

Indexing in hypertext environments: the role of user models

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A growing interest in the application of hypertext (hypermedia) to the task of indexing reflects the increasing availability of online electronic material (text and text/graphics/video; CD), and a recognition that considerable benefits might arise from the application of hypermedia techniques (both in academic and commercial contexts). This paper considers the relationship between indexing and hypermedia on two fronts: Conceptualizing adequate models of index structures and indexing procedures; and establishing what readers do when accessing indexes.

There is a range of explicit and implicit models (or abstractions) underlying databases, documents and indexes. A fundamental starting point for the development of substructure indexing tools for use with hypermedia is the precise specification of such models. Analysis of substructure indexing models will allow the identification of largely technical constraints (fundamentally linked to the system-derived parameters of particular computing systems), and conceptual constraints (intrinsic to the 'semantics' of indexes and indexing procedures). Related also are aspects of the problem deriving from how indexes (the electronic form) can, and should be, presented. The first part of this paper considers a framework for the identification of such models.

The second aspect of the research reported here concerns index use. A field study was conducted looking at the use accountants (N = 10) make of indexing facilities in a large financial services document. Task analysis highlighted the range of problems encountered, strategies employed and the kinds of solutions arrived at. The results indicate that there are six key factors underlying the 'rule of thumb' procedure users employ when interrogating an index. The implications for this study for the design of indexing tools within hypermedia environment are discussed.

Hypermedia technology and indexing

A reading of the contemporary literature on electronic information systems reveals a growing, and enthusiastic, interest in the potential of hypertext and hypermedia environments.^{1,2,3} In particular, much research is directed at uncovering how people 'navigate' in hypertext domains, which can be traced to earlier concerns with cognitive overload and disorientation in unfamiliar and unforgiving electronic environments.⁴ This raises the initial questions: what is the textual/cognitive domain which emerges during the reading of any text (electronic or otherwise), and how do people 'navigate' in texts? There are three issues here. The first is concerned with reading, at the appropriate level of convention, whatever is to be taken as 'the' standard reading of the text. The second is concerned with a creative 'misreading' of the text found in the practice of criticism, interpretation and so on. The third level of 'navigation' is most clearly seen in relation to indexing and the related creative processes involved, the focus of this paper. The issues here surround the 'placing' of a text (or text item) for later retrieval.

It may be asked: what is the relation between navigating index structures and hypertext 'sub-structure' indexing tools? Leaving aside for the moment the

claims that hyperindexes themselves will help overcome problems of cognitive disorientation,⁵ we consider first the role of indexing structure and indexing procedures.

Indexing structures and indexing procedures

Ideally, an index representation should indicate appropriate 'navigational strategies', i.e., aid and suggest ways of moving around that domain. However, designing navigational aids to indexes will require identifying the criteria for fulfilling one or other specific task related to the use of the index. Clearly, there is a difference between simply browsing through an index and seeking to retrieve a specific item. Using an index (particularly first use or where browsing) also raises the issue of the relation between moving between levels (of index structure/sub-categories) and the representation of that information. Browsing within a hypertext domain will draw, at least at first, upon those procedures previously carried out in paper based media. Whatever facilities are made available, one of the most important aspects is to allow flexibility between forms of activity. Thus one should be able to move from a 'just browsing' mode to a fairly detailed set of procedures (reading in detail something that has caught one's interest) and then back again, all

without losing the sense of what one is doing and what is going on. We might also expect that navigational experience influences 'user perceptions' of whether the task is rewarding and thus a 'learning' experience. Whatever is the case, hypermedia indexes can extend the navigational function of indexes beyond what could be accomplished with paper-based media.

Explicit and implicit models within indexes

Databases, documents and indexes of many forms vary in the degree to which the structure of their information is specified. In other words, there is a range of explicit and implicit models (or abstractions) underlying these forms of information. A fundamental starting point for the development of a hypermedia index is the precise specification of such models. A formal analysis of substructure indexing models is the necessary prerequisite for design decisions. It will allow the identification of those constraints that are largely technical (fundamentally linked to the system-derived parameters of particular computing systems), and those that are conceptual (intrinsic to the 'semantics' of indexes and indexing procedures). Related also, of course, are aspects of the problem which derive from how indexes (the electronic form) can, and should be, presented.

Criteria for the specification of such models: task constraints

One important aspect here is that there are not simply 'given' abstractions, models or structures with respect to the way information is organized; rather, what might be critical for developing an indexing tool is use, i.e., the way in which component parts of structures take on particular significance depending on the way in which a reader or author is carrying out a task. Consider the 'simple' case of a user looking up a definition. Index definitions commonly list (in a linear way) those places in the text where the topic is mentioned. However, this apparently simple list is already 'structured' in significant ways with respect to who is looking it up. A person considering a term such as palaeoanthropology, with little knowledge of what it might mean, will commonly wish to access the first or second occurrence of the term in the book: not so the user who might be a research scientist in biology. He might immediately go to that part in the text indicated by the index example of palaeoanthropology marked 46-59, in the (justifiable) belief that here is the main discussion of this topic in this particular book. Many such task-specific categories can be conceptualized, which itself should remind us that formal specification based solely on logic or set-theoretic analysis (i.e. without taking due account of the user's goals and tasks) is unlikely to lead to realizable user-friendly hyperindices. One goal of an 'idealized' hypermedia

reader/author-centred indexing tool could be that the selection of the scope of any realizable sub-structure indexing tool (at least one reflecting the considerable flexibility of hypermedia) would incorporate relationships between task and index structure.

Developing hypermedia indexing tools

Research and development of electronic indexing tools can be viewed as a rather curious evolution of earlier ideas in indexing germane to paper-based media,^{6,7} and database/query language developments in information retrieval.⁸ Rather than emphasizing the slight differences between information retrieval and hypermedia systems, attention should focus on shared points of interests (e.g. integrating querying and browsing).³ However, there remains a tendency to gloss over the failure to incorporate user based studies of indexing systems.⁹ Although there appears to be considerable potential with some of the formal models of indexes and 'hyperindices', without a clearer identification of the relationship between indexing model and task structure they may be of limited usefulness. For the development of hypermedia indexing tools, in the first instance clarification of the distinctions between conceptual and system-derived constraints would help.

Conceptual constraints

One often cited advantage of hypermedia systems is that they allow the user-reader to become a hyper-author, simply by being able to superimpose their own annotated hyperstructures within any hypermedia domain.¹⁰ Within such an environment an index cannot be conceived as simply a list, but if it is to be useful to the hyperauthor, it must constitute a critique of the text. An author's index partially represents a navigational orientation towards a text within a framework of the author's conception of the intended reader and the given discipline. The issues surrounding indexes are not simple, and many of the current constraints (that is, with developments within electronic domains) arise from the often unrecognized fact that an index is not simply a 'database' of words. Consider a (hyper)text index (structure) which presents, comments upon, and implicitly might be said to reflect the current state of enquiry in a scientific or technical field. Users (readers or authors) with differing approaches to the material might wish to 'slice up' (and, in effect, 'reassemble') the index in different ways: each interest specifies an 'aspect' of, and on, the text which implies a different 'slicing' of the structure: what is peripheral for one user is central for another. The identification of typical user models of such hyperindices is an interdependent part of the index design development. This can be facilitated by applying the appropriate human factors techniques (e.g. protocol and task analysis methods).

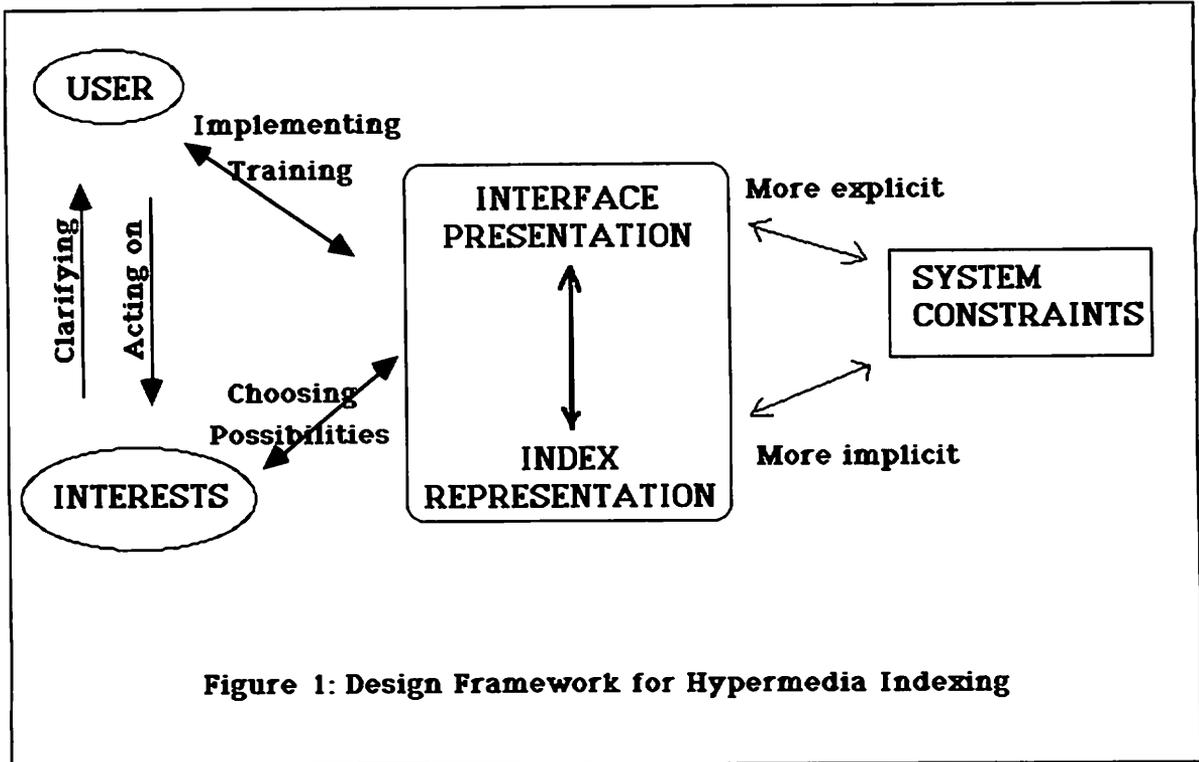


Figure 1: Design Framework for Hypermedia Indexing

System-derived constraints

The most serious system-derived constraint arises from the mismatch between the user's conception of the system and the system-designer's conception of the user. In any actual computing environments, a user will bring to the situation a model of the system—the 'user-model'—which is subject to change in the actual context of use. In contrast, in system design, although a 'virtual' user model is anticipated and presumed, it is rarely articulated with any precision. So, tacitly embodied in any system is what we can call an 'implied' user model, which itself is constituted by the preconceptions and presuppositions about the user's knowledge, interests and abilities. The important point about this is that the confrontation between user-model (what the user brings to the context), and what he or she meets (the implied user model embedded in the system) lie at the root of much user dissatisfaction with computer tools of many kinds. Indexing systems, whether of the traditional or 'hypertextual' kind, will remain constrained in terms of usability and communicability unless there is a much clearer specification of the content and dynamics of these conceptual structures at the appropriate level of generality. To date system designers have had some difficulty in incorporating the findings of behavioural science studies in the design cycle, in part due to the level of fine-detail favoured by researchers.¹¹

A framework for articulating index models for hypermedia domains

To help clarify the ways in which conceptual and system-determined constraints have a bearing on index design, figure 1 outlines the major components and how they influence each other.

Consider the framework as consisting of four key elements: the USER, his or her INTERESTS, the INTERFACE/INDEX (re)presentation and the SYSTEM. The user implements specific interface devices and representations, and at the same time such deployment 'trains' the user. In addition the user acts on, and because of, specific interests. In turn the recognition of such interests clarifies user expectations.

These interests determine the range and form of index tools/representations necessary to carry out the task. Selection criteria for what tools a designer might wish to make available to any user will be established initially with reference to our original interest, themselves developed through the clarification of available (and appropriate) interface tools and index representations. At the same time the choice of tools and representation both permits and suggests new possibilities not previously considered. For example, conceiving of an indexing task as a case of building representational models (comments upon the text) allows users (authors) to perceive a range of previously uncon-

sidered task possibilities (providing different index constructions for different readers/audiences).

Finally, system-determined constraints bear upon the INTERFACE/INDEX (re)presentation in the sense of establishing 'what can we do here?' The system communicates (both at the level of what is presented iconically at the interface, and the parameters of system performance) what it is about and what it will allow, which determine the level of interactivity possible. This needs to be contrasted with the user's interests, i.e. what s/he actually wishes to accomplish. At the very least, clarifying the relationships involved should facilitate the development of many different types of hyperindices, and clearly establishing how people currently use complex indexes is a pre-requisite for hyperindex development.

Examining everyday use of indexes—a user study

In the fields of law, accountancy and management there has been increasing use of large-scale database systems, particularly where amenable to CD and hypertext developments (e.g. JUSTUS¹²). Although a number of studies look at index use within electronic environments^{9,13} there are few paper-based studies. The study reported here is concerned with investigating and analysing how people use multi-volume reference documents, and in particular, the use made of indexes and other associated techniques for retrieving information from such documents. There is a range of such documents currently used by lawyers, accountants, taxation consultants and other related professionals (e.g. Butterworths). The multi-volume document investigated here was the ICA taxation service. A good deal of accountancy and tax work is concerned with providing a service which draws upon three distinct aspects of tax. The first is the tax statute itself; second, a number of case studies (case law) which provide outline parameters within which the statute is said to operate; and third, tax practice itself. This third element consists not only of sets of interpretations and conventions which have come into place over a number of years, but also of professional 'rule of thumb' procedures which range from service advice to detailed tax planning. The taxation service is a guidebook or cookbook of such requirements and the index is both extensive and complex (a section of the index is reproduced in the appendix).

The specific aims of the study were:

- (a) to conduct a detailed analysis of index use of the taxation service to identify key factors of concern (problems encountered, current strategies employed, solutions arrived at and so on);
- (b) to identify a number of generic principals regarding the use and design of such multi-levelled indexes.

Design and methodology

Method. Adopting a case-study approach, the principal investigative method employed was the open-ended interview consisting of three principal components:

- (a) formally structured questions regarding the index to the taxation service;
- (b) specific tasks which the subjects were asked to carry out; and
- (c) open-ended discussions about their use of the taxation service, problems not covered in the questions asked in (a).

Subjects. The people who took part in this study (n = 10) were selected from a database of users of the taxation service reflecting the market profile, principally small single sole practitioners. All were paid for taking part in the study and did so voluntarily.

Procedure. The interviews took place in the subject's office or occasionally at their home. They were carried out where the subjects normally worked and in the context of their daily use (i.e. at their desks and where they kept and used the taxation service). The interviews normally took between one and a half and two hours, and all the subjects answered the requisite questions, engaged in at least one detailed task and took part in discussions covering a wide range of issues.

Questions, tasks and patterns of use. Designing and constructing the questions to be asked in the interview followed from an analysis of (a) the structure of the taxation service and the index and (b) detailed answers attained from the first interview. A selection of the questions is given in the appendix. The tasks took three forms. At the first level they were asked to complete an index query (from the initial formulation of the enquiry through until they succeeded in getting the information they required). They were required to 'think aloud' precisely what they were doing and why, and where possible to articulate what they would do if they were prevented from fulfilling the task in some way. All subjects completed this task during the interview. A more detailed 'second' level task involved their following up an enquiry which necessitated their multiple use of an index entry, where the relevant information is spread around more than one section or volume. Six subjects carried out this task, the others either showing little interest in co-operating or insisting that they would never do such a task. The final task completed by three of the subjects involved following through a task where they recognized that they would know very little about the area concerned. This last task was designed to tap into a more complex use of the taxation service index.

Transcription and analysis. Following the interviews the tape recordings were transcribed and the transcriptions analysed using procedures developed and established in task analysis and discourse analysis research

(Sacks *et al.*, 1974).¹⁴ The transcripts were coded in line with the various categories of interest, such as (a) patterns of use of the taxation service; (b) the structure of the taxation service; (c) the structure of the index, problems encountered with it and suggestions for improvement and (d) typical tasks carried out when using the index. Part of this protocol analysis involved checking for external validity. A randomly selected 10% of the recordings were coded and categorized by two independent raters. Adequate levels of 'inter-observer' reliability were obtained for the transcripts (around 90% reliability), that is with each other and with the principal investigator.

Task analysis was also conducted on the various index query activities the subjects carried out. What this involves is a careful consideration of the various steps and procedures carried out by subjects both with regard to what they bring to the situation (their perception of what is involved and their expectations) and the way in which the task unfolds and is completed.

Results

Frequency and pattern of use. Only two subjects would go straight to the index when they had a query, one because he was very familiar with it, the other because that was how he always used these kinds of texts. The other eight subjects would only go to the index if they had failed to find what they wanted in a section (the tax service is split into different sections—here they meant the contents page of a section). Only three subjects would try more than one route to a problem in the index (i.e. try to second-guess where else it might be in the index). Only one subject had a detailed knowledge of the index, for example knowing precisely what was meant by the structure of a reference item ('Travel Expenses'—doctors and dentists: 16. 2.3.2, 2.4.1–5.). It should also be noted that six subjects reported that if they had to go to the index then already they were getting frustrated by the way their enquiry was proceeding.

General problems. A frequently reported problem (six subjects) was that using the index took too long. The reasons were: (a) it was much too detailed; (b) it took you to places that you did not want to go; (c) it was complicated. Half the subjects said that they found it incoherent because it seemed to bear little relation to what they found when they reached the entry. Also, it was seen to be incoherent with respect to the topics listed (one interviewee asked, 'why on earth is there an entry under non-trading companies?' which for him was a contradiction in terms). It was found to be too complex due to the structure of the references; the fact that entries went over more than one page and that for many users there were a significant number of items which they did not understand (and did not recognize).

Related to this was the claim that it took a lot to

understand, which did not correlate with use. Infrequent use meant that anything they had learned from previous attempts was forgotten. Of the other two most frequently cited problems, the index was seen as not containing enough 'unusual items' which necessitated (the other reason) many attempts to 'second guess' some other item a topic might be under. Those who did attempt more than one 'second guess' tended to be successful; however, this requirement was seen as a main reason for taking so long to get information from the service.

The index as a navigational tool

With regard to the potential any index has for allowing an index user to move around a text and follow up lines of enquiry and investigation, for one subject this was essential, for example:

'Ideally that's what a good index should do. In a sense it is like a giant semantic or associative mapping, which navigates around a range of sections, and it would help to have pointers about where to go, as well as where not to go. It is just as often the case that I get to places that I don't want to go, as to the places I need to get to.' (subject 10).

The clearest example of how unsuccessfully the taxation service index is employed as a navigation tool is seen in that four subjects used the index only as a route into the main section without ever returning. Speed here was seen as the most important aspect, and arguably these subjects were using the index in a similar way to a contents page. A number of additional questions were put to those users who understood more subtle 'navigational' aspects of index manipulation (five subjects). Three emphasized that the index needs to be more intelligent than the contents of the text, in the sense that it should be able to structure or indicate every possible 'route' a user might take into the text. This was recognized as a difficult problem and could only be achieved if the index was designed by, or in close conjunction with, a very experienced tax practitioner.

Criteria for good and bad indexes

All subjects were asked about what they thought a good index was (for this type of text) and what kinds of things it should be able to do. In addition, and always at a different point in the interview, they were asked to describe what a bad index would look like. The principal points which came out were as shown in Table 1 (numbers indicate the number of subjects who mentioned reasons).

For those who used indexes a lot and had a good knowledge of how they work, what was most important was that the index would permit many different possible entry points to the same information. Thus a good index is where 'all your guesses seem to hit it off' and 'it should mention every topic and every possible

TABLE 1 : Criteria for multi-volume indexes

<i>Good Index</i>		<i>Bad Index</i>	
Multiple entry points	4	No 'route' compatibility	3
Follows users' ideas	4	Like 'yellow pages'	5
Very detailed	3	Too long	3
Quick access to information	3	Over-complicated	2
Additional summaries	2	Full of non-productive items	4
Easy to read	8	Cannot get information	6

'entry route' should take me to the appropriate place'. Conversely, a bad index is where there is an inconsistency in access routes. 'Route compatibility' is where if you looked under 'benefits-in-kind' and found 'company cars' you should likewise be able to look under 'company cars' and find a sub-category 'benefits-in-kind' or a see-also cross-reference. Subject 10 went to some length to ascertain whether the taxation service succeeds in this respect and was of the opinion that it just about 'got away with it', and it was clear there were considerable individual differences here.

Three subjects suggested that a good index would have brief summaries of each definition as part of the index (clearly more their 'ideal' index than any other they might have seen). Again, for bad indexes the 'second guessing' problem was mentioned (yellow pages) and not getting adequate information on reaching the destination of the index reference. Non-productive items were related to specific areas of interest that individual users were concerned with and could be viewed alongside earlier comments for 'user-friendly' indexes (i.e. they give information but not specific enough for their interests).

Index designer—user mapping

Once the subjects had carried out one or two tasks with the index they were asked who they thought designed it. In addition a number of more subtle comments were made during the interviews about indexing structure which permitted a number of inferences to be made about the kind of 'mapping' which exists between the index designer and the user. The intention here is to uncover the degree of possible correspondence between the indexer's selection of index items and the way these relate to the associations of items that users actually employ when they are looking up a term.

Seven subjects were convinced that the index had been designed by a tax expert, either the editor or (for some more likely) an ex-revenue person. Although the broad consensus was that it had been designed by experts, five of the subjects thought that there was really little relation between what was in their and what was in the index designer's head.

Unusual items and the index

One consistent request for improvement was for an 'unusual items' index, or at least the inclusion in a much shorter index of many odd case or 'special case' peculiarities. Six of the ten subjects wanted a much shorter index which would contain a general definition reference which would take you straight into a main section (contents of a section), and other more unusual or odd items. These were defined as cases where:

- (i) items which were not everyday and had particular special status (joint partnership tax concession for somebody who came into a special category);
- (ii) unusual items which were linked to more than two sections;
- (iii) special cases where particular care had to be taken because of some peculiarity of the statute.

Although subjects recognized that one person's unusual item might be somebody else's everyday event, they asserted that within daily tax practice it would not be too difficult to identify those items which would fall into the 'unusual item' category.

Task analysis: identifying patterns of index use

What the user brings to the index

As far as users are concerned, the most important element they bring to any search is the background knowledge they have for any given topic. These are:

- (a) the specific associations they have in their heads on a topic,
- (b) memory of the area and how it might relate to the task they are carrying out,
- (c) information specific to their last use of the taxation service.

This then leads to a second 'preliminary stage' which involves:

- (d) the construction of a list of possible relevant items,
- (e) stepping back slightly from the problem and thinking clearly about it,
- (f) knowing how the sections of the index relate to the task leading then to the point where they 'know where to find the answer'.

It was clear from the transcripts that many of the decisions that the users made were based as much on 'rule of thumb' general heuristics as they were on any specific logic arising from the nature of the indexing task. Many subjects pointed out that they could understand that the way they were doing it wasn't 'strictly' logical, but based more on their own knowledge or background experience. As one put it 'there is a kind of logic but it is to do with experience'.

Procedures employed by the users

It has to be said at the outset that only three subjects actually carried out two of the tasks with sufficient skill and expertise (i.e. they knew either what to do precisely with the service or they were sufficiently familiar with indexes of this sort). For the 'thinking aloud' task, only six actually completed the task without making a mistake. Four subjects got lost very quickly or simply gave up at the first difficulty (and could not be persuaded to proceed, as they would never do this anyway).

One common procedure was to look down a heading or subheading and simply begin where something 'rings a bell'. Three subjects commented that the principal function of such an index list was to be 'primed' for something they had seen or done before. Another frequent strategy was simply to look to see if the item related to what they knew was in a given section, then leave (and not return to) the index and go straight to that section. If they could not find a section then they would start to 'second guess' what else a related index item might be under and begin again. Only three subjects actually tried with any concentrated effort to use the typographical cues available. Even the subject who was well versed in using the index (and very methodical) lost track of where he was when carrying out the task.

Summary comments:

It needs to be remembered that many professional people involved in using books, documents and varied texts every day rarely use indexes, and are certainly rarely taught specifically how to use them. Indexes are both very varied and, within different disciplines and areas, very stylized (that is, they follow a number of conventions of presentation, layout, construction and so on). Understanding and using an index is related not only to its level of detail and complexity but also to the amount of effort involved in learning (and remembering) how to use it.

For most subjects using the index took too long; it was seen as a complicated task which would require a lot of work to understand it, on a par with using a badly designed 'yellow pages' directory. The subjects' views on the various typographical devices are worth summarizing. The use of highlighted numbers (bold) was seen as inconsistent; the indentation needed to be much clearer; and care should be taken to help the reader where an entry runs on from one index page to the next. Page-numbering should be related as far as possible to precise parts of the text in a direct and easy way. The page positioning layout of the index should be much more orderly (e.g. reference levels lined up). Again, typographical cues are important.

As for moving around the text and using the index as a navigational device, for those who could use it in this way, it was recommended that every possible

route should be allowed for. However, for most topics users could think of only three or four alternative words or categories (entry points). Finally, the contents of the index were seen as somewhat odd by at least three subjects, and most found little correspondence between the ideas the index designer has and the kinds of topics they bring to an enquiry.

The role of user-studies in the design of indexing tools for hypermedia environments

The role of the index within electronic environments may alter significantly, given the development of hypermedia environments. In particular there seems to be considerable potential for using hyperindices as navigational tools in ways not envisaged in conventional media. However, identifying and articulating explicit and implicit models of indexing is arguably interdependent with uncovering precisely what people require of any index and how they understand the tasks they are carrying out. On the one hand hypermedia environments make possible highly complex and individually designed indexing models, providing a technical means for realizing the semantically rich associations utilized by readers and information users. On the other hand, however, the study reported above makes clear that there are many variables which influence an index user's search strategy (note the 'rule of thumb' procedures outlined above). It may be argued that unless we conduct more detailed studies of precisely what people do when accessing large-scale indexes and databases (particularly in hypertext environments), our design rationale for index tool development will remain impoverished. Clarifying the relationship between task structure and index model in hypermedia environments will at the very least demand a more rigorous examination of the parameters involved. The framework outlined above will help identify important distinctions between conceptual and system determined constraints. The specific formulation favoured would be informed by the kind of user study described here.

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Appendix 2: Selection of questions

- 1 What do you think of the typographical aids (bold, page numbering and so on) in the index ?
- 2 What is the index useful for?
- 3 What about distinction of grey/white index pages to indicate the volume you should be concerned with?
- 4 How did you respond the last time you could not find an answer to your query and what was the reason?
- 5 Are there items in the index which shouldn't be there?
- 6 Would you favour colour coding or other such aids to the index?
- 7 Can you look in the index and consider 'benefits-in-kind'. Is that too specific or general?
- 8 What would you do to improve the index as it stands?
- 9 What is the best kind of tax index you have come across?
- 10 Who do you think designed the index for the TS?
- 11 How do you recognize when you look at an index what are the potentially useful items?
- 12 Would it be possible to have a user-friendly index ... say with some form of topic or task list?
- 13 What would you want in the index?
- 14 When you look under say something like capital losses are you surprised by what you find under the index term?
- 15 Would you be in favour of indexes for different sections?

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Appendix 1: Tax Service Index

personal allowances
 age allowance 1.IIA. 4.8
 blind person's 1.IIA. 4.9; App 1.6.1.
 general 1. IIA 4.1
 married couple's, from 1990/91
 1.IIA 4.5
 married man's, pre-1990/91 1.IIA 4.3
 non-residents 1.IIA 14.1
 obsolete 1.IIA 4.10
 rates App. 1.5
 single, pre-1990/91 1.IIA 4.7
 single parents' 1.IIA 4.6
 widow's bereavement 1.IIA 4.7;
 App 1.6.6
 wife's earned income 1.IIA 4.4
 rates App 1.1
 receivership status 19 3.8-9

Chained letters

In the *BMJ*, 308, 18 June 1994, R. S. Bhopal and Alison Tonks deplore the invisibility and inaccessibility of letters commenting on published research. They regard such letters as important and undervalued: 'only after publication can a piece of research be exposed to critical review by journal readers': a form of *post hoc*, supplementary peer review, whose 'intellectual challenge and educational benefits need to be more widely recognized and rewarded'. They should also be properly, comprehensively indexed, the comment and corrections thereby linked to the original papers.