TEACHING HYPERTEXT TECHNIQUES WITH MOSAIC AND WWW

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INTRODUCTION

An analysis of the functions of the information scientist indicates a number of specialised tasks, such as identifying and evaluating information sources (in different formats); devising and applying systems to organise information or information sources; act as an intermediary by retrieving information upon request and providing value-added and repackaged information formats, manage information systems, and so forth. This discussion will concentrate on only two typical functions of the information specialist, that is the organising (indexing) and retrieval of information. A brief review of both functions is necessary to establish a frame of reference as well as a departure point to discuss the possible application of hypertext techniques when organising and retrieving information or information sources:

- Organisation of information: This implies the use of significant surrogates such as keywords, descriptors, abstracts, indexes or classification schemes to represent specific documents in a database. Such a database can be a small personal system of a researcher, or a large bibliographic database accessible via a commercial vendor or host such as Data-Star, ESA-IRS or DIALOG Information Services. More advanced techniques have also been developed to improve the retrieval and precision ratio (the overall quality) of document retrieval, for example "fuzzy indexing", weighting, and recently techniques to search full-text databases.

- Retrieval of information: Retrieval of documents by means of surrogates can be attempted at different levels of sophistication - from basic keyword searching to advanced Boolean string searching, relevance feedback, term frequency analysis and so forth. A wide variety of search facilities have been developed on commercial systems to assist the searcher; this may vary from a friendly menu-driven interface, to a command language approach. User-friendly interfaces are especially common in CD-ROM databases, an approach which brought large, international bibliographic databases within reach of the end-user.

The limitations of the above-mentioned traditional approach is well-documented. The emphasis of these systems is on bibliographic (referral) types of information, concentrating on ways and means to identify the document (normally paper-based) which consists of the needed information. This level of retrieval (document identification)

illustrates that the traditional approach falls short in their ability to handle context, as represented in a full-text environment. They also support retrieval, rather than exploratory activity. This is a major drawback, as research suggests that in some sectors a browsing or exploratory environment is more conducive to innovativeness (Davenport 1989:371). On the contrary, hypertext facilitates the exploration for information by mapping the document base with graphic browsers and other navigational aids - the user derives meaning from the hypertext documents by selecting and linking according to a specific information need. This is particularly important in the context of scientific communication, emphasising activities such as establishing the state-of-the art of a specific aspect, evaluation based upon peer review and improving the process of citation analysis (Davenport 1989:371), or connecting a reference (in a bibliographic database) to the full-text document.

Many other examples can be mentioned of hypertext techniques supplementing, and even improving, those of traditional information retrieval. However, as the topic of this paper indicates, the emphasis will rather be on ways and means teaching hypertext principles and techniques. The next section will deal with the content of the programme developed at RAU, followed by the reasons why Mosaic (as an interface) and the World-Wide Web are exceptionally appropriate to be used in this process. The typical phases of curriculum development (situation analysis, instructional objectives, content, teaching methods, and evaluation) will be utilised to outline the course.

NATURE OF THE PROGRAMME

a Situation analysis

Only one article could be traced in the information science literature (the departure point of this paper) discussing some of the intricacies when teaching hypertext. Ramaiah and Meadows (1993:257-262) of Loughborough University of Technology reported on an experimental study of the problems of and minimum requirements for teaching hypertext (with HyperCard) to undergraduate students. Ellis *et al* (University of Sheffield) concentrated on identifying distinct learning styles and to establish to what extent could a hypertext-based learning package address the different styles of the learners. They do not describe the nature of a hypertext teaching programme, but rather how to use hypertext for training purposes. This lack of publications might be an indication that universities and other tertiary institutions have not yet embarked on extensive hypertext training - a conclusion that could also apply to other subject fields such as computer sciene, informatics, and business computing. In South Africa only two information science schools maintain facilities to incorporate hands-on experience in their training programmes.

Various reasons could be identified for this apparent lack of teaching in hypertext (and hypermedia) systems, an spite of the fact that operational hypertext systems were alive and well by late 1980. Two of the main stumbling blocks are most definitely the steep learning curve of the PC-based hypertext software available today, as well as the extensive hardware layout needed to teach effectively. Apart from multiple workstations running under Windows (ideally linked to a LAN server), a teaching unit needs effective scanning equipment, a colour

monitor for each workstation, at least 8 RAM as well as access to large storage space for each. The financial layout increases when a teaching unit embarks on multimedia as well - multimedia reproduction equipment and sound cards are still very expensive and hardly possible to provide for each workstation. The premise of this paper is that the World-Wide Web system provides in a cheaper and more sophisticated means of hands-on teaching. The reasons will be discussed later.

b Goals, objectives, content and teaching methods

It has been implied in the introduction that hands-on experience is imperative to enable students to master the hypertext way of organising information. Goals and objectives for such a course must keep this in mind, and the emphasis must be on mastering the basic techniques by using a specific system or software package. The following goal has been formulated for the course described in this paper - this will be followed by the instructional objectives which were derived from the goal, as well as the content matter taught at each objective. The teaching method(s) utilised to reach each objective will also be mentioned:

GOAL: "The student is able to identify, evaluate and select a specific hypertext system, and can design, develop and maintain a hypertext database within such a system."

OBJECTIVES:
(Note: subject matter or content mentioned below is not necessarily in the correct teaching sequence.)

Objective 1:

"To be able to describe the principles of organising information according to the hypertext concept".

Content:
- Definition of hypertext / hypermedia.
- History of the development of hypertext principles.
- Analysis of hypertext principles, and differences with the tradional pre-coordinate and post-coordinate approaches. Agosti (1993:283-285) identified the essence of these differences; in fact, the whole issue of *Information processing and management*, vol 29(3), 1993 covers aspects of the role of hypertext in information retrieval.
- Overview of the application possibilities of hypertext (different sources, such as directories, reference works, manuals, guides, etc).
- General description of Internet-based hypertext systems, such as WWW and Hytelnet.

Methods:
- Formal lectures (theory).
- Individual research assignments.
- Extensive demonstrations of current systems (hands-on assignments are covered under Objective 2).

Objective 2:

"To be able to utilise the World-Wide Web as a major hypertext system, as well as a tool to create personal (local) and external (even international) hypertext databases".

Content:
- Characteristics of the Mosaic interface (and a brief overview of the different levels of interfacing, starting with line mode editors).
- History and development of the WWW, and its contribution towards improved access to the Internet.
- WWW as a hypertext system (concentrating upon the WWW concept; unique characteristics; types of information available; accessing information via the Web).
- Other Internet navigators, and WWW's relationship to them.
- Concept of creating hypertext documents in one file, across files, between computers and even across borders, using the WWW as example.

Methods:
- Formal lectures (theory).
- Applicable demonstrations.
- A wide variety of practical assignments to get extensive hands-on experience on how to use Mosaic and the Web effectively and optimally.

  (The emphasis is here on **retrieving** information from different types of sources - a student must have a working knowledge of these sources before Objective 3 and 4 can be accomplished.)

Objective 3:

"To be able to design, develop and maintain a hypertext system".

Content:
- Hypertext design specifications (or: how to plan a hypertext database), for example chunking, linking, interrelationships, consistency of document names, screen design.
- Authoring principles and techniques.
- Markup language, covering HTML's basic commands.
- Creating the different elements of a typical database (e.g. links, nodes, hierarchies, the database, windows, browsing).

Methods:
- Formal lectures (theory).
- Individual assignments (WWW is used in all cases). Each student must create a number of smaller hypertext databases, plus a final large project submitted for examination. The nature of these smaller projects are prescribed by the lecturer (such as creating a manual, a

guide for a museum visitor, a thesaurus or dictionary, and so forth).
- Students must take part in an exhibition and prepare to demonstrating their final projects.

Objective 4:

"To be able to apply applicable evaluation criteria in selecting a hypertext system for a given environment".

Content:
- Criteria to evaluate hypertext software (or a system) - some guidelines are given by Langford and Brown (1993:91-95).
- Application of criteria for a specific situation (unique requirements).
- Sources to be able to identify hypertext systems.

Methods:
- Formal lectures (theory).
- Practical sessions on applying evaluation criteria.

c Evaluation

As with any other course consisting of theoretical and practical work, the students are being evaluated on two levels, namely practical course work, and a written examination. A practical exam paper is envisaged, where it will be expected from a student to create a hypertext document (text files will be provided) with HTML, establish applicable links within the document, as well as between different documents available on the local system. Evaluation at such a level implies that a number of logistic problems must be addressed.

(Note: The above mentioned course will be adapted for a computer science module at the honours level (BSc(Hons)), to be taught in the second half of the 1994 academic year. This course is still in the plannning stage, but it is envisaged that the same goal and objectives would be used as mentioned above, but the emphasis will be more on developmental work.)

ADVANTAGES OF USING WWW AS A TEACHING MODEL

It is not difficult to understand why it was decided to use the Web as a model for devising and implementing the above-mentioned course on using hypertext principles and techniques for information retrieval. The DOS-based software packages (e.g. Guide, Hyperties, HyperCard) is commercially available, and some of them have been incorporated into teaching programmes. One of the limitations of following the PC-based software approach is the complete lack of examples of databases in this cagegory. Objective 2 (see above) stressed the importance of having access to and acquiring a working knowledge of a wide variety of hypertexted databases, before a student must be assigned to the design stage. Other limitations are, inter alia, the high cost of PC-based software, especially the licensing fees when using a specific product in a LAN environment, the steep learning curve and the lack of local vendor support.

Existing PC-based systems tend to be restricted to their local file systems and they often are developed with a limited set of platforms in mind (Berners-Lee *et al* 1992:52). On the other hand, current larger information retrieval systems, such as Dialog, Data-Star or Wide-Area Information Server (WAIS) do not support any hypertext facilities. World-Wide Web is consequently very suitable, because of it's merging of hypertext techniques, traditional descriptor or index searches, as well as wide area networking. The following uniqe features explains why hypertext training can benefit from using WWW (Berners-Lee *et al* 1992:53):

- The WWW model uses both paradigms of hypertext link and text search in a complementary fashion.

- Information need only be represented once, as a reference may be made instead of making a copy.

- Links allow the topology of the information to evolve, so modeling of the state of human knowledge at any time is without constraint.

- WWW stretches seamlessly from small personal notes on a local PC to large databases in other continents. This useful aspect implies that almost all existing information systems can be represented in terms of the WWW model; for example, a menu becomes a page of hypertext, with each element linked to a different destination.

- Indexes become documents, and so may themselves be found by searchers and/or following links.

- Documents in the Web do not have to exist as files; they can be virtual documents generated by a server in response to a query or document name.

Other advantages of using the Web, specifically for a teaching environment, are the following:

- Mosaic (as an interface) and WWW (as a large information system) are being supported by NCSA and CERN, and hence upgraded on a continuous basis.

- Systems available via WWW is being supported by the international scientific community, indicating a growing corpus of information sources and thus enlarging the possibilities for hands-on experience.

- Systems, or databases for that matter, varies from large to very small, covering different types of information: from bibliographic databases to those in full-text format, such as encyclopedias and news sources. Students have the advantage to be exposed to this wide variety of sources.

- Users do not pay any subscription or access charges.

- The system is available via Telnet (TCP/IP), whilst for individual tertiary users, communication is "free of charge".

- No special licensing agreements are necessary when accessing the system - multiple workstations (or a teaching laboratory) is a common phenomenon at teaching units.

CONCLUSION

The hypertext way of organising information is an important new addition to the knowledge base of the information scientist. Traditional PC-based systems demonstrate limitations when using them as models in the teaching of hyptertext techniques. The recently developed hypertext course at RAU, using World-Wide Web and the Mosaic interface software as models, has proved that the advantages of such a large and international available information system can add much to the quality of the teaching process. However, certain obstacles must still be overcome, for example

- Full-capacity communication lines (especially after noon) slow down the downloading of HTTP files, or other functions such as FTP.

- Practicals are traditionally scheduled for the afternoon - the time of the day when the lines are very busy.

- Students do not have a working knowledge of the UNIX operating system.

- HTML is not friendly to apply (or: HTML fundi is non-existent in this part of the world!).

- A teaching unit must have high priority access to a UNIX server (an expensive necessity).

Although hypertext is a very interesting way of organising information, it does have its limitations. When compared with traditional indexing principles, the following must be considered in future research:

- Searching by command language: Instead of navigation (which can be time-consuming and poorly organised), searching by command language (e.g. search strings and Boolean operators) must be available when needed.

- Weighting of links: This can be accomplished, for example, by attaching a sort of level of importance to a link, depending on the path the user is coming from (Agosti 1993:283).

- Automatic authoring of an information base: Tools must be developed to simplify the authoring process, for example automatic upgrading to HTML from a general wordprocessor, or the automatic generation of links.

- Development of techniques by which to evaluate the quality of hypertext information retrieval (Agosti 1993:284): Evaluation techniques for traditional post-coordinated information retrieval are not directly applicable in the evaluation of the performance of hypertext systems. New procedures and tools are needed in this environment.

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