Research Reports

Hypertext and its implications for library services

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The dissertation's main intention was to give librarians a clear introduction to the hypertext concept. Rarely do methods of information retrieval arise that have a potential for revolutionizing the way in which people work with information in as many ways as hypertext has.

Definition

Hypertext provides us with a new way of both storing and retrieving information from a computer database. Information stored in a hypertext system is in the form of small discrete chunks called nodes. These nodes can consist of any type of machine-readable data eg. text, images, sound, etc. Nodes are connected together by links, and retrieval is achieved by traversing the network from node to node via the links. Nodes are linked together if the content of both nodes are associated in some way.

This is the crux of hypertext; the ability to give a user the power to explore the information network in an associative way, without the constraints of conventional linear presentation. This means browsing is very easy; users can respond as they see fit to any piece of information presented, and the information produced corresponds to the personal needs of the individual, features very poorly represented in conventional database management systems.

Advantages of hypertext

Creating and tracing references

This is the main feature of hypertext; all references are easily followed. Users can grow their own networks to form customized webs, or simply annotate another's document.

Flexibility of nodes and links

Forming nodes from the information mass means a hypertext system can be structured in any way appropriate to the information or user, in a hierarchical, relational or network structure. Views of the information base can be local or global.

The way links can be updated whenever the information content is changed gives an accurate, consistent and highly dynamic information environment.

Several divergent paths through the network can also be supported simultaneously.

Cognition augmentation

The fact that hypertext links are formed to augment the human mind's processes of thought and memory make it a powerful tool for information retrieval; ideas are linked together associatively.

Collaborative work

Hypertext can provide an environment capable of highly collaborative writing, research and teaching. Multiple users can inter-weave documents and comments to interact with, discuss and criticize each other's work. The cognitive way relationships and processes are presented can also make abstract discussions clearer.

Disadvantages/problems of hypertext

Static nature

Although hypertext enables a high degree of browsing flexibility, it is still common for the user to be confined to browsing within predefined paths within the database, therefore restricting the user to approaches and perspectives previously outlined by the system designer.

Conceptual fragmentation

Conversely, the amount of freedom given to explore and network means that users may get easily sidetracked, following arbitrary associations and thereby missing the ideas and arguments presented[1].

Disorientation

It is common for users to be unable to trace their steps back to their intended route after following an arbitrary link. In other words, they get lost in hyperspace.

Cognitive overhead

Users have to be constantly aware of possible paths from a node. In their desire to follow these paths, a user may be tempted to assimilate too much information.

Presentation rhetoric

In the context of hypertext systems, presentation rhetoric is the method by which the "conjunctive and relational devices inherent in the linkage of chunks in trail"[2] are communicated to a user. The linkage between two nodes needs not only to be connected, but the relationship implied by such linkage needs to be expressed. So far, their are no accepted presentation rhetoric conventions for hypertext.

Cost

The need to cater for all possible links to and from all the nodes in a system means a high cost factor in the system design, both in terms of money and time.

Intellectual security

Because hypertext gives such a good basis for collaborative writing and research, and 'open' hypertext systems (where the material can be compiled from any digital source and then manipulated) are becoming more common, the traditional boundaries between published and unpublished material are now not so clear. It will become increasingly difficult for individuals to claim work held within such systems as their own.

Some library applications of hypertext

Libraries provide a wide range of automated information services eg, the OPAC, CD-ROM/online databases, library guides etc., and this selection continues to grow. However, these systems are often fragmented and many are mainframe-based, utilizing interface technology primitive to those used to PC workstations (the OPAC being a prime example). Hypertext has the ability to provide a common knowledge representation, integrating these services into a seamless information environment. It also satisfies the ultimate demand of an interface by allowing the user to concentrate on the information itself rather than the mechanisms utilized to gain access to the information.

Information retrieval

The vast majority of existing information retrieval (IR) systems are based on retrieving units of information through a Boolean, keyword-orientated search strategy. This emphasizes the relative autonomy of the information units, and the dependence on query formulation which must express the information need accurately.

Hypertext's approach is to emphasize the semantic link structure of the web of text fragments, providing effecting means to traverse the web of nodes as well as present the contents of these nodes. Conventional IR systems emphasize searching, whereas hypertext emphasizes browsing via link traversal. Therefore hypertext is more suited to users that wish to discover information or who have ill-defined information goals, rather than specific goal-orientated searching.

Hypertext is an effective form of IR because information gained relates by analogy to the starting information, rather than to an explicit query. The use of analogy in hypertext enables metaphors to construct a task-oriented interface that allows searching at a conceptual, descriptive level. This gives the information a recognizable, visual representation, with associations and connections that may be just as valuable as the information itself.

Online databases

Hypertext has been used as an aid to searching online databases eg. LINK, which connects related databases and so retrieves information based on the user's need rather than the subject orientation of a particular database.

Using hypertext in large online systems may cause the problems of cognitive overhead and disorientation however, so systems such as SPIRIT (Syntactic and Probablistic Indexation and Retrieval of Text) combine hypertext with natural language processing to aid specificity.

Citation indexing

Citation indexing is another area of IR ripe for hypertext. A citation network is very similar to a hypertext network; the citations are the nodes, the 'refers to' and 'cited by' references are the links. Transient hypergraphs have been shown to enhance the hypertext model for this purpose [3].

OPACs

Current limitations in OPAC technology lead to most OPACs being useful for author, title, or broad subject heading, but not for examining the library collection by browsing. The HYPERCATalog (developed at Linköping University, Sweden) is a research system in which its top level is an OPAC, represented as a hypertext structure implying a dynamic network of fundamental information elements rather than a static database structure.

The HYPERCATalog provides a 'subject map' of key papers in a subject area; this is the beginning of a search, the remainder being done by navigation and browsing. This negates the paradox of the need to describe that which you do not know in order to find it.

The HYPERCATalog also improves on the conventional OPACs' use of subject headings. The system allows for the addition of users' commented links and personal annotation, enriching subject access and illustrating each work's pertinence and meaning as well as its subject.

The HYPERCATalog possesses the flexibility to adapt to all kinds and levels of use, and also serves as a base for a personal information management tool. Parts of the contents and functions of the catalogue can be downloaded to create a private version on a local workstation, which can be modified to suit the individual user. This information base can include anything, with the subject area, link types and functions specified by the user. Current awareness can be built into the private version, with searches of subjects, names or link-type profiles run against the public catalogue and incorporated into the private version, providing a dynamism unheard of in conventional OPACs [4].

Electronic books

The phenomenon of electronic books has arisen primarily to overcome the technological limitations of paper; hypertext is of particular relevance here as its benefits can be directly contrasted with the static, linear nature of paper. Encyclopedias have shown particular promise in their conversion to hypertext.

Encyclopedias attempt to encapsulate world knowledge within one publication. However, organizing knowledge within topics may be arbitrary, and knowledge is not fixed to one perspective or structure. In hypertext, categories are merely guides, with the user able to switch between different perspectives or abandon them altogether.

Hypertext can support many co-existing structures. Users can also form their own links and annotations, personalizing their copy and mirroring their own world view.

Hypertext also has potential in other electronic books, such as dictionaries and interactive fiction.

Computer-aided instruction

Hypertext applied to training programmes allows for different levels of prior knowledge, encourages exploration, and empowers a user to follow their own learning style. It has been applied to library guides and research skills teaching packages, as well as training librarians, for example in cataloguing. Systems such as Intermedia at Brown University have indicated great potential for hypertext's educational applications.

Hypertext and artificial intelligence

Hypertext and expert systems are two technologies that some believe have cooperative abilities. Both technologies also have drawbacks which may be remedied by the introduction of the other.

Expert systems with hypertext features

Expert systems commonly have difficulty interacting with the user; firstly, to explain its reasoning, and secondly to give context-sensitive questions and answers. This is due to the difficulty in modelling the user of an expert system.

Adding hypertext to an expert system would make up for this difficulty by enabling the user to find the relevant information themselves. Dialogue from the expert system can be linked to various explanations, or the same dialogue from different perspectives.

Hypertext with artificial intelligence

Artificial intelligence has the potential to assist users with the common difficulty of navigation/ disorientation in hypertext. If the links are well specified and computable by an inference engine, then a user could be advised on the syntactical content of the links, making for a more educated navigation. Exit points from a node could depend upon the user's level of experience, knowledge, interest, or navigational history.

Another possible application is in the automatic creation of a hypertext network. Certainly in large hypertext systems, manually forming all possible links is unrealistic; the computer could do the job itself.

However, there are some who feel that the push to unite these two technologies is often inappropriate. Artificial intelligence strives to emulate the human thought process in order to take decision-making away from the user. Hypertext, on the other hand, is designed to augment the human thought process, whilst empowering the user to take control and enabling them to find the information themselves. Hypertext gives power; artificial intelligence takes it away. Whereas using a hypertext interface an expert system has great advantages, adding intelligence to hypertext means hiding something from the user, which prevents free passage through the hypertext network.

Nevertheless, some of the navigational and constructional drawbacks of hypertext systems may result in some compromise, trading some freedom in the hypertext for assistance from the computer.

Conclusion

The future will probably see increases in the applications of hypertext. It has the potential to allow each user to become their own information retrieval specialist, with less need for intermediaries such as librarians.

Work on projects such as Ted Nelson's Xanadu may result in hypertext system for the repository of all world knowledge, accessible from anywhere.

Hypermedia is likely to be the common means of information retrieval in many of the multimedia home entertainment and reference systems of the future, the beginning of which we can see with such developments as CD-I.

There are a great many implications for librarians in hypertext, both in terms of using it to improve services but also in issues that need a great deal of research eg. usability, interface design, standards, presentation rhetoric, and so on. As information professionals, we have our part to play.

Acknowledgments

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The information needs of prisoners: a study of three penal establishments

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This research was conducted as part of the coursework requirements to complete the MA in Librarianship at the University of Sheffield, and was carried out during the early part of 1992. The objective of the study was to determine the nature of inmates' information needs and examine how effectively they were met.