

## Suppose There Were No Printers

That's just what Frank Davidoff, then editor of *Annals of Internal Medicine*, did in an editorial introducing a redesign of the print version of his journal. Because this editorial seems likely to interest many readers of *Science Editor*, it is reprinted here almost in toto.

**From: Davidoff F. Suppose there were no printers. Reprinted with permission from *Ann Intern Med* 2000;133:57-8.**

The biologist Edward Wilson has said that "a discovery does not exist until it is safely reviewed and in print."<sup>1</sup> That's a strong statement, but it says much about why print publication is important. . . .

. . . These days many [might think], ". . . Print is dead. Put it on the Web." We agree that electronic journals are useful.<sup>2</sup> . . . But we are also convinced, as Mark Twain might have put it, that reports of print's death are an exaggeration. An excellent way to appreciate the importance of print is to imagine a world without printers. The first thing we would discover in such a world is that information loses a good part of its reality. Printed information exists in three dimensions: You can touch it, feel it, turn it over. It has a sheen, a pattern, even a smell. Like calligraphy, print "addresses the eye and is an art of space."<sup>3</sup> Information on a computer screen exists in only two dimensions, not three. Can you really believe something that doesn't even take up room, that doesn't have a back to it?

The second thing we would discover in such a world is that information vanishes. Information in electronic form is like information inside a person's head: Neither is useful unless it comes out into the world. But the way it comes out matters enormously. Like the spoken word from a person's mouth, information coming out of a computer onto a screen is ephemeral; it vanishes when the power is turned off. Like the words written by a person's hand, information coming out of a computer through a printer is captured; it is stabilized, frozen. As the old Latin saying puts it, *verba volant, scripta manent*: Spoken words fly away, written words endure.

The enduring quality of written or printed words is, of course, both a curse and a blessing. Their frozen state can give them excessive, almost magical power, makes them hard to modify, and causes big storage problems. (It is also fashionable these days to point out the ecologic incorrectness of print; "killing trees" is the usual expression. There's obviously no justification for sacrificing trees unnecessarily, but trees, unlike many other important commodities, are a renewable resource, and paper can be and is being recycled.) But the frozen state of printed words is also precisely what makes them accessible for so long. The hieroglyphic writing on Egyptian papyrus is as clear and crisp today as it was the day it was written 5000 years ago.<sup>4</sup> Magnetic media, in contrast, begin to lose their integrity in 5 to 10 years, "one-tenth the readable life span of acid-laced newsprint"<sup>5</sup>; optically etched media, such as CD-ROMs, last only 5 to 15 years, even with moderate use. What's more, "[D]igital files do not degrade gracefully like analog audio tapes. When they fail, they fail utterly. You can't open them."<sup>5</sup>

Instability of storage media is only the beginning of the problem. Much more serious is the overwhelming likelihood that the encoding of any document, however natural it seems to us now, will not remain readable by future software for very long. Information technology continually creates new schemes, which, as Rothenberg points out, often abandon their predecessors instead of subsuming them.<sup>6</sup> Brand puts the problem this way: "Fixing digital discontinuity sounds like exactly the kind of problem that fast-moving computer technology should be able to solve; but it can't, because fast-moving computer technology is the problem."<sup>5</sup> The difficulty is compounded because we are storing new data in electronic form so rapidly that we will never be able to manage the older data properly. In effect, "loss of cultural memory becomes the price of staying perfectly current."<sup>5</sup> The National Aeronautics and Space Administration's enormous digitized files of satellite images of Earth, which were recorded in the 1960s

and 1970s, now exist only on magnetic tapes that are obsolete and unreadable; the entire content of at least one electronic journal that was “published” only a few years ago has already vanished because no one maintained access to the files.

The pronouncement that “digital information is forever” thus turns out to be a fantasy, and a dangerous one at that.<sup>6</sup> The published body of all scientific work makes up a kind of collective mind that continually refines and extends itself, but only on condition that its memory—the published record—continues to exist and is easily and fully accessible. To the extent that storage of scientific content in electronic form creates a record that is unstable, hidden, or not retrievable, science suffers from a kind of collective dementia.<sup>7</sup>

To be sure, many persons are now hard at work trying to overcome the enormous obstacles to long-term digital archiving by migrating files to new media, translating them to new formats, and creating systems that emulate obsolete programs. It is still not at all clear, however, that their efforts will succeed. What is clear is that we abandon print at our peril. The person who coined the term “peripherals” to describe devices, such as printers, that attach to the new, dazzling, high-tech electronic “brains”

known as computers could not have been farther from the mark if they had tried. In point of fact, it is hard to think of any element less peripheral and more central to the new information technology than the plain old boring “low-tech” printer. Even—perhaps especially—in the new information age, a scientific discovery does not exist until it is safely in print.

## References

1. Wilson EO. *Consilience: the unity of knowledge*. New York: Knopf; 1998:59.
2. Davidoff F. [www.annals.org](http://www.annals.org) [editorial]. *Ann Intern Med* 2000;132:92.
3. Wilson EO. *Consilience: the unity of knowledge*. New York: Knopf; 1998:118.
4. Parkinson RB, Quirke S. *Papyrus*. London: British Museum Pr; 1995.
5. Brand S. Ending the digital dark age. In: *The clock of the long now: time and responsibility*. New York: Basic Books; 2000:82-92.
6. Rothenberg J. Ensuring the longevity of digital documents. *Sci Am* January 1995:42-7.
7. Davidoff F. The other two cultures: how research and publishing can move forward together. In: Jones AH, McLellan F, eds. *Ethical issues in biomedical publication*. Baltimore: Johns Hopkins Univ Pr; 2000:323-44.