

Multimedia and Hypertext

THE INTERNET AND BEYOND

Jakob Nielsen



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Preface

Why is this a book?

The Preface to my book *Hypertext and Hypermedia* (AP Professional, 1990) asked why a book on hypertext would be published as a paper book. So why do I still insist on writing books? Well, the answer I gave in 1990 still holds, though it will probably not hold that much longer: there are still so many practical disadvantages connected with electronic publishing¹ that I decided to stay with paper a few more years for a long work like this book. Developments on the Internet are moving so fast these days, though, that I would expect a future book to be some form of Internet publication.

One of the main advantages of having this book in a hypertext format would be to provide readers with the possibility of linking directly to supplementary reading material for issues of special interest to each individual reader. Unfortunately this would be mostly impossible to do given current copyright restrictions, since the relevant literature on hypertext has so many different copyright holders that nobody could acquire all the relevant permissions.

Instead I have relied on the traditional form of “dead” links in the form of references to the published literature. The appendix contains an extensive bibliography on hypertext, which is annotated to allow you to determine the relevance of a given reference before you go to the trouble of getting hold of it. References throughout the book point to this bibliography through the standard notation of listing the author’s last name and the year of publication in square brackets.

To try to compensate for the lack of a running hypertext, Chapter 2 gives a very detailed case study of one hypertext system. The remaining chapters give examples of several additional hypertext systems, and the book is richly

¹ Slower reading speed from computer screens than from paper, problems with showing illustrations across platforms, relative lack of portability of computers, etc.

illustrated to give you an idea of the variety of ways hypertext can be implemented.

There have been three major changes in the hypertext field since *Hypertext and Hypermedia* was published. The first major change is the explosive growth of the Internet from about 300,000 host computers with three million users in 1990 to about four million host computers with about 30 million users in 1995. The Internet and its implications for hypertext are discussed in Chapter 7. The second major change is that home computing finally seems to be happening,² with millions of people buying powerful computers³ with CD-ROM drives and other facilities for hypermedia viewing and with networked features like video-on-demand being made ready for introduction by several high-powered consortia of companies from the computer, telecommunications, and entertainment industries.⁴ These events permeate many chapters in the book that have been rewritten to reflect the new emphasis on home computing. The third main change is the information overload inherent as a result of the other two changes. In 1990, we were happy every time we could lay our hands on a new hypertext, but in 1995, we have to fight our way out from under a mountain of online information and unsolicited CD-ROMs received as so much junk mail. The information overload problem is discussed further in Chapter 8.

The home computing and multimedia trends have resulted in so many products that it is impossible to include a complete survey of hypertext products. Instead, coverage of many products has been integrated with the main chapters. As further discussed in the following, one of the main benefits of this book is that it is not product-specific, but instead aims at providing the

² Home computing was a pipe dream for many years and early home computers were sold only in small quantities that mostly ended up in closets. As an example of the change, it took ten years to sell the first million copies of Microsoft's *Flight Simulator* but only one year (1994) to sell the second million (according to Microsoft VP Patty Stonesifer as quoted in the *Wall Street Journal* November 15, 1994).

³ In fact, the typical home computer sold in the U.S. these days is more powerful than the typical office computer since companies try to save on data processing costs while consumers want as high multimedia quality as they can get.

⁴ The 17.5 million CD-ROM drives sold in 1994 was 170% more than 1993 sales. The number of subscribers to the major home-computing online services (CompuServe, America Online, and Prodigy) increased by 76% in 1994 from 2.9 million to 5.1 million.

reader with broad insights from the diversity of hypermedia designs in the world.

A Multitude of Hypertext and Multimedia

This book is based on many examples of hypertext and multimedia in the form of both systems and applications. There are so many different approaches to hypertext and multimedia that it would be wrong to base a book on a single one. There are many books on the market devoted to a single hypertext system, whether it be Apple's HyperCard, Macromedia's Director, NCSA's Mosaic, or yet some other popular tool. These books have many qualities and can be recommended for readers who own one of these tools, but even if you limit yourself to a single delivery platform I believe you can benefit from an understanding of the wide range of design options that exist across the market.

It would also be wrong for users to base their judgment of hypertext's usefulness for them on the basis of knowing a single example of hypertext. Many people may know a single system because they have seen it reviewed or because it is used by one of their friends. Such first hand information should of course be utilized as *part* of a decision on whether to use hypertext, but it should not be the only input to the decision.

Which hypertext system should you choose? The simple answer is, "That depends," since there is no universally single best hypertext system, no matter what the salespeople might tell you [Nielsen 1989e]. You should consider the size of the information you want to represent in hypertext and whether you want a text-oriented system or a system that is good on graphics. You also have to consider whether your application calls for a multi-user system or whether a single-user system will do. Finally, you have to take usability considerations into account. Some systems are suited for professional users who need a lot of features and who have the time to learn them, whereas other systems are simple enough for naive users. I cannot give you a single recommendation since I have used and designed several different systems myself.

It is important to realize that hypertext is such a broad concept that one hypertext system might well be completely unsuited to a particular application even though the application could be well supported by another hypertext system. Therefore this book aims at providing you with an idea of the multitude of hypertext, so that you will be better able to decide for yourself whether your needs can be served by hypertext and what requirements should be fulfilled to serve these needs *well*.

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1. Defining Hypertext, Hypermedia, and Multimedia

The simplest way to define hypertext is to contrast it with traditional text like this book. All traditional text, whether in printed form or in computer files, is *sequential*, meaning that there is a single linear sequence defining the order in which the text is to be read. First you read page one. Then you read page two. Then you read page three. And you don't have to be much of a mathematician to generalize the formula which determines what page to read next.

Hypertext is *nonsequential*; there is no single order that determines the sequence in which the text is to be read. Figure 1.1 gives an example. Assume that you start by reading the piece of text marked **A**. Instead of a single next place to go, this hypertext structure has three options for the reader: Go to **B**, **D**, or **E**. Assuming that you decide to go to **B**, you can then decide to go to **C** or to **E**, and from **E** you can go to **D**. Since it was also possible for you to go directly from **A** to **D**, this example shows that there may be several different paths that

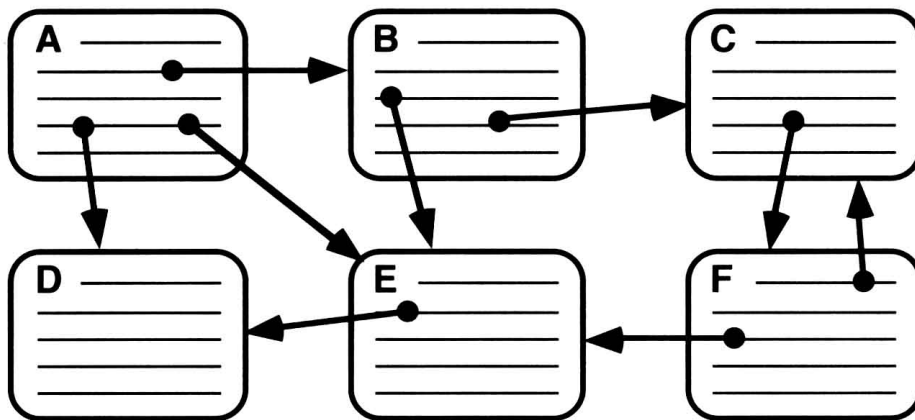


Figure 1.1. Simplified view of a small hypertext structure having six nodes and nine links.

connect two elements in a hypertext structure.

Hypertext presents several different options to the readers, and the *individual* reader determines which of them to follow *at the time* of reading the text. This means that the author of the text has set up a number of alternatives for readers to explore rather than a single stream of information.

The same is true of footnotes in traditional printed texts, since readers have to determine upon reaching the footnote marker¹ whether to continue reading the primary stream of text or to branch off to pursue the footnote. Therefore hypertext is sometimes called the “generalized footnote.” Another printed form with access structures similar to hypertext is the encyclopedia with its many cross-references.

As can be seen from Figure 1.1, hypertext consists of interlinked pieces of text (or other information). These pieces are illustrated as computer screens in Figure 1.1, but they can also be scrolling windows, files, or smaller bits of information. Each unit of information is called a *node*. Whatever the grain size of these nodes, each of them may have pointers to other units, and these pointers are called *links*. The number of links is normally not fixed in advance but will depend on the content of each node. Some nodes are related to many others and will therefore have many links, while other nodes serve only as destinations for links but have no outgoing links of their own. Sometimes such nodes without further links are called leaf nodes.

Figure 1.1 also shows that the entire hypertext structure forms a network of nodes and links. Readers move about this network in an activity that is often referred to as browsing or navigating, rather than just “reading,” to emphasize that users must actively determine the order in which they read the nodes.

A hypertext link connects two nodes and is normally directed in the sense that it points from one node (called the *anchor* node) to another (called the *destination* node). Hypertext links are frequently associated with specific parts of the nodes they connect rather than with the nodes as a whole. In the example in Figure 1.1, we see that the links are anchored at specific locations in the departure node while their destinations are the entire arrival node. A typical application of this feature is to have a link anchored at a certain word in the departure node and then let the user activate the link by clicking on that word.

¹ I guess you decided to *read* the footnote this time. But you could as easily have skipped it.

When users follow the links around the hypertext network, they will often have a need to return to some previously visited node. Most hypertext systems support this through a *backtrack* facility. Assume that we are currently located in node **D** in Figure 1.1. If we had arrived at this node via the path **A**→**B**→**E**→**D**, then the backtrack command would take us to node **E** the first time it was issued. A second backtrack command would then take us further back along our path to node **B**. If, on the other hand, we had jumped directly from node **A** to node **D**, then issuing the backtrack command at node **D** would take us to node **A** since that would then be where we came from. This example shows that backtracking is just as dependent on the individual user's movement as is the order in which the nodes were visited in the first place.

Narrower Definitions of Hypertext

Since hypertext has become so popular in recent years, much rides on the exact definition of what constitutes hypertext. Many products are advertised as hypertext without being so according to the common definition presented above. Additionally, many products that are hypertext according to this definition lack important features which might be included in a narrower definition of hypertext.

For example, Frank Halasz from Xerox has put forward the view that a true hypertext system should include an explicit representation of the network structure in its user interface. As shown in Figure 1.1, *any* hypertext will form a network of nodes and links, but in most current systems that network is only present inside the computer. At any given time the user sees only the current node and the links leading out from that node; it is up to the user's imagination to picture how the entire network is structured.

Halasz wants to give the user a dynamic overview showing the structure of this network. Very few current hypertext systems provide such diagrams.² The reason the overview diagram needs to be dynamic is that it is normally impossible to draw a graphic representation of the entire hypertext on a computer screen since a hypertext typically contains thousands of nodes. Instead the diagram is displayed in detail only for the local neighborhood surrounding the user's current location, which is often highlighted on the

² Halasz's own system, NoteCards, is one of the few exceptions. It is discussed further in Chapter 3.

diagram. The various ways of providing an overview are discussed in further detail in Chapter 9.

Almost all current hypertext systems are limited to providing one-directional links like the ones shown in Figure 1.1. This means that the system can show the user the links that have the current node as their departure point but not the ones that have it as their arrival point. In other words, the system will tell you where you can go next but not in what alternative ways you might have arrived at where you are now.

K. Eric Drexler has advocated the use of bidirectional links in hypertext, meaning that the system should also be able to display a list of incoming links. From a computer science perspective it would be almost a trivial task to implement such a feature, but almost none of the current hypertext systems do so.³

One example came from Intermedia, which did support bidirectional links. A hypertext structure on Chinese poetry [Kahn 1989b] had links from each poem to the references to those anthologies where it has been reprinted and/or translated. This set-up automatically ensured that each listing for an anthology or a translator had a complete set of links pointing to occurrences of the relevant poems in the Intermedia hypertext.

Drexler has also stated the need for supporting links across various forms of computer network such as local area networks (LANs) and international networks. This step will become necessary if hypertext is ever going to replace the traditional publishing business, since nobody can have all the world's literature stored on their own local computer no matter how big an optical disk they get. Access to remote databases will become a necessity for many future hypertext applications, but many current hypertext systems are limited to working with data stored on a single personal computer. The main exceptions are the World Wide Web which works across the entire Internet and technical documentation systems like Sun's AnswerBook which work across a corporate network.

Many non-hypertext computer techniques may at least match various aspects of the definition of hypertext, but true hypertext should also make users *feel* that they can move freely through the information, according to their own needs. This feeling is hard to define precisely but certainly implies small overhead with respect to using the computer. This means short response times

³ It would just involve updating two lists instead of one every time a new link was added.

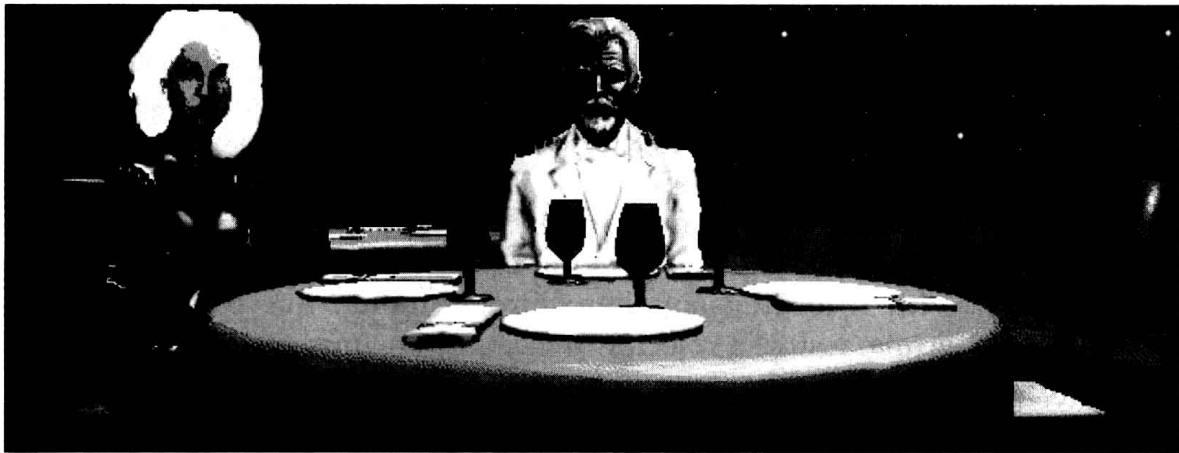


Figure 1.2. Screen from the *Spaceship Warlock* hypermedia adventure. This game combines detailed graphics with a small amount of animation and recorded sound: appropriate music is played in the background to set the mood and the characters speak. This game has proven so popular that a sequel was released in 1995. Copyright © 1991 by Reactor, reprinted by permission.

so that the text is on the screen as soon as the user asks for it. Small overhead also requires low cognitive load when navigating, so that users do not have to spend their time wondering what the computer will do or how to get it to do what they want.

When asked whether I would view a certain system as hypertext, I would not rely so much on its specific features, command, or data structures, but more on its user interface “look and feel.”

Hypermedia: Multimedia Hypertext

The traditional definition of the term “hypertext” implies that it is a system for dealing with plain text. Since many of the current systems actually also include the possibility for working with graphics and various other media, some people prefer using the term *hypermedia*, to stress the multimedia aspects of their system. Personally, I would like to keep using the traditional term “hypertext” for all systems since there does not seem to be any reason to reserve a special term for text-only systems. Therefore I tend to use the two terms *hypertext* and *hypermedia* interchangeably with a preference to sticking to *hypertext*.