prioritization with the editor or publisher will usually produce a workable compromise.

In the following rule-set, *shall* statements indicate index requirements based on actual user requirements that have been established by the usability studies already undertaken. *Should* statements indicate potential requirements. The number or letter in brackets following each rule links it to specific study results or to other comments made (see previous section).

- The index should include chapter titles, concepts, proper names, terms, titles, relationships, and subheads as entries [A].
- Formatting rules:
  - The index shall be in indented style, rather than run-on style [1.1, 1.2, 1.3].
  - The index should avoid turnover lines, if possible [G].
  - The index should be in two rather than three columns [I].
- Main entry rules:
  - Main entries shall include all items (as sub-entries) discussed under main entries (exceptions: titles, proper names); ancillary entries shall not be excluded [3.2].
  - There shall be a main entry that reflects the book title with *see* or *see also* references to other primary main entries (table-of-contents entry) [3.3, 3.4].
  - Main entries should avoid undifferentiated page references when sub-entries are present [C].
  - Main entries with sub-entries should include chapter spreads to indicate primary discussions [D].
  - Main entries should avoid undifferentiated page references with more than 3–5 page references; sub-entries should be created [E].
  - Main entries should be limited to no more than three columns in length [H].

Table 5. Factors influencing book selection (%)

Book selection factors	Novice users	Familiar users	Expert users
Author	32	29	35
Index comparison	47	48	52
Price	20	15	10
Other factors	1	8	3

  - Main entries should be created for detailed discussions continuing for 10 or more pages with a *see also* reference from the primary main entry [H].
- Sub-entry rules:
  - Sub-entries shall avoid prefix words (prepositions/conjunctions); if necessary, prefix words shall be put at end of the sub-entry [2.1, 2.2].
  - Sub-entries shall be double-posted (exceptions: 'defined', 'overview'), in addition to double-posting acronyms and common/Latin names [3.1].
  - Main entries should determine which sub-entry page references to include [B]. For example: a main entry of 'Snowboarding' with sub-entry 'Aspen', should *only* include those page references to snowboarding in Aspen and exclude page references about 'horseback riding in Aspen' or 'skiing in Aspen'.
  - Sub-entries should avoid commas, if possible [F]. For example: 'business plan, developing' should be rephrased as 'business plan development'.

Concluding remarks

When selecting a book for purchase, the three factors most often listed were as shown in Table 5. This emphasizes the vital importance of creating the most complete, most user-friendly indexes possible. Indexes directly affect publishers' profits and add value to authors' reputations by making their knowledge accessible in a user-friendly manner. It is a challenge for professional indexers to ensure that we understand how indexes are used and continually look for ways to improve their usability. Conducting formal usability tests would go a long way toward that goal. In the absence of formal testing, usability studies such as that reported here can provide valuable insight.

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Notes

1. I confronted this fact time after time during my 20 years' experience as a systems engineer/manager.
2. Usability studies should also be conducted on website indexes. We may not be taking into account the impact of users' expectations or the fact that 'clicking' gives users ultimate control over what they view.
3. All percentages are rounded to the nearest whole number.
4. The letters in brackets provide traceability to the rule-set outlined below.

References

Liddy, Elizabeth D. and Jörgensen, Corinne L. (1993) Reality check! Book index characteristics that facilitate information access. In *Proceedings from the American Society of Indexers 25th Annual Meeting*, pp. 125–38. Port Aransas, TX: American Society of Indexers.

Liddy, Elizabeth D. and Jörgensen, Corinne L. (1996) Information access or information anxiety? An exploratory evaluation of book index features. *The Indexer* **20**(2), 64–8.

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Wondrous taxonomy

Foucault famously opens *The Order of Things* by describing a 'certain Chinese encyclopaedia', drawn from a story by Borges, in which it is written that 'animals are divided into: a) belonging to the Emperor, b) embalmed, c) tame, d) sucking pigs, e) sirens, f) fabulous, g) stray dogs, h) included in the present classification, i) frenzied, j) innumerable, k) drawn with a very fine camelhair brush, l) *et cetera*, m) having just broken the water pitcher, n) that from a long way off look like flies'. 'In the wonderment of this taxonomy,' Foucault continues, 'the thing we apprehend in one great leap, the thing that, by means of the fable, is demonstrated as the exotic charm of another system of thought, is the limitation of our own, the stark impossibility of thinking *that*.' What the encounter with otherness forces us to rethink most insistently are not so much the formalities and customs beloved of anthropological speculation as the little things – those patternings of mind so naturalized and automatic that we never think about them at all. In seeing the way they order things abroad, what we are brought up short against are the very things we do absent-mindedly – the way we pocket a handkerchief or bear a grudge, crack an egg or, for that matter, watch a play.

(From Catherine Bates, Cleaning up Caliban, book review, *Times Literary Supplement*, 19 Nov. 1999)