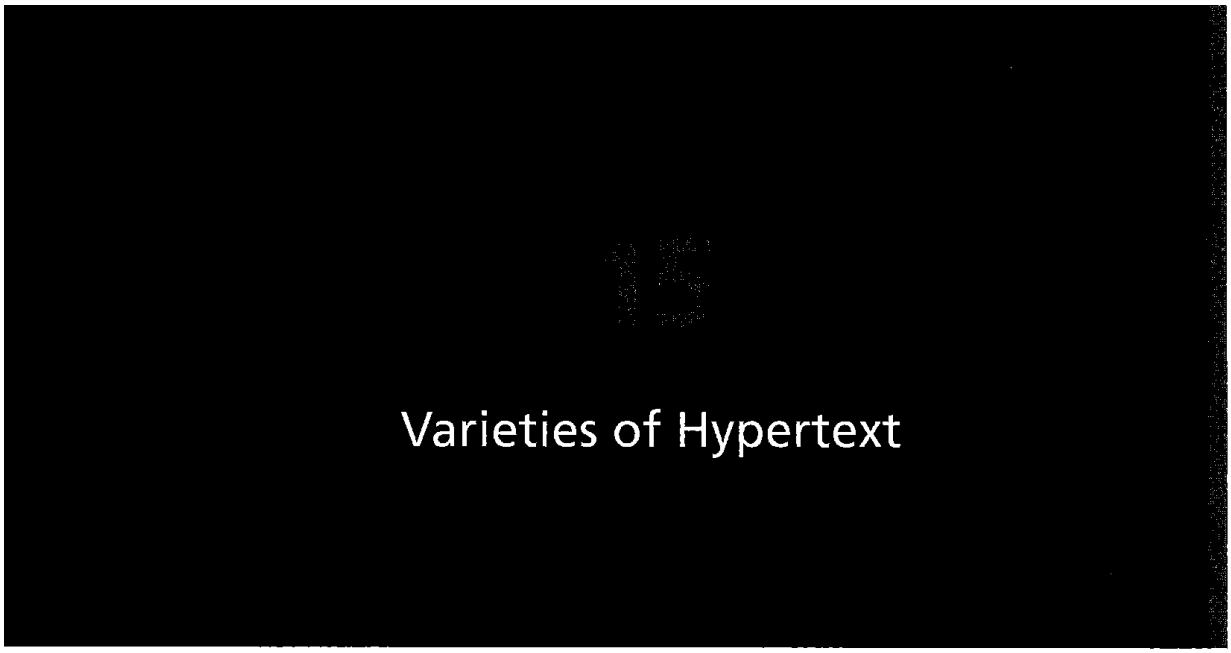

Varieties of Hypertext

In computer science, the concept of hypertext designates a way of making direct connections among various pieces of information, textual or nontextual, that may or may not be located in the same file (or on the same "page") by means of embedded links. Using an interface based primarily on visual and intuitive elements such as color and icons, hypertext users can identify the places in a document where additional information is attached and access them directly with a mouse click.

Literary theory also uses the term *hypertext*, but in a very different sense. For Gérard Genette, for example, hypertext is "any text derived from a previous text either through simple transformation . . . or through indirect transformation."[1] In this sense, James Joyce's *Ulysses* is a hypertext of Homer's *Odyssey*. The current concept of hypertext, as it comes to us from computer science and the Web, is closer to that of intertext as first proposed by Julia Kristeva and redefined by Michael Riffaterre: "the perception, by the reader, of a relationship between a work and others that have either preceded or followed it."[2] But the two concepts do not coincide completely, since the intertext, in this meaning, results from the act of reading, while the hypertext we are talking about is a computer construct of links and data corresponding to files or parts of files that can be displayed in windows of various dimensions.

There are many hypertext software programs. Among the pioneers are Hypercard, Hyperties, KMS, Intermedia, and Notecards. Since the advent of the Web, hypertext has been based mainly on HTML (HyperText Markup Language), XML (Extensible Markup Language), and XHTML.

Historically, the term *hypertext* was created in 1965 by Ted Nelson, who used it to designate a new way of writing on the computer, in which the

units of text could be accessed nonsequentially. The text thus created would reproduce the nonlinear structure of ideas as opposed to the "linear" format of books, films, or speech. Nelson himself was indebted to a visionary article by Vannevar Bush, who in 1945 already envisaged a huge storage system for human knowledge that anyone would be able to connect to and that would allow them to annotate documents of interest. Even before the introduction of the personal computer, Nelson had attempted to realize Bush's dream using a computer system called Xanadu—the name of Mongol emperor Kublai Khan's palace, immortalized in a poem by Coleridge as a symbol of memory and its accumulated treasures. Nelson's Xanadu was supposed to lead to a huge universal library system (docuverse), which could be consulted on workstations by making "micropayments" for each information node accessed. Despite its commercial implications, Nelson's model had a profound influence on the evolution of hypertext, and the World Wide Web may be seen as its culmination in an unrestricted form.

Hypertext can be used to manipulate data of all kinds, not only linguistic data but also images, sound, video, and animation. It makes it possible to regulate a reader's interaction with a document by programming various behavior into objects on the screen in relation to the reader's movements of the mouse: the author of a computer program can stipulate, for example, that touching a certain word with the mouse pointer will change its form or color or trigger a process that will lead to a new text. Through these features, hypertext creates a radically new form of electronic dialogue in written language. Even more numerous than the many forms of books, hypertext products vary substantially in appearance and internal organization. Indeed, computer technology can give digitized text any form imaginable.

In a text on paper, the paragraphs or blocks of information are arranged in sequence, and the reader can access them essentially through contiguity, relying on a number of tabular elements. In a hypertext, the various blocks of information may be distinct and autonomous and may be located on a single "page" or on separate "pages." In accordance with the nature of the document and the target readers, the author of a hypertext can provide access by means of selection, association, contiguity, or stratification, and these modes can exist alone or in different combinations.

Selection. In the simplest case, selection, readers select the block of information they want to read from a list or enter a letter on the keyboard. The various blocks of information are distinct units with no essential links among them. Readers are guided by a specific need for information, which exists only until it is satisfied. This model is

typical of the catalogue, the entire organization of which is based on the principle of expansion, with each word of the index leading to a detailed description. Dictionaries also work on this principle, but each of their entries can also contain references to other entries such as synonyms, antonyms, and so on. The user may also select from the list of pages already consulted in the document during the work session or may choose from a table of contents or from a tree diagram in which the various branchings are accessible at different hierarchical levels. Finally, the most frequent mode of selection is by means of hyperlinks indicated by a particular color, on which the user clicks in order to explore the content behind them.

Applied to a text of a certain scope, the principle of selection is also characteristic of hypertext fiction in which each screen page includes several links to other pages, making Jorge Luis Borges's ideal of forking paths a reality. Similarly, in the case of a philosophical essay, every block of text could be followed by a number of icons, each one corresponding to a possible continuation of the text according to the anticipated reactions of the reader insofar as the author could predict them. After reading a segment of text, the reader could select the most relevant continuation. In so doing, he or she would become actively involved in reading, making choices, and expressing opinions at every step through each section read. But the number of combinations can easily skyrocket. If a block of text gives rise to three choices, and each of these gives rise to another three, there would be nine possible continuations of the initial text at the third level, twenty-seven at the fourth level, and eighty-one at the fifth. As a result, 121 texts would have to be written for a sequence of five paragraphs to be accessible in perfectly "free" hypertext mode. Thus the idea of providing choices at every level has to be abandoned, or their proliferation would lead the reader into endless movement and force the author to rigorously explore every logical alternative at each point in the argument. Moreover, the freedom given the reader is purely artificial; it only reinforces the dominant position of the author, who is the master of all possible outcomes.

Selection and association. In this mode, readers choose the element they wish to consult but can also navigate among the blocks of information, letting themselves be guided by the associations of ideas that arise as they navigate and by the links offered them. This model is typical of encyclopedias.

Selection, association, and contiguity. In addition to the above-mentioned modes of navigation, the blocks of information are here accessible sequentially, like the pages of a book. This model is suitable for an essay or a scientific article and would be used, for example, for adaptations of printed books. It corresponds to a simple transposition of codex format to electronic format. For example, in a hypertext adaptation of an essay such as Marvin Minsky's *Society of Mind*, readers can choose to select a title in the table of contents, search for a word in the index, or move from section to section by scrolling. The contiguity mode is useful only if a document is divided into pages and sections that are supposed to be read in a specific order—as is usually the case with a book.

Selection, association, contiguity, and stratification. In addition to being accessible by the above-mentioned modes, the elements of information can be distributed in two or three hierarchical levels according to their degree of complexity. This makes it possible to meet the needs of various categories of readers or to satisfy different information needs for a single reader. This hypertext model best combines the advantages of the codex with the possibilities opened up by the computer by taking into account a new dimension of the text, that of depth. By superimposing different layers of text on a single subject, or to use another metaphor, by encircling a central nucleus with various supplementary documents, the uses of which are well defined, a stratified hypertext provides several books in one.

Users of such a hypertext could scroll through pages in a main window, while at the same time being able to open one or more secondary windows, providing more theoretical or more popularized discourse. There are many fields in which this type of structure with two or three layers, offering a basic discourse and additional windows accessible on demand, is desirable. This is the case for self-teaching textbooks and learning situations, for example, in which the learner is confronted with a mass of interrelated concepts that may not all be familiar. It is also the case for technical manuals in which the user may at any time want to consult supplementary information on a specific element.

These four modes of navigation may also be combined in the electronic edition of a work, opening up new perspectives for critical editions of works on paper. The main thread of reading would thus be the final version of the text,

dominating the layers of the previous versions, which the reader could also choose to display in parallel windows. The different pages of the text would be accessed by contiguity or by selection in a table of contents. Finally, comments, notes, and illustrations would be accessible through connections or associative links. Because of the richness and diversity of the links provided, I will call this ideal type of hypertext a "stratified" or "tabular" hypertext.

The success of a tool of this kind obviously depends on the consistency and interest of the base layer. While this is relatively easy to determine in the case of a critical edition, the same is not true for other documents. In a textbook aimed at a diverse readership, the various strata of information it should contain would have to be established. The base layer would contain the main thread of the text, consisting of the minimum information at a medium level of difficulty. On every page where needed, hyperlinks would open one or two supplementary windows, such as a "novice" window for users whose knowledge is insufficient for them to grasp the main ideas and an "expert" window for those who already possess the basic knowledge and want to know more.

In creating an arrangement capable of working in depth and not only on the surface of the thread of discourse, the author of a tabular hypertext must take the utmost care in establishing the different layers and distributing the information between the base level and the other layers. These choices will vary with the type of text and target audience. The levels of information may be distributed on the axis of concrete/abstract or divided between narrative and documents or between scholarly text, experimental data, and reference works, or between didactic text, examples, and exercises, and so on.

Generally speaking, it does not seem desirable to create more than two layers in addition to the base level. Increasing the number of layers will result in a proliferation of cross-references, and reading would quickly become difficult. It is important to remember that in a reader-based textual economy, reference markers should be provided that allow readers to predict the results of their actions when moving the mouse pointer over the surface of the screen. The presence of a "novice" or an "expert" layer linked to a particular word or page should thus always be indicated in the same way, by an icon or the use of a color. Novice readers who click on an icon hoping to find an explanation at their level would quickly become discouraged if, instead of getting what they wanted, they encountered material intended for experts. To be effective, reading must be based on stable conventions that enable maximum concentration on the content.

Stratified hypertext will undoubtedly develop its own conventions just as the print media did, and these will become part of readers' culture. In spite of the problems, this is where the most promising future for hypertext lies if it is to move beyond the stage of utopian dreams of liberation to become a productive working tool. However, these modes of organization of hypertext may lead to methods of navigation that are very different depending on the degree of opacity or tabularity of the presentation of data. A literary or game hypertext may opt for greater opacity in navigation and allow users to produce events on the screen without knowing where they are or where they are going. In this case, there are no obvious "movements," since everything occurs within the same visual framework. This form of opaque hypertext may be suited to an experimental narrative such as Stuart Moulthrop's *Hegirascope*[3] or to an adventure game such as *Myst*, in which the players have no idea of their position in relation to the puzzles to be solved. For an informational document, however, the most satisfying option for readers is one that gives them a clear view of the distribution of information and enables them to directly access all the blocks, with full control of their movement. In this regard, it is significant that some games allow players to choose the episode they want and allow them to display the percentage of the episode completed at any time.

One area where the user's route cannot be left to chance is learning. Instructional programs and textbooks are based precisely on the principle that the acquisition of knowledge cannot take place in random order guided only by the learner's associations. The first computer-assisted learning (CAL) programs took this principle of the sequential path to the limit, locking students into programmed paths in which access to each exercise was conditional on success in the previous one. Students were expected to move forward blindly, without knowing how many steps they would have to go through or even, sometimes, what they would actually learn from the program. Hypertext, too, can be used in an opaque manner, to totally control users' progress, allowing them to follow only branchings accepted by the logic of the program, thus reinforcing traditional practices of computer-assisted learning. I believe, however, that hypertext should adopt some of the characteristics of the age-old technology of the book to create a new product that will satisfy the needs of demanding readers who use it as a tool for informational or educational purposes.

As we can see, the production of a hypertext requires constant strategic choices by the author. The distribution of elements of information also poses

the problem of identifying every primary textual unit with a title. If these titles are meaningful to the users, it will be easier for them not only to find the information they want, but also to keep track of which pages they have read when they exit from the hypertext. In this way, readers will be able to have real control over the text instead of being controlled by it or groping their way through it.