

10.

Reading on Screen: The New Media Sphere

Christian Vandendorpe

Far from being "natural," reading is a complex skill that is highly dependent not only on the way it has been learned, but also on the nature of the text to be read and the media on which the text is written. Even if it is not within the scope of this chapter to do a history of reading ([Manguel 1996](#); Vandendorpe in print), it is necessary to highlight the main points of its evolution in the western world if we want to grasp the new context created by the advent of the computer and the internet.

The history of reading is closely related to the history of the book. In a nutshell, one might say that it is characterized overall by the evolution of the document from a linear and uniform flow of text to a tabular organization. In Rome, two thousand years ago, silent reading was unknown and people read out loud; or, if they were affluent enough, they listened to their slaves reading to them. Since then, reading has evolved from that "hearsay" model into the complex semiotic interaction of a variety of verbal and visual clues we know today.

The most important milestone in the history of the book was the adoption of the *codex* format — a Latin word meaning booklet— and the subsequent demise of the *volumen* or scroll. That revolution took place in Rome in the first century ad. The Christians were the first to adopt the codex, for a variety of reasons: the codex was cheaper than the scroll because the sheets could be written on both sides; it was also more compact and easier to conceal, an important feature for members of a forbidden religion who traveled a lot, and so this new medium was best adapted to a new religion preaching a revolutionary gospel. As the ascent of the codex followed that of the new religion, the new format of the book became progressively more common. It was dominant in Rome by the end of the fourth century ad, when the new religion was recognized as the official religion of the empire.

The passage from scroll to codex allowed important changes in the way texts were read. First, it freed the hands of the reader. The scroll was necessarily held with both hands; it was unrolled horizontally, and the readers might need to control the proper reenrolling of the scroll with their chin. The codex also made it easier to refer to a given portion of text. It gave more visibility to the content of the book and allowed artists to illuminate sacred manuscripts in order to foster a reverential attitude among believers. More importantly, various incremental improvements across the centuries would make the text easier to read: adoption of a minuscule script around 800, introduction of spaces between words ([Saenger 1997](#)), and of embryonic forms of punctuation ([Parkes 1993](#)), for example. Those developments would make silent reading easier to achieve and therefore fairly common in the monasteries' scriptoria of the twelfth century.

After the invention of the printing press, the book progressively gained its most modern features: page numbering, delineated paragraphs, secondary titles and tables, titles of chapters, etc. All these improvements made it easier for readers to control their reading activity, to retrieve a particular passage of a text and to share it with others. The book thus became ideally suited as a vehicle for the revolution in knowledge that characterized the Renaissance and ushered in the modern era.

According to the history of reading ([Engelsing 1974](#)), another important change in the habits of reading would occur in the eighteenth century. Until then, the book was thought of as an entity whose content a serious reader should assimilate through sessions of intensive reading, digesting and ruminating until it became part of him or her. With the multiplication of books and of all forms of printed material, a new attitude toward text called "extensive reading" would gain legitimacy. In place of percolating intensively a few books, the reader could choose to browse through vast amounts of material and content by reading only passages of particular interest. This attitude would foster the production of big encyclopedias like Chambers' *Cyclopaedia, or Universal Dictionary of Arts and Sciences* (1728) and the Diderot and D'Alembert's *Encyclopédie* in 33 volumes (1751–72).

Over the centuries, reading thus became a distinct cognitive experience autonomous from the spoken word. As a distinct media, the specificity of the printed text is that it allows readers to understand verbal content at their own pace.

From Print to Screen

The advent of the personal computer at the beginning of the 1980s made the writing process infinitely more fluid than it had ever been before. Being easy to correct, to format and to disseminate, digital writing was rapidly adopted by the many professions dealing with the production of text. But the adoption of the screen as a reading device was much less enthusiastic. For quite a few years the computer did not look like a real rival of the printed book, a fact that was partly due to the poor quality of monitors at the time. This situation began to change with the massive adoption of the web in the mid-1990s.

The internet solved elegantly and definitively the old problem of the portability of documents. In that aspect, we have come a long way from the bulky clay tablets of the Sumerians. As we have seen, the codex was adopted in part because it was more portable than the scroll. And the printers had the intelligence to invent through the ages very small books that were very

handy for travelers. But with the web, documents no longer need to be transported: they can be stored in public repositories accessible from everywhere. Ubiquity is the perfect solution to portability.

Thanks also to improvements in display technologies, and to increasingly vast amounts of data available on the web, there has been, over the course of a dozen years, a steady increase in the time the general public spends in front of a screen, which in the USA was around fifteen hours per week in the spring of 2006. However, since not all of that time could be considered as "serious reading" by most people, it may be useful to introduce some distinctions between various modes of reading.

[Heyer \(1986\)](#) proposes three different modes of reading or gathering information, based on metaphors borrowed from the ways our ancestors gathered food: grazing, browsing, and hunting. In the grazing mode, the "reader" picks up everything coming out of the book. For this purpose, we shall call that mode "continuous reading," in the sense that the reader aims to construct a significant whole out of a long text, even if the reading spans many sessions. This mode of continuous reading is most typical of the novel where users have to immerse themselves in a book in order to create a fictional universe. It is also the case, albeit with significant differences, with long essays where the reader has to master a series of arguments and relationships, like Darwin's *On the Origin of Species* or Freud's *Interpretation of Dreams*. In browsing mode, readers pick up only what is of interest to them through the "scanning of a large body of information with no particular target in mind" (Heyer). That mode became fairly common with the advent of newspapers, magazines, big catalogues, and coffee table books. In hunting mode, the reader seeks specific information. This mode is relatively recent and became a real possibility only when alphabetical order was adopted for dictionaries, in around 1000, and then extended to indexes for scholarly books between 1200 and 1300. Naturally, this characterization of various modes of reading is only an approximation: there are many processes involved in reading just as there are in the process of understanding. These categories are useful, however, as guidelines.

These three modes of reading are not at all equal when it comes to implementing them on a computer screen. Significantly, the browsing mode was the first to define the activity of reading on the screen: it is so well adapted to the screen that the interface created for the web was aptly named a "*browser*." It allows the user to navigate the web from one node of information to another, as is done with the titles of a newspaper. It should be no surprise, then, that printed magazines and newspapers were among the first to be digitally available through the web.

Next, the hunting mode became fairly common with the advent of sophisticated search engines and basic interactivity. The turning point occurred in 1999 with the appearance of Google, whose fast algorithms and page-ranking system greatly improved the results of any search. The search engine is to the book index what the internet is to portability: far from being limited to a small percentage of books, full text search is now available for all kinds of documents. By an effect known as a "virtuous loop," the more information there is on the web, the more probability there is that a user will get an elaborate answer to any given request. That, in turn, provides a greater incentive for people to put documents on the web, knowing that it may be found by someone looking for it. That powerful dynamic has led to the exponential growth of the web. Far from slowing down, this trend should continue in years to come.

By another interesting feedback effect, the reading sphere could well be profoundly affected by this new conjuncture. With the availability of ever more powerful search engines, a culture of questioning is now spreading to all categories of people. In other words, what was once considered as typical of a learned method of reading is now gaining in popularity and occupies a more important segment of reading time for many people.

Thanks to the ubiquity and searchability of documents, the screen is now the place of choice for the modes of reading related to browsing and searching, but it still lags well behind paper for continuous reading activities. Many people prefer the conviviality of the book or even photocopies when they have long documents to read attentively. This is due to a variety of reasons, notably the rigidity of the screen and the technological barriers posed by the mouse and the keyboard, which prevent readers from immersing themselves in a reading experience comparable to that offered by the book.

The Issue of Legibility

It took many years to adapt typography to the screen. Owing to the fact that the monitor is made of tiny little squares, it was necessary to develop sub-pixel addressing technologies in order to avoid ragging effects in the display of type. Even if that technology was pioneered as early as 1976 by Apple and later introduced in Acrobat Reader PDF format, it was not until 1998 that it was made available in the Microsoft world under the name ClearType. And even then, that method of smoothing the edges of screen fonts was not the default mode of the operating system until the latest versions of Windows XP. As poor font quality makes reading difficult and strenuous, it should be no surprise that the screen was generally discarded as a continuous reading device.

Meanwhile, new fonts were developed for enhancing legibility, such as Georgia and Verdana. While the later is sans serif, the former is a serif font, which means that each letter has a kind of small footprint at its base. The general effect of a page of text is very different depending on which type has been used for its display. The question of which family should be preferred has been the matter of many debates. There is no ideal font: choices are dependent on context and on the effect that is desired. In the world of printed books, serif

fonts are largely dominant because they have been used since the Roman era and also because the decorative strokes of the serif tend to offset the dull effect otherwise produced by the extreme regularity of type across pages and pages of text. Many magazines, on the contrary, will favor sans fonts in order to make the text look light and "clean" in the midst of pages already heavily decorated by illustrations, color bars, and publicity.

On the screen, serif fonts were largely dominant in the nineties, due to their dominance in the printed world. For many years, Times was the font of choice because it looks better than Helvetica (or its clone Arial) when it is printed on paper. Increasingly, however, sans fonts are gaining followers, and rightly so: as screens and webpages are often cluttered by icons and graphical elements, sans fonts look cleaner, stay legible at a very small size and make for more appealing and more visually balanced screen pages.

The size of the letters is another thorny issue. Small typesize allows the display of more text in one screenshot, but if it is too small, many readers will have to resize it, which may be cumbersome, even impossible with certain browsers. If it is too large, the screen looks cluttered and as ugly as a billboard. Spacing between the lines creates white space, which is a relief for the eye: the closer the lines, the more strenuous will be the reader's effort. Again, however, a too large spacing reduces the amount of text displayed in the window. Generally, the longer the columns of text available on a single screen, the easier it is for the reader to grasp the context of what is being read.

Handling the Flow of Text

The codex took over from the scroll and sent it to the dustbin of history mainly because it gave the reader a better control over the reading process.

The main advantages of the codex were lost when text was converted to the screen. The main drawback of the screen lies in the fact that it is a two-dimensional object. As such, it can only show one "page" at a time. This is far different from the book whose structure allows the reader to leaf through the pages and, in doing so, gain some visual control over the content of the book, and be able to compare pages in one section with those in another one. It is also possible to browse through the book, search in the index for a word, or read the book from cover to cover. This flexibility of the book, which adapts easily to any of the three main modes of reading, helps to understand why the printed media was so successful and why it is still very much attached symbolically to the highest cognitive activities.

Therefore, we should not see the attempt to reproduce the qualities of the codex in the virtual world as backward longings for a dead past, but as a quite rational desire to ensure a smooth transition between the remarkable achievements of the book and the new possibilities offered by the digital world. A culture does not progress by erasing the past, but by weaving it into its future — like the humanists of the Renaissance did with the works from Greek and Roman antiquity. If the screen is the future of the page, governments and libraries should ensure that books from the past will be accessible in this new medium.

The first vision of a digital library was put forward by Michael Hart, who founded the Gutenberg Project in 1971. Twenty years later, some national libraries began to make available thousands of books on the web, but the real wake-up call came with the announcement at the end of 2004 that Google would digitize 15 million books. Even if this project has been attacked on legal grounds by various American publishers, its mere perspective has raised an incredible interest all around the world and incited various governments to enter the fray. The task is gargantuan. [Kelly \(2006\)](#) estimates that "humans have 'published' at least 32 million books [and] 750 million articles and essays" since the first Sumerian clay tablets appeared on the surface of the globe. This vast quantity of published texts represents the repository of human experiences in various cultures throughout history and it should be made available on the web for future generations. All over the world, various projects have been initiated and the pace of digitization is now estimated at one million books per year. The big question is how to make those books easily readable on screen.

The scroll and the codex are the two main metaphors available for displaying text on a computer screen. The vertical scroll format was adopted as a norm by the first word processors in the 1960s. In that metaphor, the text is seen as a continuous flow of words that the reader handles by clicking with the mouse on the scrollbar or by using keyboard controls (page up, page down). An important drawback of this solution is that the position of a specific sentence on the screen shifts with the scrolling movements, which excludes the participation of visual memory in the reading process.

Moreover, the scrollbar gives the user very poor control over the flow of text. The size and position of the scrollbar are very insufficient for handling large documents and make it difficult for the reader to build up a mental model of the entire text or to go directly to a specific position in the text. There is no small irony in the fact that the first attempt to naturalize the reading process on the screen reverted to the antiquated metaphor of the scroll and to an analogous way of handling the flow of text, in place of a digital one. But these shortcomings were considered as acceptable since the screen was seen as a transitory space, with the actual reading taking place when the text was printed on paper.

Progressively, some word processors would offer the possibility of seeing page breaks, margins, headers and page numbers, even when the user is scrolling through the text, and of displaying the layout of the pages in any format. Over the past twenty years, the dominance of Microsoft Word is due to the fact that it was the first word processor to give the user full visual control over the text, a control popularized by the acronym *wysiwyg* ("*what you see is what you get*"). The 2006 version of this program offers no fewer than five ways of

visualizing the flow of text, each with its own strengths, depending of the user's goals: normal, web, page, plan, and double page (aptly called "reading mode"). Word processors are thus getting away from the "native" scroll format adopted at the beginning of the computer age, and they now tend to replicate many aspects of the codex format.

In that respect, PDF offers some of the closest approximations to the experience of reading a codex. It replicates the appearance of the printed page and offers many sophisticated features that enhance the navigation and the reading process by giving the reader various *tabular* controls over the text. He or she may flip through the pages laterally (codex-like) or vertically (scroll-like). Any page is accessible by its number or by clicking on thumbnails of pages on the left. Some features even surpass the functionalities of the codex. The search function displays in a window all the occurrences of a word in the document, with the page numbers and a short context. It is also possible to highlight, underline or cross-out portions of text, insert comments and place bookmarks, and even reorganize the document. Readers are thus able to appropriate the text as deeply as needed, check their progression in the text, easily compare two sentences positioned in different sections of the text, and find a specific occurrence without having to lose their position in the document. These features tend to make reading on a screen quite efficient.

The Advent of Hypertext

The reconciliation on a screen of the vertical scroll and the horizontal codex formats was unproblematic as long as the text was a closed linear entity. Things changed radically with the advent of hypertext. Hypertext is a way of linking any portion of a document to another one (see Belinda Barnet and Darren Tofts, Chapter 15, *Too Dimensional: Literary and Technical Images of Potentiality in the History of Hypertext*, this volume). The term "hypertext" was coined in 1965 by [Ted Nelson \(1974\)](#), who took his inspiration from the seminal paper "As we may think" written by [Vannevar Bush \(1945\)](#). In this paper, Bush envisioned a system where the users could access all books and scientific articles in microfilm format, combine sections of interest to them and record their reading sessions. This dream began to become reality when the necessity of handling enormous masses of documents on a small computer monitor led to the implementation of the SGML (Standardized Generalized Markup Language) in the mid-1980s. The concept of hypertext began to penetrate into the public domain in 1987 with the arrival of a new Macintosh equipped with HyperCard. It was fully realized with the creation of the World Wide Web by Tim Berners-Lee and Robert Cailliau in 1993.

Hypertext introduces a new metaphor for the representation of text, since it is conceptualized as a hierarchy or an arborescence of textual nodes linked together. The text is thus apt to be thought of as a purely logical structure.

The basic unit of a hypertext has received various names. Computer people first used the technical term "stacks," which refers to a series of addresses in the RAM memory of the computer. For some time, the term "hypercard" was very common, by metonymy with the software of the same name and the similarity between hypertext nodes and library cards. For the literary hypertext, [George Landow \(1994: 1\)](#) proposed the term "lexia," in reference to the way Roland Barthes names chunks of text in *S/Z* (1970). Many hypertext writers published at Eastgate in the 1990 have adopted the term "writing space" derived from the software Storyspace.¹ Today, most people simply use the word "page."

This designation gained in popularity with the advent of the web. Within a few years, the hypertext became part of the mainstream experience and it showed its ultimate strength in its ability to link seamlessly billions of pages as if they were a single entity, a constantly evolving book. But its basic unit, the so-called page, has only a vague resemblance with its physical cousin. On paper, a page is a fixed spatial entity whose word-count is approximately the same for every page of a book. As a physical entity, it coincides only loosely with semantic content; on the screen, a page has no intrinsic limit and could include only one word or a million.

Only ten years after the web became a common experience for billions of people, the text on the screen has morphed into an interactive mix of text, images, sounds, and graphs. Not only the "page," but even the traditional notion of "text" does not seem any more adequate to name this hybrid, which is better designated as a "document." At the same time, the reading experience is changing. This experience was previously shaped by the physicality of the codex and the immense popularity of the novel during the past two centuries. For the average reader, a book was seen not just as a collection of pages bound together, but as an organic whole worth being read from cover to cover. With the web, pages accessed by the user are generally just fragments whose meaning depends on the context within which they are grasped. Hypertext links give an incredible lightness to the reader, who can easily jump from one idea to another one, shifting contexts as easily as in a conversation. This is not always a blessing, of course, since it distracts the reader from following a single thread of thought, as is normally required in reading a printed book.

Hypertext has, however, made possible easy access to a wealth of data that exceeds humanists' wildest dreams since the great vision that gave birth to the library of Alexandria in 300 bc.

The Disappearance of the Column

The advent of hypertext also makes more complex the task of displaying text on the screen in a way that would foster, or at least be compatible with, continuous reading. When Tim

Berners-Lee and Robert Cailliau had to choose a language for designing a "distributed hypertext system for the management of general information," they opted for "an interchange format very similar to an SGML application" (Cailliau 1999). HTML was perfectly suited for the linkage of nodes of text, the display of lists, and for representing various hierarchical levels of titles, but it had only very basic tools for the layout of the page. The main drawback was, and still is, the lack of a fixed-width column of text, as the text in basic HTML is supposed to flow freely in the browser, going from one border to the other. As long as the monitors did not exceed 800 pixels of width, the width of the browser was adequately suited to reading.

Short columns of text are easier to read than large ones. This was already known in Greece, more than two thousand years ago. In the papyrus scroll, the width of the column of text varied between 8 and 12 centimeters, which corresponds to approximately 30 to 40 letters per line. Interestingly, those dimensions are still in use in today's newspapers and magazines. And it is so, not because they are imposed by cultural habit, but by the physiology of reading. In fact, experimental studies have shown that, in the reading activity, the eye does not proceed in a linear and smooth fashion. As Wikipedia puts it, "Eye movements are typically divided into fixations and saccades".² As the eye proceeds in a jerky fashion, the longer a line of characters, the greater the risk that the eye loses track of the line on which it is fixed. This is the reason why a column of text in a printed book usually stays under the upper limit of 70 characters per line. If it needs to be longer, like in art book, then the spacing between lines must increase, in order to facilitate reading and make the text more appealing.

In the past dozen years, we have witnessed steady progress in the quality and size of monitors. On a big screen, therefore, a web page that follows the World Wide Web Consortium (W3C) recommendations may well display a line of more than 300 characters. While practical for revising a software program where each line of code is an instruction, this "kilometric display" is quite inadequate for serious reading. In fact, as evidenced by many studies, it incites the reader to skim through the text rather than to read it attentively. Of course, the reader has always the possibility to resize the browser. But this process is cumbersome and tends to distract from the reading activity since it makes the screen more cluttered. Moreover, it does not give the reader the white space of the margins. Contrary to what one might think, margins are not just lost space. They give shape to the text and allow the eye to regenerate from the tension produced by the innumerable saccadic movements of the eye during the reading process. With the disappearance of margins, text is reduced to its content. This is the ultimate victory of the logical over the visual.

By reducing the text to a collection of bits of information that should flow freely on any screen, the engineers of the W3C broke away from the millennial tradition that saw the page as a semantico-visual space organized in order to procure a maximum of legibility. They were victims of the same illusion that McLuhan recognized in some of his students who were "prone to be concerned with book content and to ignore its form" (1962: 77).

Sure enough, the main providers of text for serious reading on the screen, like newspapers and magazines, in the main do not follow the W3C recommendations and calibrate precisely the width of the column of text at around 400 to 600 pixels using sophisticated *cascading style sheets*. It may be even less. For example, *The New York Times* displays text in columns of about 45 characters per line. That gap between official standards and real practices indicates that we are still in an era of transition, comparable in many ways to the fifty years that followed the Gutenberg invention, where books were still *incunabula*. We have to reconcile the logical with the visual, the fluidity of hypertext with the imperatives of a visual layout and the characteristics of the reading process desired.

The Birth of the E-book

The first attempt to naturalize the book for a digital media was the *Dynabook* designed by Alan Kay at Xerox Park in 1968. The design was very similar to what is known today as a laptop computer or a tablet PC. This kind of portable device, holding thousands of encoded books, was the inspiration for Neal Stephenson's novel *The Diamond Age*, in which a young girl is given a talking book as a companion and a tutor. As Beverly Harrison describes Kay's project, "This was one of the earliest reference designs that captured the notion of today's e-books — a portable, wireless, networked device that could act as a notebook and reading device while maintaining many useful affordances of a book" (2000: 35).

Owing to display technology, battery life, and miniaturization problems, it was not until the mid-1990s that we saw various attempts to design computers specifically and uniquely dedicated to replicating the book in a portable digital format, namely the e-book. The main models were the SoftBook Reader, the Rocket eBook, Cybook, and Gemstar eBook. In recent years, considerable advances have been made in display technologies, mainly with the invention of "digital paper," notably e-ink, which displays text using reflective light. The absence of backlighting translates into an enormous longevity of the battery, allowing some 10,000 pages to be read with the Sony's Librié, launched in 2005. Digital paper is also very light, making for better portability.

Ideally, the perfect e-book should also allow the user to manipulate documents as with Adobe Acrobat: highlighting, selecting, copying, commenting, and exchanging. The arrival of hypertext has opened doors that today's readers already appreciate too much to give them up.

The Future of Reading

It may be premature to make predictions for the future, since the display of documents on screen has not yet reached its maturity. History has shown, however, that a medium as widely used as the scroll could be completely replaced by the codex or book format in the course of three centuries.

Since our reading activity is shaped by the constraints of the media, we can forecast that the relationships between the various modes of reading will shift. While the grazing mode was the standard way of reading in the Gutenberg galaxy, it is now superseded by the browsing mode. And the hunting mode is also becoming fairly common due to the availability of answers to any given question a user might happen to think of. In the future, if this trend continues, the novel as a literary genre could well become an endangered species, despite its long history. There should be no surprise if today's novelists and publishers look at the web with some suspicion.

In a passionate plea for digitizing the millions of books presently in the various national libraries, [Kevin Kelly \(2006\)](#) suggested that such an accomplishment would allow those books to become part of the global hypertext:

Turning inked letters into electronic dots that can be read on a screen is simply the first essential step in creating this new library. The real magic will come in the second act, as each word in each book is cross-linked, clustered, cited, extracted, indexed, analyzed, annotated, remixed, reassembled and woven deeper into the culture than ever before. In the new world of books, every bit informs another; every page reads all the other pages.

Such a vision is indicative of the appeal of hypertext and of its enormous power of transformation on the reading sphere. In Kelly's view, the main interest of digitizing these millions of books is not to make them readable on the screen in a continuous mode. On the contrary, he envisions a future where books would be reduced to "snippets of a page" and "These snippets will be remixed into reordered books and virtual bookshelves." Their contents would be linked and tagged so that they would become a single huge hypertext. In this anticipation of the future, the printed book is no longer seen as a universe, but as a separate entity, at best an island, at worst a prison.

It is therefore no wonder if Kelly's vision was anathema to the writer [John Updike \(2006\)](#), who labeled it "a pretty grisly scenario":

In imagining a huge, virtually infinite wordstream accessed by search engines and populated by teeming, promiscuous word snippets stripped of credited authorship, are we not depriving the written word of its old-fashioned function of, through such inventions as the written alphabet and the printing press, communication from one person to another — of, in short, accountability and intimacy?

All too naturally, the novelist is not ready to accept a future where authors would be stripped of their status. In that respect too, the electronic text ushers us into a new era, just as the Gutenberg printing press did five hundred years ago. Writers gained a status that has been growing over the centuries: "printing tended to magnify the distance between the author and the reader, as the author became a monumental figure, the reader only a visitor in the author's cathedral" ([Bolter 1991](#): 3.) The revolution brought in by the internet may well be seen by some as a barbaric invasion similar to the ones that marked the end of the Roman Empire and the beginning of the Middle Ages. It is evident that cyberspace favors anonymous collaboration over single authorship, be it by blogs, forums, or encyclopedias like Wikipedia.

As time goes by, however, the printed book will have more and more difficulty meeting the expectations of most readers; i.e., that all texts should share the characteristics of digital documents: ubiquity of access, fluidity of copy-paste and exchange operations, integral searchability, participatory interactivity and hypertext links. It will become imperative that the millions of books printed up to now become available online.

It is true that in mid-2006 there was not yet a clear market for e-books. Sales were still a fraction of what printed books represent, and had not changed much from the previous year. In 2004, the market for e-books "accounted for an estimated 0.1% of the 2.3 billion books U.S. publishers sold worldwide" ([Helm, 2005](#)). Things could change rapidly, however, if a new device were to make digital reading as convenient as reading on paper. All over the world, publishers and newspapers are experimenting with electronic paper. It is now possible to envision a kind of truly electronic scroll the size of an open magazine where text would flow in parallel columns and that would display at least twice as much text as a big monitor. Such a device, that would combine the affordances of PDF format with those of the double page and of an extreme portability, would greatly enhance the readability of articles and long documents, since continuous reading comprehension greatly depends on the possibility for the reader to embrace a rather large quantity of text.

Ironically then, the foreseeable future of the book could well be in an electronic re-creation of the original scroll format, a development that would make digital reading as "natural" as reading a codex is today.

Notes

- 1 Eastgate describes this software in these words: "Storyspace map shows each hypertext writing space and each of its links": <<http://www.eastgate.com/storyspace/index.html>>.
- 2 <http://en.wikipedia.org/wiki/Reading_%28activity%29>.

References and Further Reading

- Aarseth, E. (1997). *Cybertext. Perspectives on Ergodic Literature*. Baltimore: Johns Hopkins University Press.
- Bolter, J. D. (1991). *Writing Space*. Hillsdale, NJ: Lawrence Erlbaum.
- Bush, V. (1945). "As We May Think." *The Atlantic Monthly* 176 (July): 101–8.
- Cailliau, R. (1999). "Hypertext in the Web – a History." *ACM Computing Surveys* 31.4 (December). <<http://www.acm.org/surveys/Formatting.html>>.
- Engelsing, R. (1974). *Der Bürger als Leser: Leser-geschichte in Deutschland 1500–1800*. Stuttgart: Kohlhammer.
- Harrison, B. L. (2000). "E-books and the Future of Reading." *IEEE Computer Graphics and Applications* 20.3: 32–9.
- Helm, B. (2005). "Curling up with a Good E-book." *BusinessWeek Online* December 29. <http://www.businessweek.com/technology/content/dec2005/tc20051229_155542.htm?chan=search>.
- Heyer, M. (1986). "The Creative Challenge of CD-ROM." In S. Lambert and S. Ropiequet (Eds.). *CD-ROM. The New Papyrus. The Current and Future State of the Art*. Redmond, WA: Microsoft Press, pp. 347–57.
- Kelly, K. (2006). "Scan This Book!" *The New York Times Magazine* May 14, sect. 6, p. 43, col. 3.
- Landow, G. P. (1994). *Hyper/Text/Theory*. Baltimore: Johns Hopkins University Press.
- Manguel, A. (1996). *A History of Reading*. New York: Viking.
- Manovich, L. (2001). *The Language of New Media*. Cambridge, MA: The MIT Press.
- McGann, J. (2001). *Radiant Textuality: Literature after the World Wide Web*. New York: Palgrave.
- McLuhan, M. (1962). *The Gutenberg Galaxy*. Toronto: The University of Toronto Press.
- Negroponte, N. (1995). *Being Digital*. New York: A. Knopf.
- Nelson, T. H. (1974). *Dream Machines: New Freedoms through Computer Screens – a Minority Report*. Chicago: Nelson/Hugo's Book Service.
- Ong, W. (1982). *Orality and Literacy. The Technologization of the Word*. London: Methuen.
- Parkes, M. B. (1993). *Pause and Effect. An Introduction to the History of Punctuation in the West*. Berkeley: University of California Press.
- Saenger, P. (1997). *Space between Words. The Origins of Silent Reading*. Stanford: Stanford University Press.
- Shneiderman, B., and G. Kearsley (1989). *Hyper-text Hands-On! An Introduction to a New Way of Organizing and Accessing Information*. Reading, MA: Addison-Wesley.
- Stoicheff, P., and A. Taylor (2004). *The Future of the Page*. Toronto: The University of Toronto Press.
- Updike, J. (2006). "The end of authorship." *The New York Times* June 25. <<http://www.nytimes.com/2006/06/25/books/review/25updike.html?ex=1156219200&en=24f36593b5c16137&ei=5070>>.
- Vandendorpe, C. (In print). *From Papyrus to Hypertext*. Illinois: Illinois University Press.
-