

centuries of church intolerance, stupidity, and slaughter. But the talking heads represented the apologies as crescendos of authentic feeling that actually accomplished the goals the church hoped to achieve by making them, and in some way absolved it. Christiane Amanpour earnestly related that the pope had apologized to the Muslims for the “excesses of the Crusades”—though not for the Crusades themselves—and also to the Jews for the Holocaust. She then solemnly intoned that during John Paul’s pontificate the Catholic Church had apologized to the Eastern Orthodox Church, and the Eastern Orthodox Church had apologized to the Catholic Church, for the schism that had occurred between them in the eleventh century, though neither set of apologies had closed the schism. This persistent discord between Catholicism and Eastern Orthodox Christians was, she said, “the great sorrow of the pope’s life,” but neither she nor anybody else on television bothered to explain what the schism was really about, or what steps the pope might have taken to defy church doctrine and overcome it. There was little time for such nuances. There were still the matters of the Inquisition and the historical anti-Semitism that led to the Holocaust, and John Allen eagerly reminded us that this pope made sure to apologize for them, too. Also the *tsuris* with Galileo.

Meanwhile, an archbishop working as a consultant to CNN—there’s a phenomenon—was able to show that the injuries were not all one-sided. Gerhard Schroeder himself had apologized to the Catholic Church, and also to the Polish people, for Germany’s failure to come to the aid of Solidarity during the revolt against Soviet rule. All these apologies, the CNN theatrical troupe assured us, were “amazing” and “extraordinary” acts of reconciliation on the part of this pope, who also, we were told reverentially, had the courage actually to set foot in a synagogue, and also in a mosque. You almost felt like you should apologize to the church for making it feel so guilty that it had to do so much apologizing. Was the thing with Galileo really *that* bad?

There were moments of sanity, or at least an occasional recognition that the performance had gone too far. Toward the end of CNN’s run in Rome, the network even brought in someone whose very presence might imply a criticism of this pope’s attitudes toward women and human sexuality, one Claudia Spadazzi,

an Italian gynecologist. Spadazzi assured viewers that far from being in thrall to the church, Rome was a great city “where there are many different realities.” Of course, she couldn’t have been directly critical of John Paul. And any such old-fashioned journalistic independence quickly collapsed under the weight of having to turn in the most treacly reading of events possible. When Jeff Greenfield tried to make the point that the massive demonstration of affection in St. Peter’s Square did not necessarily signify broad support for the pope’s more intransigent positions, Wolf Blitzer reined him in: “And yet at the same time, Jeff, the outpouring of emotion that we saw today involving the pope’s funeral does involve an extraordinarily strong bond. You have to, I think, agree with that.” You just have to.

By that point, only Christ himself could have harrowed the CNN crowd

into some semblance of rational skepticism and detachment. For the pope had barely arrived in heaven when he seemed to swing into action. Amanpour credited him with the handshake between the Israeli president and the Syrian president: “Maybe it’s the spirit of John Paul.” “Amazing,” agreed Cooper, who asked the archbishop-consultant if the pope was watching from heaven. “Certainly,” said the archbishop, pleased to offer his expertise in the afterlife department. (What are his sources? I demand to know.) And the archbishop added that the pope watching from the sky “is pleased at the great number of young people who are here.” But what about Schiavo, Sontag, Bellow, Hunter Thompson, Grace Kelly’s husband, and all the other new arrivals? What about a special two-hour “edition” with the dead on *Larry King Live*? It would be, as they say in the kingdom of television, ratings heaven. ■

David A. Bell

The Bookless Future

What the Internet is doing to scholarship.

I.

SCENES FROM THE INTERNET revolution in scholarship:

It is late at night, and I am at home, in my study, doing research for a book on the culture of war in Napoleonic Europe. In an old and dreary secondary source, I find an intriguing but fragmentary quotation from a newspaper that was briefly published in French-occupied Italy in the late 1790s. I want to read the entire article from which it came. As little as five years ago, doing this would have required a forty-mile trip from my home in Baltimore to the Library of Congress and some tedious wrestling with a microfiche machine. But now I step over to my computer, open up Internet Explorer, and click to the “digital library” of the French National Library. A few more clicks, and a facsimile copy of the newspaper issue in question is zooming out of my printer. Total time elapsed: two minutes.

It is the next day, and I am in a coffee shop on my university campus, writing a conference paper. A passage from

Edmund Burke’s *Letters on a Regicide Peace* comes to mind, but I can’t remember the exact wording. Finding the passage, as little as five years ago, would have required going to the library, locating the book on the shelf (or not!), and paging through the text in search of the half-remembered material. Instead, on my laptop, I open Internet Explorer, connect to the wireless campus network, and type the words “Burke Letters Regicide Peace” into the Google search window. Seconds later, I have found the entire text online. I search for the words “armed doctrine” and up comes the quote. (“It is with an armed doctrine that we are at war. It has, by its essence, a faction of opinion, and of interest, and of enthusiasm, in every country.”) Total time elapsed: less than one minute.

It is a few days later, and I am in my university office. I have seen a notice of a new book on Napoleonic propaganda, and am eager to read it. A few years ago, I would have walked over to the library and checked the book out. But this particular book does not exist on paper. It is

an “e-book,” published on the Internet only. A few clicks, and the text duly appears on my computer screen. I start reading, but while the book is well-written and informative, I find it remarkably hard to concentrate. I scroll back and forth, search for keywords, and interrupt myself even more often than usual to refill my coffee cup, check my e-mail, check the news, re-arrange files in my desk drawer. Eventually I get through the book, and am glad to have done so. But a week later I find it remarkably hard to remember what I have read.

AS THESE SCENES SUGGEST, IN the past few years the world of scholarship in the humanities and social sciences has been astonishingly transformed by the new information technology. Above all, it has been transformed by the amount of source material now available online—some of it by paid subscription, but much of it there for the taking by anyone with an Internet connection. Google made news in December with its ambitious plan to digitize the entire collections of several major research libraries (or at least the proportion that is in the public domain)—but to a much larger extent than the journalists who covered the story realized, the future that Google promises is already here. As I sit writing these words on my front porch, I can call up, in a matter of seconds, the sort of riches once found only in a handful of major research institutions: every issue ever printed of *The New York Times*; tens of thousands of classic and not-so-classic works of literature; a large majority of the books published in English before 1800; a million pages’ worth of French Revolutionary pamphlets and newspapers; every issue of virtually every major American newspaper and magazine going back a decade or more; every page of most major American academic journals going back half a century; most major encyclopedias and dictionaries; all the major works of Western painters and sculptors. And much more is coming. Some of this material will remain available only in facsimile form. Much of it, though, is already entirely searchable. Name your keyword, and the Internet delivers the citations to you with the force of a fire hose in the face.

So far, most scholars have seen this transformation as a blessing—particularly those who do not have access to large, privileged research libraries. Indeed, its

democratizing effects cannot be overestimated. Ten years ago, a historian whom I know took a job at the University of South Dakota. The entire library collection in her field ran little more than the length of her arm on the shelf, making real work on the subject effectively impossible, and she soon left. Today, a scholar in South Dakota, or Shanghai, or Albania—anywhere on earth with an Internet connection—has a research library at her fingertips, even without access to the “subscription-only” content that makes up a large share of the holdings. The only protest I have seen against this democratization of information has come from Jean-Noël Jeanneney, director of France’s National Library. In a February op-ed piece in *Le Monde* that will long stand as a classic of unintentional Gallic self-parody, he complained that the Google project, by drawing principally on American libraries, would reinforce America’s “crushing domination” of online information—no matter that the project will vastly expand the number of French books available as well, and that nothing is stopping France from engaging in a similar project of its own.

BUT THE INTERNET REVOLUTION is soon likely to become much more controversial, and for a simple reason: scholarship is fast moving toward a bookless future. Physical books are expensive to produce, and they are easily damaged or stolen. Shelf space costs money to build. Shelving and re-shelving books costs more. Stacks have to be kept at the appropriate temperature and humidity; they need to be lit, cleaned, inspected, and insured. Why, it is already being asked, should universities pay large sums to preserve and circulate physical books if copies exist online? Just as physical card catalogues have been stored away or even destroyed, replaced by electronic ones, so physical books are likely to follow. Libraries, in turn, are likely to turn increasingly into virtual information-retrieval centers, possibly located thousands of miles from the readers they serve. They already largely serve this function in the physical sciences, where the revolution in question took place much earlier, and without much protest.

Writers such as Nicholson Baker, who eloquently objected to the disappearance of the physical card catalogues, are likely to greet this much larger change with despairing howls of anger. They will defend

the physical book as an irreplaceable treasure, dwelling in covetous detail on every aspect of it: the paper, the typefaces, the binding. They will talk about its tactile pleasures, about the inimitable scent of dusty vellum and leather, and compare these things to the unnatural, unpleasant, uncomfortable experience of reading on a screen. They will cite the famous line of Borges: “I have always imagined that Paradise will be a kind of library.” They will call the transformation another victory of soulless barbarism over true culture.

But this stance, for all its obvious aesthetic attractions, is far too sentimental, and too easy. Not only is the advent of bookless or largely bookless libraries too large and powerful a change to be held back, it also offers too many real advantages for it to be considered a tragedy. Its democratizing potential, to begin with, counts for a great deal. Making vast libraries of learning available at no cost to anyone with an Internet connection is surely more important than preserving the rarefied pleasures of physical research libraries for those lucky or privileged enough to have easy access to them. The Internet also promises to make new forms of scholarship possible: new forms of research predicated on the rapid and efficient searching of vast databases, new hypertextual methods of presenting the results, and new means of ensuring their accuracy. Moreover, there are also ways—technological ways—of minimizing the aesthetic price to be paid.

What really matters, particularly at this early stage, is not to damn or to praise the eclipse of the paper book or the digital complication of its future, but to ensure that it happens in the right way, and to minimize the risks. For the risks are certainly real, and they go well beyond the disappearance of a particular physical object. The Internet revolution is changing not only what scholars read, but also how they read—and if my own experience is any guide, it can easily make them into worse readers. Technological innovation can help to address this problem, and it is already beginning to do so. But it is not yet receiving the support it needs, from either the publishing or the electronics industry.

II.

HOW IS THE INTERNET CHANGING the experience of reading? Consider the e-book that I found so hard to get through.

Its title is *The Genesis of Napoleonic Propaganda, 1796–1799*, and in most ways it is a typical well-researched academic monograph. Fifteen years ago, its author, Wayne Hanley, would have easily found a university press willing to publish it as a sturdy hardcover volume with a print run of five hundred or a thousand copies.

But today specialized books of this sort are a distinctly endangered species. Their main purchasers—university libraries—have far less money to spend on these items than they once did. Computerized catalogues, subscription content, hugely expensive scientific journals, exploding storage costs: all these demands are putting tremendous pressure on budgets that are often already flat or declining. In response, libraries have cut back purchases or have started to form consortia with their neighbors, so that now only one research library in a given region may buy a particular book. As a result, specialized academic titles often sell as few as two hundred copies, and university presses lose an average of more than \$10,000 on each. The presses have cut back in turn, particularly in the more arcane precincts of scholarship. They are also passing the cost pressures on to those authors they do accept; it is becoming routine in some fields for university presses to demand subsidies of \$5,000 or more to publish a book, and to insist on strict limits on length. In some fields, the printed academic monograph seems dangerously close to extinction.

As scholars started to grapple with these problems several years ago, they concentrated, not surprisingly, on the immediate professional consequences: what happens to “publish or perish” if publishing becomes impossible? The obvious solution was to move specialized scholarship onto the Internet, but this presented its own set of professional problems. Today, anyone with a website is a “publisher.” I have published several particularly specialized pieces of scholarship on my own website, for the sake of convenience. But this sort of “publishing” eliminates the peer reviewing that gives printed monographs the stamp of approval from the academic establishment, not to mention professional editing. Few scholars without tenure have the luxury to do it.

Just when these problems started to seem acute, Robert Darnton, a professor of history at Princeton, appeared on the scene with a suggestion. Darnton is a founding father of the field known as “the history of the book.” (He was also

my dissertation adviser.) Serving as president of the American Historical Association in 1999, he saw the chance not simply to write history, but to make it. He proposed creating a new book award, called the Gutenberg-e Prize, in fields of history where the publishing crisis had grown particularly acute. The winners, instead of the usual certificate and check, would instead get their manuscripts “published” online. Columbia University Press came on board as a sponsor, and to provide editing support. The result has been a “book series” well-produced and prestigious enough to convince the most demanding tenure committee.

AND DARNTON HAD EVEN GREATER ambitions. As he pointed out in a series of articles, electronic monographs can be much more than simple “books on a screen.” He envisioned scholarship as hypertext, with “books” that would operate on several layers: a top layer of argument, from which readers could click down to a lower level of more detailed substantiation, and, below that, to further levels of raw evidence. Darnton himself provided an example in an impressive experimental article titled “An Early Information Society: News and the Media in Eighteenth-Century Paris,” about the circulation of “seditious” information under the Old Regime. Published online (at www.indiana.edu/~ahr/darnton), it contains a thirty-five-page text, illustrations, maps, a score of transcribed police reports, and twelve music files of seditious songs. An early modern society in the midst of one communications revolution (most notably, the rise of the newspaper) had come under study by a scholar using the experimental methods of another.

Internet publication can also improve scholarship in another way: by allowing for easy correction of mistakes. Last year, with much fanfare, an impressive new version of the British *Dictionary of National Biography* appeared, only to have various critics assail it for all manner of minor and not-so-minor errors. Making corrections easily available to users of the print version is a Sisyphean task, but correcting the online version is ridiculously easy. And where serious disagreements arise, the publishers can, if they choose, publish the debates themselves online. The result would be to make the work less of an imposing, “definitive” monument, and more of an ongoing scholarly conversation—and that

is an attractive proposition.

The “Gutenberg-e” series invented by Darnton now has eleven titles, ranging from Hanley’s study of Napoleonic propaganda to Daniel Kowalsky’s *Stalin and the Spanish Civil War* to Michael Katten’s *Colonial Lists/Colonial Power: Identity Formation in Nineteenth-Century Telugu-Speaking India*. All are intelligent and lucid monographs, of interest principally to specialists. All take advantage of technology, even if they do not always live up to the promise of Darnton’s hypertext model. Kowalsky’s book includes short clips of Soviet newsreels alongside photographic illustrations, but in such low screen resolution as to make them virtually unwatchable. Gregory Brown’s impressive monograph *A Field of Honor*, about French literary culture in the eighteenth century, has links to the collected works of several French authors, lengthy reproductions of archival documents, and hypertext links that allow one to move back and forth through the text in pursuit of particular themes.

For scholarly readers, these “books” are the shape of the future. Anyone who wants to check a citation in Edmund



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Burke can still find his works in print in any good library; but anyone interested in the Spanish Civil War who wants to learn Kowalsky's revisionist opinion of Soviet involvement, and anyone interested in the birth of modern literary culture who wants to consult Brown on the subject, has no choice but to read them online. And it is inevitable that great numbers of older, out-of-copyright titles will soon join these new ones in a cyberspace-only existence. One can almost hear the calculators clicking in the library offices: why keep multiple copies of *Hard Times*, *The Social Contract*, *Paradise Lost*, or *War and Peace* on expensive shelf space when anyone can download a perfectly good copy in his or her bedroom? Libraries that balked, decades ago, at putting much of their collections on microfilm, given the cumbersome machinery needed to read it, are showing no such hesitation when it comes to putting books on line.

But again: what will this rush to cyberspace mean for the simple act of reading? This is where the problems with the Internet revolution are most obvious, and most harmful, as I discovered with Hanley's book, and even more with Brown's *A Field of Honor*. Printed in standard form, even without the bibliography, this book would run 350 to 400 pages. It is clearly written, but it deals with difficult concepts, and it invokes dense and demanding theorists such as Bourdieu and Habermas. Even skipping certain sections, it took me many hours to get through, and by the end, the experience of reading on the screen had become, through no fault of the author's, distinctly painful.

III.

WHY IS READING ON THE screen so genuinely unpleasant? Start with a basic point: reading itself is a fundamentally unnatural act. Anyone who has ever taught a child to read will remember the difficulty involved in distinguishing, for instance, between lowercase b, d, and p. After all, if you move them around or flip them over, they are the same. We have to be taught to see them only as they appear, flat and unnatural, upon the printed page. And we have to be taught also to take in not just a few of these odd marks, but the thousands that go into telling even the simplest children's story, to say nothing of the rough-

ly one million that make up *A Field of Honor*. It takes years of practice before most of us do it easily, and even then, when it comes to difficult texts, it is the rare reader who perseveres, hour after hour, without a break.

Faced with these problems, Western culture long ago invented the optimal device for reading. Devised in the fourth century to replace cumbersome scrolls and parchments, it was called the book: a series of pages bound together between sturdy covers, light, portable, and easy to hold in the hand. Although some books, considered deserving of particular reverence, came to be produced in large "folio" formats that could be consulted comfortably only on a desk or bookstand, most could be read virtually anywhere, in any position.

Remarkably, the great "printing revolution" that began with Johannes Gutenberg changed these practices very little. Gutenberg and his colleagues purposefully designed their new printed books as virtually exact physical copies of the manuscript books of the late Middle Ages. Put a printed book of the late fifteenth century side by side with a manuscript book of the same period, and it is surprisingly difficult to tell the gothic typeface of the one from the scribal handwriting of the other. The "revolution" was a revolution in the means of production far more than in the nature of the product itself.

IN THIS SENSE, OUR OWN COMMUNICATIONS revolution has been strikingly different from the earlier one. It has emphatically not been "Gutenberg II." To state the obvious: computer screens were not originally intended to replace books, and it is something of a technological accident that they are now coming to do so. Until the advent of the personal computer twenty-five years ago, computer screens were mostly used by professional computer programmers. They were modeled on earlier devices such as teletype terminals, with their typewriter keys and endless scrolls of yellow paper, which in turn had partially replaced punch cards and paper and magnetic tape. While screens were used to read programs, and data, and the early e-mail messages carried by Arpanet, very few people used them to read prose texts of any length.

This situation began to change with the rise of the PC in the 1980s, and the Internet a decade later; but still comput-

er screens did not evolve very far toward the physical form of the book. Screen resolution improved, and today even a basic laptop screen will hold several hundred words in a reasonable facsimile of a printed page. Yet most screens remain wider than they are long, unlike printed book pages. Most computers make it easier to scroll down, line by line, than to page through a text. And screens are by no means as portable or as comfortable to hold as books. Personal digital assistants (PDAs), while more comfortable, display very little text at a time.

There are good reasons why an evolution toward the form of the book has not taken place. The wide screen that looks so unnatural for book reading is perfect for spreadsheets and for video. Scrolling down, line by line, remains the logical way to view things like computer code. And computers are designed above all for the comfortable input of information, which is to say that the screen is locked to a keyboard (or, in the case of a PDA or a Tablet PC, the screen itself becomes a slate designed for writing on with a stylus). In short, reading has remained distinctly subordinate to the computer's other uses. Nothing could be more different from the printing revolution, which had the reproduction of an existing form—the book—as its principal purpose.

Unfortunately, this subordination has grim consequences for reading. Start with the fact that what is already an unnatural task becomes more physically uncomfortable. One must stare at a screen in an upright chair, or hold a heavy, awkward, and rigid piece of equipment on one's lap for hours. People will accept these constraints where no alternative is available—when working on a spreadsheet or playing computer games—but this is not the case with books. The relatively low resolution of even today's screens, compared with that of the printed page, tends to induce eyestrain. So does the fact that the eye remains at a constant distance from the screen. The tendency to scroll down rather than flip pages only makes things worse. It may seem a small detail, but a page becomes all the harder to concentrate on when the physical position of the words is constantly changing.

THE VERY NATURE OF THE computer presents a different problem. If physical discomfort discourages the reading of texts sequentially, from start to finish, computers make it spectacularly easy to

move through texts in other ways—in particular, by searching for particular pieces of information. Reading in this strategic, targeted manner can feel empowering. Instead of surrendering to the organizing logic of the book you are reading, you can approach it with your own questions and glean precisely what you want from it. You are the master, not some dead author. And this is precisely where the greatest dangers lie, because when reading, you should not be the master. Information is not knowledge; searching is not reading; and surrendering to the organizing logic of a book is, after all, the way one learns.

If my own experience is any guide, “search-driven” reading can make for depressingly sloppy scholarship. Recently, I decided to examine the way in which the radical eighteenth-century thinker d’Holbach discussed warfare. I could have read his book *Universal Morality* in the rare-book room of my university library, but I decided instead to download a copy (it took about two minutes). And then, faced with a text hundreds of pages long, instead of reading from start to finish, I searched for the words “war” and “peace.” I found a great many juicy quotations, which I conveniently cut and pasted directly into my notes. But at the end, I had very little idea of why d’Holbach had written his book in the first place. If I had had to read the physical book, I could still have skimmed, cut, and pasted, but I would have been forced to confront the text as a whole at some basic level. The computer encouraged me to read in exactly the wrong way, leaving me with little but a series of disembodied passages.

Of course, there was an obvious alternative to reading on the screen: printing the thing out. With d’Holbach, I did print the first hundred or so pages, only to have my computer chirpily announce that it was time for another expensive ink cartridge. Printing out is an expensive proposition, as well as a troublesome and time-consuming one. In any case, printing a book out goes against the point of using the Internet in the first place. Printing takes away the hypertext, multimedia functions built into works such as Darnton’s. And reading on the screen, frustrating as it is, has certain advantages. On my own computer I keep several foreign-language dictionaries and a good thesaurus; the Oxford

Nighttime Begins with a Line by Pablo Neruda

So my body went on growing, by night,
went on pleading & singing to the earth
I was born to be woven back into: Love,
let me see if I can’t sink my roots
deeper into you, your minerals & water,
your leaf-rot & gold, your telling & un-
telling of the oldest tales inscribed
on wind-carved rocks, silt & grass,
your song & prayers, your oaths & myths,
your nights & days in one unending lament,
your luminous swarm of wet kisses
& stings, your spleen & mind,
your outrageous forgetting & remembrance,
your ghosts & rebirths, your thunder stones
& mushrooms, & your kind loss of memory.

YUSEF KOMUNYAKAA

English Dictionary and the Encyclopaedia Britannica are just a few clicks away. I can have several books open at the same time to compare texts. I have immediate access not just to Internet resources but, on my hard drive, to just about every note I have taken and every piece of writing I have done in the last twenty years. Finally, there is a certain intellectual justification for instant gratification: ideas occur with particular readiness when you can pursue a train of thought quickly from one book to another. Readers of physical books have long known this form of research—it is called browsing in the stacks.

IV.

IS THERE A WAY TO HAVE THESE advantages without doing lasting harm to the experience of reading itself? Perhaps, at least in part. What is needed is a technological solution, in the spirit of the original Gutenberg revolution, the revolution of the fifteenth century. That is to say, what is needed is a computer that looks and feels exactly like a book. And it is coming. Recent advances in “electronic ink” and new reading devices so far sold only in Japan come tantalizingly close to this ideal, but there are still major obstacles on the road—not all of them technological.

To date, the various attempts to produce specialized electronic reading devices have mostly been failures. In 1999,

at the height of the tech boom, gadgets called the SoftBook and the Rocket eBook created a brief stir when they came on the market. Designed explicitly for reading, they were light, easy to hold, and had vertical, page-like screens, although with poor resolution by today’s standards. But both devices flopped. So did a cheaper, smaller, PDA-like version called the eBookman, sold by Franklin.

The electronics industry has had marginally greater success getting people to use their PDAs, laptops, cell phones, and Tablet PCs for reading. A number of programs such as Palm Reader, Microsoft Reader, and Acrobat eBook make these computers as “book-like” as possible, including special screen fonts that in theory reduce eyestrain. But e-books have not yet come close to challenging the hegemony of printed books. Their sales, while

growing, amount to a tiny percentage of industry totals (just under \$10 million in the first three quarters of 2004). Barnes and Noble, which made a significant effort to sell e-books on its website, quietly discontinued the practice last year.

Perhaps the surest sign of the insignificance of e-books is that for years electronic versions of best-sellers have been available on file-sharing services such as Kazaa without causing much scandal or even notice. *The New York Times* estimated recently that as many as 25,000 titles can be downloaded, including all the Harry Potter novels and *The Da Vinci Code*—but sales of the print versions have not been hurt enough to make the publishing industry worry. Most book editors I know are not even aware of the files’ existence.

THE PHYSICAL E-BOOK READERS have failed for three reasons. First, and most important, the various devices are simply not book-like enough. While the specialized reading machines, PDAs, and cell phones are lighter and more comfortable to hold than computers, their screens are terribly small and coarse. A Pocket PC screen using Microsoft Reader can display barely a hundred words at a time, which makes even a relatively short book more than a thousand screens long. The Tablet PC does better on this score, but it is heavy, rigid, and awkward, and thus has been marketed almost

exclusively as a note-taking device. Nor does any of these gadgets really solve the eyestrain problem—even with Reader, which Microsoft released to considerable fanfare a few years ago and has since allowed to wither. Secondly, the specialized reading devices, while slightly more comfortable, were too expensive. Who was going to spend \$800 on RCA's color version of the Rocket eBook when a few hundred dollars more would purchase a full-featured laptop with a better screen?

Most importantly, the companies, clearly fearing that the devices themselves would not generate sufficient income, focused instead on selling "proprietary content"—that is, encoded versions of books under copyright. Several of them, such as the SoftBook, initially did not even provide a way for readers to load their own readings onto the devices. As might have been predicted, the companies thereby drove themselves into a classic vicious circle: publishers refused to make more than a handful of titles available without evidence of readers' interest, and readers, faced with a tiny selection of titles, shunned the devices entirely.

This story points to one of the most powerful factors inhibiting the development of book-like computers and reading devices: the publishing industry itself. For the moment the sharing of pirated book files over the Internet has attracted little attention. But imagine the development of a computer that really was as easy and as comfortable to read as a book. Would book-sharing become as great a threat to publishing as music-sharing has been to the record labels? True, there is no real textual equivalent to the "ripping" of a music CD. Most readers have little incentive to turn libraries of books they have already read into shareable files, and doing so is far more difficult than ripping a CD. It involves either breaking open a coded file or tediously scanning a book, page by page.

Still, only one person has to take the trouble, and within hours millions of copies can be circulating on the Internet.

Remember that text files are very, very small compared with music or video. A best-seller can be downloaded over a high-speed connection in a matter of seconds. This scenario must cause publishers some sleepless nights.

And the moment may be coming closer. In Japan, Sony and Panasonic recently released new-generation reading devices that put clunky predecessors like the SoftBook to shame. Sony's entry, called the LIBRIé, is particularly impressive, for it employs a technology called "electronic ink," in which the screen is composed of tiny "microcapsules" that can turn black or white through the manipulation of an electronic field. While previous screen technologies required an internal source of illumination, electronic ink does not, making it easily readable even in full sunlight and cutting back significantly on bulk and power consumption. It also has greater resolution than previously achieved. The LIBRIé weighs only a little more than a pound, can run for weeks on ordinary AAA batteries, and displays half a million pixels on its six-inch screen—six times more than most PDAs. To put things simply, it weighs the same as a book and looks very much like paper (although it takes a frustratingly long time to "turn" pages). For the moment, it is available only in black and white, but full-color versions are said to be only a few years down the road. And even the first-generation model costs less than \$400.

But will the LIBRIé succeed? At first, Sony and Panasonic both repeated the disastrous strategy of allowing only proprietary content, downloaded from special websites for a fee, onto the devices, and Japanese publishers refused to make more than a relative handful of titles available. Will people pay hundreds of dollars for a reading device when they cannot use it to read work documents or free books downloaded from websites of their own choice? Will publishers make enough books available to persuade readers to purchase such a limited device? I have my doubts. More recently, both companies have made it possible to use the devices to read other documents, but only after a complicated conversion process that will repel most users. Sony has yet to announce a release date for the LIBRIé in the United States. I suspect that such devices will only truly succeed when they have the full capacities of computers—so that readers can download Web pages and electronic books

onto them as easily as I now download my research materials onto my laptop.

V.

WHEN THIS HAPPENS, IT IS entirely possible that a second Gutenberg revolution will finally take place, bringing about the long-discussed paperless office, together with the bookless library. If I had an inexpensive, full-function computer that was roughly the size and the weight of a hardcover novel, with a high-resolution, paper-like color screen, a detachable keyboard, and wireless Internet access, I would be quite happy to stop squeezing new bookshelves into my basement and office.

But this scenario is not inevitable. The publishing industry can do a great deal to frustrate it by refusing to make copyrighted material easily available in electronic form for fear of piracy. Traditional book-lovers can also do a certain amount to frustrate it, by stigmatizing electronic publishing as the sign of a second dark ages. And if demand for advanced reading devices remains low as a result, then the electronics industry will not invest significant resources in electronic ink, and the LIBRIé will go the way of the SoftBook.

The traditionalists may applaud this outcome, but they would be wrong to do so. Frustrating the development of real "book-like" reading devices will undoubtedly slow the transformation of libraries into virtual information centers. It will slow the pace at which books are scanned and then relegated to sub-basement storage facilities. It will stave off the death of the academic monograph. But it will not stop any of these things, not least because the financial pressures bringing them about are too strong. It will just make the electronic books we have—and we will have more and more of them—unnecessarily awkward and difficult to read. It will encourage searching rather than true reading, and turn eyestrain into a new form of occupational hazard for scholars everywhere.

It would be far better for publishers to learn from the semi-disastrous experience of the music industry. Threatened by Napster and its clones, the record labels initially tried to shut down the new technology by heavy-handed legal tactics, but eventually made songs available online themselves for a reasonable price

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and with reasonable restrictions. And when they did, consumers flocked to services such as Apple's iTunes. The publishing industry would do well actively to plan for the day when it will sell a majority of its products not on paper but over the Internet, to consumers who will read them on new, attractive, paper-like screens.

BUT WHAT WILL HAPPEN TO THE experience of reading, particularly in scholarship? Will traditional reading—the slow, serious reading of entire texts—sink from sight in an ocean of hypertext searching? We can at least hope not. Reading itself will surely change, for the simple reason that new electronic devices, even if they look and feel exactly like books, will still be different from them—far more different than Gutenberg's books were from their printed predecessors. For one thing, they will most likely be full-function computers, with word-processing and Internet capability. But we can hope that as the physical discomforts and frustrations of reading on a screen diminish, more traditional sorts of reading will find their way into cyberspace—that readers, holding a truly “readable” computer in their hands, will not abandon themselves to searching and clicking, but will instead find it comfortable to sit, and read slowly, and stop to ponder what they have read.

And even the newer forms of reading are not to be entirely deplored. For a start, they will encourage new works of scholarship to take full advantage of the possibilities of hypertext and multimedia in a way that the pioneering Gutenberg-e books, for the most part, have not. Even more important, they will raise the simultaneously glorious and terrifying possibility of having an entire world library at one's fingertips. In any case, we need not assume that one form of reading will entirely replace others. Different forms have always co-existed with one another. Before Gutenberg, when books were rare and expensive, the dominant form was probably the slow, intensive, repetitive study of sacred and quasi-sacred texts. It may have remained so even during the first centuries of printing, but gradually it was challenged by more “extensive” sorts of reading, involving the relatively quick, onetime perusal of books for entertainment and the speedy acquisition of information. But the first sort never disappeared, and of course it still exists in many settings. Now, with

the Internet, have come yet newer styles. But they, too, can co-exist with older varieties, especially within the academy.

Perhaps this is too sanguine a view. But scholars are, after all, professional readers. The books that they read are likely, as time goes on, to have a physical existence only as evanescent electrical patterns on delicate pieces of machinery, and this technology will affect the way they read. As long as the things they read are as physically easy to read as paper books, scholars need not be over-

whelmed by their new world of choices, any more than the scholars of the Renaissance were overwhelmed when faced with the sudden explosion of books brought by the printing press itself (although they certainly had to invent new strategies to deal with it). Those scholars adapted and flourished; and so can we. The bookless future need not be a barbarian age. The character of our culture will finally be determined in the old way, not by the form of words and ideas, but by their content. ■

Daniel J. Kevles The Gene Wars

THE MAN WHO INVENTED
THE CHROMOSOME:
A LIFE OF CYRIL DARLINGTON
By Oren Solomon Harman
(Harvard University Press,
329 pp., \$49.95)

IN THE HALF-CENTURY AFTER THE identification of the structure of DNA in 1953, a generation of biologists forged the revolution of molecular genetics. They deciphered the genetic code, invented biotechnology, and found themselves entangled in the high-stakes and sometimes tempestuous politics of genetics and society. A few won Nobel Prizes, a number gained fame and wealth, and all achieved iconic status for their involvement with DNA, the revolution's emblematic molecule. But if they achieved much, it was because, like Newton, they stood on the shoulders of giants, the leading biologists who in the decades after the rediscovery of Mendel's laws in 1900 established the field of classical (as distinct from molecular) genetics. These researchers worked out the mechanisms of Mendelian heredity, reconciled them with Darwin's theory of evolution, and applied them successfully to agriculture and not so successfully to human beings. And they, too, became embroiled in politics, campaigning

for eugenics, where biology confronted human rights, and battling over Lysenkoism, where the stakes were the freedom of science in the new Soviet state.

This first generation was multinational, but its British leaders, along with their counterparts in the United States, contributed with signature force to its scientific achievements and its political controversies. Cyril Darlington, born in 1903, grew up with Mendelism. He was a peer in what Oren Solomon Harman rightly calls the “great founding school” of British genetics, which also included William Bateson, J.B.S. Haldane, Julian Huxley, and Ronald Fisher. Darlington's obituaries referred to him as the “Copernicus” or the “Newton” of his branch of the field, which mainly comprised genetics at the cellular level, particularly the behavior of chromosomes and their relationship to evolution. Politically engaged like his peers, he was among the first biologists to denounce Lysenko and to indict the Soviet Union for persecuting Lysenko's enemies. Yet for all his prominence, Darlington has been forgotten. It is not simply that he has been obscured by the dazzle of DNA. It is also that later in life he embraced a degree of hereditary determinism and a contempt for the welfare state that made him appear to be, as Harman puts it, “a dinosaur, a crank.”

Harman's brilliant book—the first and, almost surely, the definitive biography—wrests the earlier Darlington from the later crank, recovering him as a human being and restoring him to scientific eminence. Drawing on Darlington's

Daniel J. Kevles teaches history at Yale. His books include IN THE NAME OF EUGENICS: GENETICS AND THE USES OF HUMAN HEREDITY (Harvard University Press).

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