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Nocean: a multiuser distributed hypermedia system

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Abstract

This paper describes the practical problems and the academic context which lead to the development of a hypertext system called nocean. It examines the philosophy behind the design of the nocean stack, its educational use and provides a description of how it was used to reestablish a unit journal for off campus students.

Nocean allows students and staff to quickly and easily create a hypermedia document containing interlinked articles and contains tools to assist the reader to find relevant information (indexes, table of contents, histories, text search). It also contains tools to allow people to easily create new articles or links. Links are shown as underlined words or phrases and can be linked to other phrases in document, pop-up annotations, sound clips, images shown in an external window, or QuickTime movies.

A unique aspect of nocean is that it allows multiple remote users to create articles and links using floppy disks. In 1994 one hundred remote off campus students used a floppy disk version of nocean to write articles and build links in a Unit hypertext. Using nocean, the students floppy disks contributions were merged into a single hypertext document and returned to them. In a networked environment changes are stored on the local machine and a journal file is returned to the server where the original hypertext is updated.

The paper concludes with reflections on the success of this project, an examination of the importance of cross platform compatibility and the future of nocean in the light of the capabilities of WWW clients and the Internet.

Who am I

I have recently been employed within the Course Development Centre to design and research the use of interactive multimedia and hypermedia environments within Deakin University. Prior to this I was a lecturer in educational computing within the Faculty of Education. In 1993 I completed my PhD research entitled "The enabling and disabling effects of a hypermedia information system on information seeking and use in an undergraduate course". In this paper I will describe one of the developmental projects I undertook in 1994 and 1995.

Reasons for developing the nocean hypertext system

I created the nocean hypertext system for two broad reasons: to solve a practical educational problem and to expand my research on the use of hypertext systems.

Practical problem: encouraging interaction between off campus students

Most academics recognise the educational importance of encouraging meaningful interaction between students. Traditionally this happens in tutorials or in the student cafe but it is more difficult to achieve with off campus students. Without such interactions, units are reduced to the "bicycle wheel" model of education in which the student interacts with teaching staff but there is little or no interaction between students.

At Deakin we use many ways to encourage interaction between students, e.g. residential schools, telephone tutorials, self-help groups, computer mediated communication, and unit journals. Regular unit journals, containing student written articles, have proven to be popular but they do pose some difficulties. Even if students submit articles on disk or via email the production, printing and distribution of a paper based journal requires significant time and money. While these resources were available in universities in the early 80's the contracting resources of the 1990's means that this is no longer possible. For example, the Deakin Educational Computing News (DECN) which has been published 4 times a year since 1985 was discontinued when I went to America to do my PhD. Another problem with unit journals is that they further contribute to the vast amount of paper-based information sent to off campus students.

Thus, my practical problem was to find a cost effective way of encouraging students to interact through writing about their own experiences related to educational computing without needing to invest large amounts of my own time and effort.

In addition to this practical problem I was interested in collaborative hypertext systems for the following academic reasons.

Hypertext systems as the next tool after stand-alone word processing

Most academics agree that a word processor is a basic tool for writers. Research is now emerging which suggests that hypertext environments can similarly leverage both reading and writing abilities and thus enhance teaching and learning possibilities. In a sense, collaborative reading and writing hypertext environments are the next step beyond single-user word processing systems.

Hypermedia systems allow multiple representations using different symbolsystems

One of the major advantages of a hypermedia system is that it allows information to be represented using a range of symbol systems (text, images, video and sound). This is important because certain information can be better represented using different symbols, e.g. some images are worth much more than a thousand words. Also people differ in their ability to understand and use different symbol systems, e.g. some people prefer to have a text description of how to get to a location while others prefer a map. The real advantage of multimedia systems is that it can provide multiple representations using different symbol systems and allow users to select the representations that are of most use to them for the task they are undertaking.

Interconnectedness and context bound nature of knowledge

There is also a large body of literature which highlights the importance of allowing students to see the interconnectedness and context bound nature of knowledge. Without this students often see a field of knowledge as a mass of isolated facts and view the educational experience as a transmission of these facts from the teacher to the learner. Furthermore the interconnected node and link structure of hypertext has been found to be an effective way to represent and communicate this interconnectedness to students. It has been suggested that computer mediated communication and hypertext technologies are converging and this will have a large impact on the delivery modes and pedagogical strategies used in distance education.

Require an active learner and reader

Much evidence has been collected that suggests that readers adopt a more active and self-directed role when reading hypertext rather than linear documents. In a sense hypertext systems blur the distinction between the author and the reader who becomes able to easily read the document in an order that is most relevant to their own needs.

Tools for using and understanding information

Hypertext systems can and should contain tools which help the reader to engage with the materials in a way not possible using other information systems. At the very least such tools should allow the user to find information (e.g. word search and multiple tables of contents and indexes), understand information (e.g. links to glossary and related information) and use information (automatic history logs, bookmarks and tools for using information).

Empower the user with hypermedia technologies

It is ironic that while some hypermedia systems empower the author they offer few tools for using information to the user, e.g. once the reader has found relevant information they are forced to print it out or perhaps cut and paste it into a document using a word processor. If hypermedia technologies are to be powerful tools for presenting and organising information then users as well as developers must have access to tools that enable them to use and organise relevant information.

Many people talk about hypertext as a constructivist environment because it allows the reader to access information based on their own needs by following thematic links through the material. But if these links have all been created by other people then the user is still restricted to some extent. Thus we need to give users tools to use hypermedia in ways not imagined by the developers (e.g. general purpose search tools) and also allow them to create links that are meaningful to them and which other people can follow.

Out of the research laboratory and onto "the kitchen table"

Many hypermedia systems require powerful computers but we find that our students are using a large range of computers in very different circumstances. While it is critical that we develop powerful systems using state of the art hardware (state of the art today will be entry level in several years) it is also important that we develop systems that are usable on the hardware which is commonly available in schools and homes. One student remarked that most of her study is done using a Macintosh Plus after dinner when she is able to clear the kitchen table!

Computer networks and tools such as email, bulletin boards and Web browsers offer much to assist student to student interaction. Ideally all students should have modem access to the Internet but there are still problems and limitations in this and thus other options are necessary.

Collaborative work

Studies have shown that readers of hypertext documents tend to be more self-directed and more active when compared to readers of linear documents. While the majority of studies have examined student use of hypertexts which have been written by others, some studies suggest that students will similarly benefit from the ability to annotate and add information to the hypertext. They suggest that all hypertext systems should allow the reader to add new nodes and annotations. My doctoral research highlighted the importance of providing students with tools to allow them to comment on existing information. In addition to allowing people to add to the hypertext, the literature on computer supported collaborative work suggests that there will be great value in providing environments which encourage many students to interlink ideas in a multiuser environment.

Experience with electronic documents and ways of working

As we move towards the networked world it is critical to give students (and ourselves) experience working with electronic documents containing hypertext links. Without such experience we will have very limited models for using the vast possibilities which the information superhighway offers.

Specification for the required software

Based on the practical problems and my academic interest I developed the following broad specification for the nocean hypertext software. It should:

- be relatively easy to use and require at most one page of instructions;
- run on the relatively low end Macintosh computers common in schools; and
- be relatively compact and fit on an uncompressed 800 k floppy disk with upto 150 articles.

The hypertext software should allow users to:

- easily find and read relevant information;
- not become lost (e.g. maintain a history log and bookmarks);
- prepare their own article exactly as they want it to appear in the hypertext;
- make links between articles and annotations on articles; and
- delete an article or link only if they have created it.

The software should allow many students to add articles and links to a floppy disk version of the hypertext and facilitate the automatic merging of these articles and links into the growing unit journal. The software should also be usable over an AppleTalk network with the unit hypertext stored on a central server.

I spent some time looking for software which was able to do these things. Neither commercial products (e.g. Expanded Book Toolkit, InterText!) or the many shareware HyperCard document starters (e.g. Storybook, Bookbinder, Tellingtools) provided the functionality I required.

Describe the nocean hypertext system

The nocean hypertext system is a HyperCard stack in which each card is an article containing a title, author, keyword and scrolling text field. Figure 1 shows such an article, the navigator palette and a helper palette. Users can move around the hypertext by selecting menu items or using the navigator palette. The navigator buttons refer to the table of contents, the help section, previous, next or recent article, do a word search, or go to the author, keyword, link index or the history log. Also shown is the online helper palette which is available at all times and allows the user to perform actions while reading the help information.

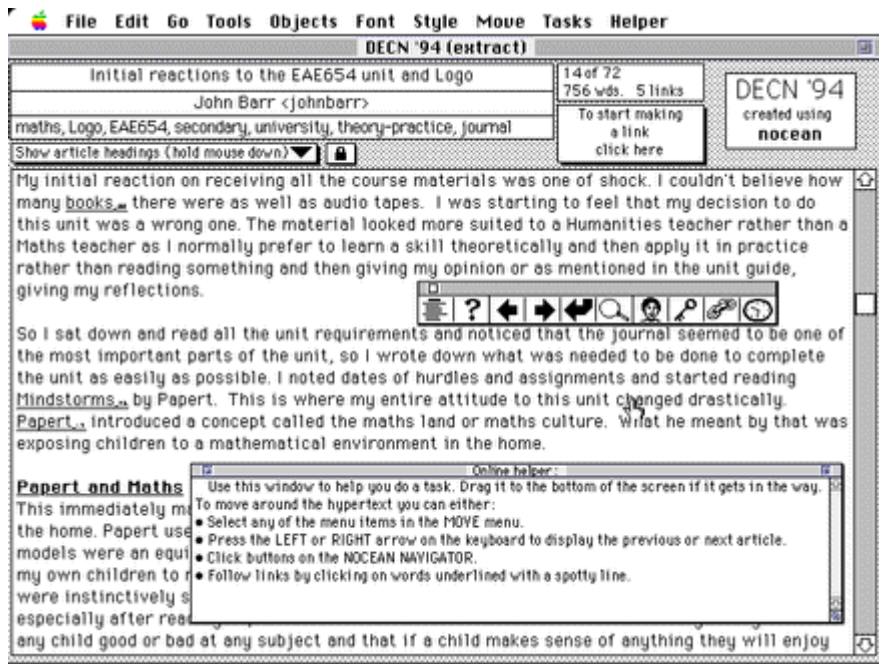


Figure 1: Nocean article showing the navigator palette, the online helper palette and three underlined links.

Figure 2 shows a link anchor (the underlined word) which when clicked opens a box giving information about who created the link, why it was created, and the article to which it is linked. Based on this information the user can elect to follow the link (by clicking the mouse) or to continue reading the current article. A small tick or "breadcrumb" is placed after the link to show that the user has referred to it.

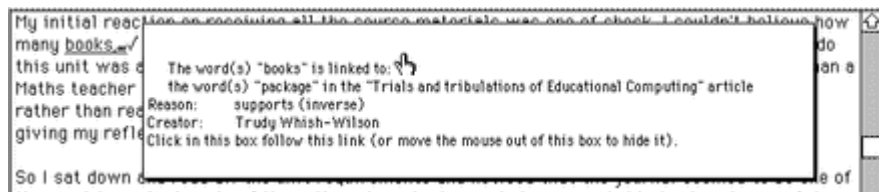


Figure 2: Showing the link information box displayed after the user clicked on "books"

Nocean contains several tools to help the user to find information (multiple indexes and word search) and to remain orientated in able to return to previously located relevant information. Figure 3 shows the history log which is automatically collected as the user moves through the database. Also shown are two annotations entered by the user when looking at useful locations. Items in the indexes and history logs are also sortable and clickable.

History log			
Click a heading to sort the lists by that column, drag the arrows to change the width, click "A..Z" to display that section of the list and click a line to display that article			
Time	Secs	Title of article	My annotation
12:35:34 PM	624	Initial reactions to the EAE654 unit and Logo	
12:45:58 PM	1	**** Personal and professional development	
12:45:59 PM	2	Teachers and computers (policy and professional development)	
12:46:01 PM	25	The problem-solving approach from a learner's perspective	2 interesting article
12:46:26 PM	1	The poetry of competency ✓	
12:46:27 PM	17	Someone help me before I kill my computer!	2 frustration!!!
12:46:44 PM	1	Computers - creating instant experts?	
12:46:45 PM	1	Panic stations	
12:46:46 PM	1	So much happening - so much ahead!	

Figure 3: Showing the history log and two annotations.

Nocean allows any user to easily create a link between phrases in any of the articles. In Figure 4 the user has highlighted a phrase and is about to start to create a link anchor by clicking on the "start link" button. Once the start of the link is created the user specifies the end of the link using the same mechanism and is then asked to specify the relationship (e.g. supports, refutes, exemplifies) between the two articles.

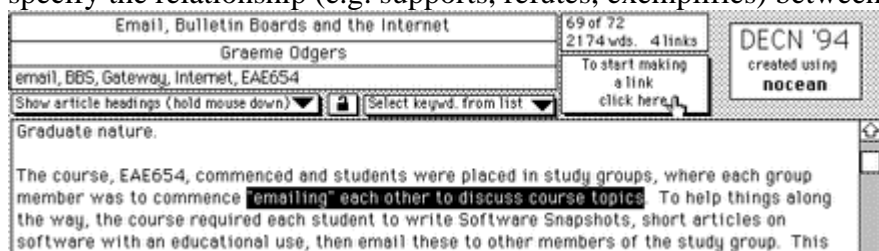


Figure 4: After highlighting the text the user is about to create the start of the link by clicking on the "start link" button.

The version of nocean used with DECN occupies less than 400 k and this leaves enough room to store approximately 150 articles on an uncompressed 800 k floppy disk. For this reason links can only be made to other articles or a popup annotation, but the linking mechanism and the underlying data structure will allow links to external picture files, sounds, or QuickTime movies. Within the constraints of an uncompressed floppy disk these data types were not possible.

Use of nocean to support DECN in 1994

In 1994 nocean was used re-instate and further enhance the Deakin Educational Computing Newsletter (DECN) unit journal in five educational computing units. As previously mentioned DECN was a highly valued aspect of the pedagogy of the units (editions are regularly borrowed from the library) but was discontinued in 1992 due to increased staff workloads and the time required to prepare a paper based journal.

The hypertext was sent to students four times throughout the year. In the first round students were asked to contribute an article to the newsletter and in subsequent rounds they could contribute additional articles and links. Students returned the disk with written assignments and the nodes and links they created were automatically added to a master copy of the hypertext and the latest copy of the hypertext was then returned with the marked assignment.

All students in these courses are required to have access to a computer and our records show that about 40% of students use a Macintosh as their primary computer and another 30-40% are able to access a Macintosh if needed. Students who do not normally use a Macintosh were urged to organise access to one for the time needed to use the DECN hypertext. A small percentage of students claimed that they could not access a Macintosh and thus submitted their articles as text files, generally on DOS formatted disks. Over the year students wrote about 150 articles and created 60 links. It is interesting to note that some students created many articles and links and others created only enough to satisfy the course requirements.

I am no longer teaching the Educational Computing units but the new unit team is continuing to use the DECN hypertext in 1995.

Other applications of Nocean

Based on demonstrations of the software at Deakin seminars other applications of nocean have been suggested and these are being explored in 1995. One possibility is that nocean be used to publish hypermedia documents containing content in the fields of Arts and Literature and a case study in strategic management. While this would be possible it is more likely that nocean will be used to develop a quick prototype and the finished package will be developed using other tools (e.g. HTML editors allowing the documents to be read by any WWW client in the world).

Developmental issues

Anyone who has developed software in addition to their normal work will attest that it is a time consuming task. I am an experienced HyperCard developer and I was able to apply for a Deakin Teaching Development Grant to provide some time release. The Apple University Development Fund also provided a Power Macintosh and this greatly assisted in the developmental process.

Delivery hardware

Given that end users will continue to use different operating environments (Macintosh OS and Windows) it is essential that software run and data files are compatible across these platforms. While a windows player for HyperCard has often been rumoured it is likely that nocean will be converted to SuperCard and thus be available to Windows users when the Windows SuperCard player becomes available.

While it is essential that documents and content be playable on all platforms (whether these be stand-alone or clients attached to some form of network) it is essential that underlying data is stored in a format which allows it to be easily transferred to other formats. In the case of nocean the data structure allows the data to be easily translated into HTML and this be accessible to anyone in the world using any of the freely available WWW clients.

Outcomes of using Nocean

For students

Feedback from students suggests that no one did achieve many of the aims outlined earlier in this paper. Below are some comments made by students in an end of year questionnaire:

Reading the articles helped me to feel part of a larger collegial community rather than a struggling individual searching for "computency", meaning and the sense of it all. ... I was a complete novice at the beginning of this course, I found DECN easy to pick up and understand. If I can--anyone can.

It (DECN) provides a link with other students outside of the small tutorial groups. This broadens the base of ideas and the thinking of those involved in the unit.

Making and using links is an effective means of exploring ideas. I enjoyed reading other students' articles. ... I was a bit intimidated at first--I didn't really feel that I had much to contribute, but as I got into it I enjoyed the process.

I was amazed at the amount of information which was contained on the one disk. A useful means of communication as well!

So many of the articles were so relevant and it also puts you in touch with numerous computing issues. I felt much more secure after reading some of the articles.

I like the notion (no pun intended) of using electronic publishing--great for the environment and for computing students too. A very worthwhile activity that should be encouraged and continued. It is an exciting project that encourages students to think, write and read about computing experiences and learning. We have enough bits of paper. If I have wanted to look at an article in more detail I have printed it off.

Yes (a hypertext version of DECN should be continued in future). It addresses many contemporary issues--especially conservation. It helped me, through using DECN, understand the qualities of hypertext.

(Do you believe that a hypertext version of DECN should be continued in future) Solely for the experience with electronic media and to increase understanding of this written format. Good to see on-line literacy in progress, (we) need to be made aware of its place.

The only negative feedback came from two students who were not prepared to use a Macintosh computer and wanted a Windows version of the software.

For me

As a teacher I was pleased that nocean allowed the re-establishment of DECN in an electronic format offering more functionality than the paper based journal. On a professional level the project has allowed me to speak in several Deakin and national forums on the use of collaborative hypertexts. In part these activities have contributed to my new role regarding the use of hypermedia and multimedia at Deakin. These activities have also resulted in greater understanding of the role of hypermedia within the broader Deakin community.

As a developer of nocean I would like to receive some compensation for the time and resources I have invested in the project. I hope to make nocean available to others either commercially or as shareware.

The future for nocean

Thus far I am still unaware of any relatively cheap software which offers the functionality to create collaborative hypertext at remote sites and merge these into a single document. While commercial groupware applications exist, we would not be able to distribute these to all our students.

However, the Internet and easy to use tools such as forms capable Web browsers allowing users to submit web pages offer a better solution for people who have access to the net. This does not mean that the time and effort spent on nocean was wasted. Many people will continue to use it especially if they do not have access to the Web.

Ironically nocean will also be used as an easy way for novice computer users to create documents which will then be exported from nocean in files containing HTML tags. In addition it has provided impetus to include some of the functionality of nocean (e.g. history lists, annotations, user created links and ability to merge articles and links from different documents) into CD-ROM based hypermedia systems currently being developed at Deakin.