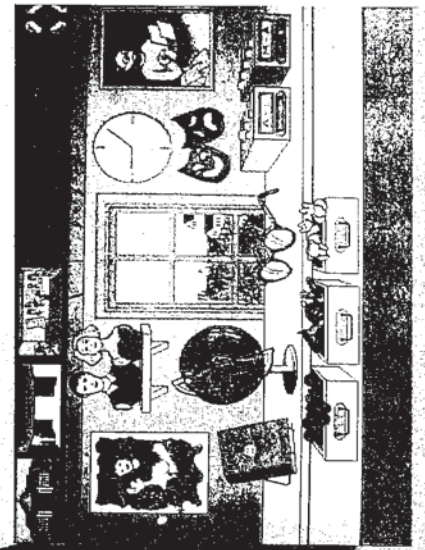


HYPERText & HYPERMedia

Hyundai Ex. 1020



Jakob Nielsen

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Hypertext & Hypermedia

Jakob Nielsen

Hypertext is becoming a very popular approach to many computer applications, especially those dealing with the online presentation of large amounts of loosely structured information such as online documentation or computer-aided learning. This book covers a broad range of hypertext systems, as well as their features and applications using many concrete examples and illustrations from real systems. Jakob Nielsen, a recognized expert on hypertext, provides a history of the subject, explores social issues related to hypertext, and gives the reader a picture which is not limited to the perspective of a single system.

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coordination tool, Figure 4.5 shows a management report for keeping track of the status of the work in large teams of auditors.

A high degree of standardization can be observed not just in the structure of auditing procedures and reports but also in the very language of the reports. Therefore there are substantial advantages in being able to *reuse* portions of the language in reports from previous audits of the same client or of another client with a similar type of business. A hypertext system would facilitate such reuse by making the appropriate earlier documents easily available in online versions for copying and editing.

Trade Shows, Product Catalogs, and Advertising

Many kinds of advertising and communication to customers can be improved by hypertext. Right now hypertext has a novelty value, which is an advantage in itself in some types of advertising. For example you can attract attention at trade shows by having a computer with hypertext information about your products.

Hypertext can also be used to provide information about an entire trade show and help people find those exhibitors that would interest them, as has been done at some MacWorld exhibits.

In the long term, the novelty value of hypertext will of course disappear and one will have to rely on the intrinsic advantages of hypertext in an advertising context. One of these advantages is the general ability of hypertext to provide access to large amounts of information but to show the user only those small parts that interest him or her. This property of hypertext is important for applications like product catalogs. A hypertext product catalog can reduce the complexity of choosing among a large number of options by showing only those that are relevant for the individual customer. It can also offer help in placing the order and might even place it by an online connection to the vendor. A hypertext catalog could also include an option to remember what products the user ordered the previous time, thus making them especially easy to reorder.

Having a hypertext product catalog could be a tremendous asset for direct marketing people if they could gain access to data about how customers have used the hypertext.³ For example the system could

³ In some countries it may be illegal to collect such data without the user's knowledge.

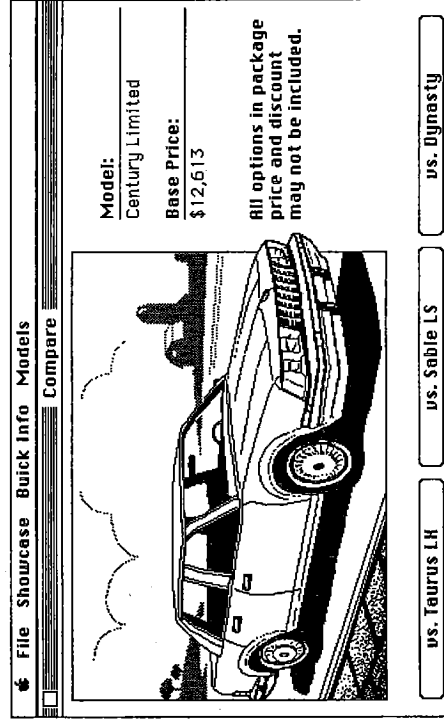


Figure 4.6. A screen from a 1988 SoftAd for Buick. © 1988 by The SoftAd Group, Inc., reprinted with permission.

record how many times a specific user clicked on links related to the price of products and special savings options as compared to how many times the same user clicked on links related to advanced features of the product or descriptions of luxury options. This somewhat simpliminded example shows how the hypertext system could provide the basis for a market segmentation down to the level of the individual customer. The next hypertext catalog sent to the customer could be tailored to have more prominent links of the type that customer had shown an interest for.

Hypertext advertising can also benefit from other properties of the computer medium. For example, Buick has released their car catalog in hypertext form for several years now and has included driving simulations and other games to attract attention. Figure 4.6 shows a screen from this so-called SoftAd. In a hypertext form for comparative advertising, this screen allows the user to compare the Buick cars with several competing alternatives. Users can click on the one other car they might consider buying instead and then see a detailed comparison like that in Figure 4.7. This example again uses hypertext to manage complexity. A printed catalog would have had to compare all the cars in a single confusing table.

In the marketing field, the bottom line is considerably more interesting than theoretical speculations about information complexity. And hypertext does sell. The manager of Buick Motor Division's electronic product information department, Nancy J. Newell, was

Equipment	Century Limited	Dynasty
Base Price	\$12,613	\$12,275
Destination Charge	\$425	\$445
Air Conditioning/Tilt Steering	package	package
Delay Wiper/Side Molding	package	package
Cruise Control	package	package
AM/FM Radio w/Cassette	package	package
Carpet Savers/Power Antenna	package	package
Power Windows/Locks	package	package
Wire Wheel Covers	package	\$231
6-Way Power Driver Seat	package	\$248
Rear Defogger/Side Mirrors	package	package
Package Price	\$2,072	\$1,893
Package Discount	(\$500)	(\$276)
Price As Equipped	\$14,510	\$15,310

Figure 4.7. A comparison screen from the 1988 Buick SoftAd generated by clicking on the "os. Dynasty" button in Figure 4.6. © 1988 by The SoftAd Group, Inc., reprinted with permission.

quoted in *Business Week* on October 9, 1989 as saying that 12% of those who bought cars after receiving the Buick disk ended up picking a Buick. This rate is about double their usual market share.

Intellectual Applications

I do not want to imply that business and education are not intellectual activities, but there seems to be a third category of applications that are less immediate in nature and more oriented towards the scholarly approach. In fact, many of these "intellectual" applications are actually used quite a lot in business.

Idea Organization and Brainstorm Support

Some hypertext enthusiasts claim that hypertext is the most natural way to organize human ideas because its semantic network-like structure matches the human brain. That may or may not be true, but even if hypertext should not be the optimal way to organize human thoughts it is still much better than the linear text format used by word processors. The one way humans certainly do *not* work when they are, say, writing a book is to start by getting the idea for what to write on page one, then moving on to getting the idea for page two, and going on like that until they finally end by getting the idea for the last page.

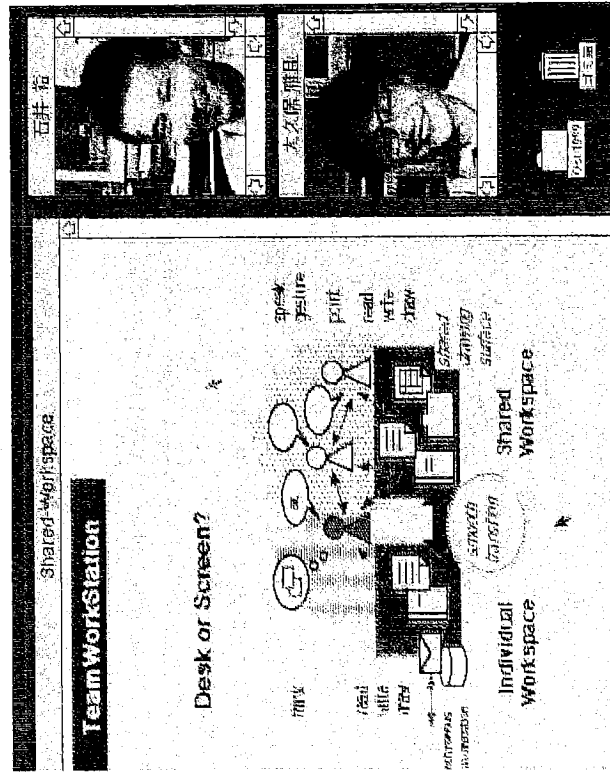


Figure 4.8. A session with two users cooperating on the NTT TeamWorkStation. The screen shows video images of both users and also has a shared workspace where both users can point at the same time (note the two cursors—one at the top of the window and one at the bottom). The real screen is in color and has better resolution than is reproduced here. © 1990 by NTT Human Interface Laboratories, reprinted with permission.

We have already discussed gIBIS as a tool for organizing the discussions of software designers (see Figure 4.2). NoteCards from Xerox [Halasz et al. 1987] is another famous hypertext system built mainly to be used as an idea organizer. It will be discussed further in Chapter 5.

Because hypertext allows the coordination of many disparate pieces of text, it can also be used to organize the ideas of groups of people. Doing so was part of the basic design of gIBIS but was originally not possible in NoteCards. More recent versions of NoteCards do include support for cooperative work. Besides regular multi-author support, hypertext can also help coordinate ideas by its basic capability for having any user add new annotations and links to any node. For example, the Intermedia InterNote service shown in

center and related concepts in a circle around it. A typical Intermedia hypertext for a given course would contain many such overview documents, one for each of the central concepts in the course material.

Intermedia was designed for educational use on the university level and has already been used to teach several courses in both humanities and natural sciences. There is no reason why it should not be used for many of the other hypertext applications listed in Chapter 4, but the educational origin has had some impact on the design. For example, the Intermedia model assumes that several users (i.e., students) will access the same set of hypertext documents (i.e., course readings) and make their own annotations and new links. Therefore Intermedia stores separate files with links for each user in the form of so-called webs. Figure 5.8 shows the creation of a link in Intermedia. When the user has selected the other anchor for the link (for example the event listed under 1879 in the InterVal timeline) and has activated the "Complete Link" command, the new link will be added to the user's web.

Intermedia is a very well designed hypertext system with a lot of integrated and useful facilities, some of which are discussed in other chapters of this book. See Figures 1.3 (the animation editor InterPlay), 4.9 (the InterLex server for automatic dictionary lookup), 6.2 (the InterNote annotation facility), and 8.9 (full text search).

6. The Architecture of Hypertext Systems

In theory one can distinguish three levels of a hypertext system [Campbell and Goodman 1988]:

- Presentation level: user interface
- Hypertext Abstract Machine (HAM) level: nodes and links
- Database level: storage, shared data, and network access

Actually, no current hypertext systems follow this model in their internal structure; they are a more or less confused mix of features. Even so, the model shows interesting directions for the future and is important for standardization work. The following sections describe each of the levels in further detail, starting at the bottom.

The Database Level

The database level is at the bottom of the three-level model and deals with all the traditional issues of information storage that do not really have anything specifically to do with hypertext. It is necessary to store large amounts of information on various computer storage devices like hard disks, optical disks, etc., and it may be necessary to keep some of the information stored on remote servers accessed through a network. No matter how the information is stored it should be possible to retrieve a specified small chunk of it in a very short time. This sounds very much like a specification for a database, which is what it is.

Furthermore, the database level should handle other traditional database issues, like multi-user access to the information, and various security considerations, including backup. Ultimately it will be the database level's responsibility to enforce the access controls which may be defined at the upper levels of the architecture.

As far as the database level is concerned, the hypertext nodes and links are just data objects with no particular meaning. Each of them

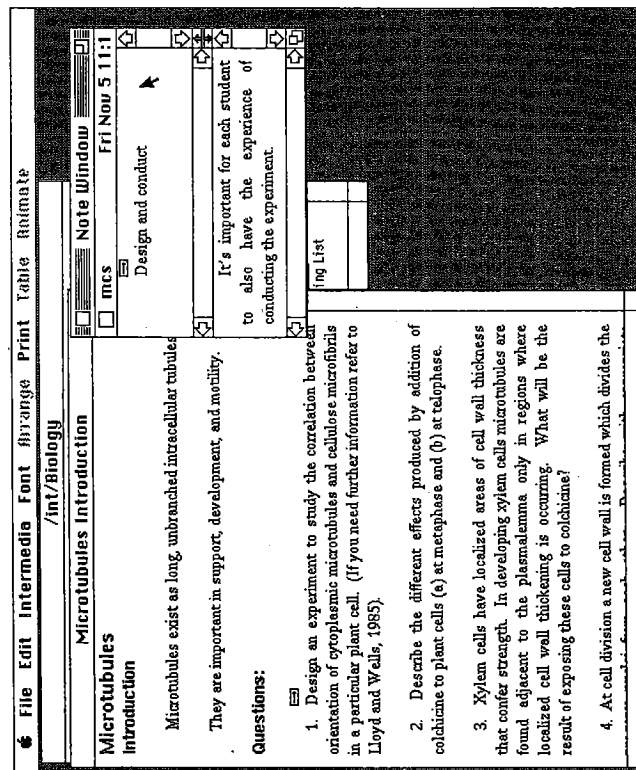


Figure 6.2. The InterNote service within IRIS Intermedia provides a quick facility for annotating documents of any type. The top frame of the note window (right) contains the annotator's suggestion of a change in wording. The bottom frame explains the reason for the suggestion. The author of the "Microtubules Introduction" document may now choose to incorporate the change by selecting the marker at either end of the link that connects the note to the document and choosing the "Incorporate Annotation" command. © 1989 by Brown University, reprinted with permission.

form of a temporary excursion from the primary material to which the reader returns after having finished with the annotation. Annotations are quite similar to footnotes in traditional text and can be implemented, for instance, as Guide pop-up windows that disappear as soon as the user releases the mouse button.

Hypertext writers can use annotations in the same way they would use footnotes in traditional text with the exception that hypertext annotations are less intrusive because they are not shown unless the reader asks for them. The most interesting use of annotations in hypertext is for the readers, however. Many hypertext systems allow readers to add new links to the primary material even if they do not always allow the reader to change the original nodes and links, and

readers can use these facilities to customize the information space to their own needs. For example, readers of a hypertext medical handbook [Frise 1988] might want to supplement the generic description of a drug in the handbook with an annotation stating the brand name normally prescribed at their hospital.

One system that does provide an annotation facility is Intermedia, as shown in Figure 6.2. Other systems like Hyperties do not allow readers to annotate but reserve all options to change the information space for the authors. In the case of Hyperties, one reason for refusing readers the right to add information is that the system was originally designed for museum information systems where one may in fact not want random users to alter the content of the hypertext. Another reason was the desire for an extremely simple user interface to Hyperties: Having a smaller number of options available to the user means that there is less to learn.

Hypertext Engines

All the hypertext systems described in Chapter 5 are really hypertext engines that can display many different hypertext documents. Other hypertext systems are built specifically to display a single document and can therefore provide a much richer interaction with respect to the content of that particular document.

Besides the obvious advantage of not having to program a new application, the use of hypertext engines also has the advantage that they provide a user interface common to many documents. Users who already know how to use Guide, for example, can immediately start to read the next Guide document without any training.

Some hypertext systems like Guide and Hyperties are truly plain engines. The author just pours text into them and they take care of everything else. For example, a pop-up window in Guide *always* appears in the top right corner of the screen. The author does not have to make any user interface decisions except for a few low-level formatting details such as where to break paragraphs. Considering that most people are poor user interface designers, this may well be an advantage.

Other hypertext engines allow the hypertext designer to customize the user interface to a document within a certain framework. HyperCard is a prime example of such a system since it allows the designer to move fields around and add all sorts of background

may be justified in their counter-claim that the link was almost invisible and not likely to be found by a person who was not already an expert in the subject matter.

The reverse problem would occur when the professor was grading the students' essays, which would of course be turned in in hypertext form. What happens if the professor misses the single hypertext link leading to the part of the paper with all the goodies and then fails the student? Actually the solution to this problem would be to consider hypertext design part of the skills being tested in the assignment. If students cannot build information structures that clearly put forward their position, then they *deserve* to fail even though the information may be in there in some obscure way.

A further problem in the learning process is that novices do not know in which order they need to read the material or how much they should read. They don't know what they don't know. Therefore learners might be sidetracked into some obscure corner of the information space instead of covering the important basic information. To avoid this problem, it might be necessary to include an AI monitoring system that could nudge the student in the right direction at times.

There is also the potential problem that the non-linear structure of hypertext as being split into multitudes of small distinct nodes could have the long term effect of giving people a fragmented world view. We simply do not know about this one, and we probably will not know until it is too late if there is such an effect from, say, twenty years of reading hypertext. On the other hand it could just as well be true that the cross-linking inherent in hypertext encourages people to see the connections among different aspects of the world so that they will get *less* fragmented knowledge. Current experience with the use of Intermedia to teach English literature at Brown University [Landow 1989b] did indicate that students were several times as active in class after the introduction of hypertext. They were able to discover new connections and raise new questions.

A Summary: Hypertext versus the Competition

As can be seen from the discussion of the empirical usability research in Chapter 9, there is no clear evidence for whether hypertext is in fact superior to paper. For some applications hypertext tested better, but for other applications paper tested better than the current

Advantages of Hypertext	Compared with paper	Compared with traditional computer systems
	Disadvantages of Hypertext	Possible spaghetti structure No central definition of the structure of the data, and therefore no easy way to specify general actions or computations on the data
Can show moving images, animations, film Easier to update—can permit automatic downloading of changes May be shipped over networks Making single copies is easy Takes up less physical storage space Can be shared by several people User-oriented reading Potentially: The whole world's literature a click away	30% slower reading speed on current displays Lower resolution graphics Not portable Overhead in having to learn system and setting up computer No user interface standard No standard for data transfer No regular publishing channels, bookshops, libraries, ISBN, etc. No "romance"—first editions, leather binding, etc. Computer text "homogenized"	

Table 12.1. Summary of the advantages and disadvantages of hypertext compared with the competition.

generation of hypertext. It seems clear that hypertext is indeed superior in some cases even now. But for many other applications we will have to wait for better technology and better user interface designs to get any hope of replacing paper.

Furthermore, we have almost no experience with really big hypertexts. Almost all the hypertexts that have been tested in formal usability experiments have been very small and have contained only about a hundred nodes or less. Only a few larger hypertexts have been constructed, such as *The Electronic Whole Earth Catalog* with its