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E-Readers and E-Paper

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PERSPECTIVES

E-Readers and E-Paper

The music industry has undergone considerable changes from records to cassettes to compact discs to MP3s and is now again being threatened by music streaming through the Internet. Web sites that allow free streams to be incorporated into personalized playlists are currently the most significant threat to an industry already burdened by financial difficulties. These problems are not unique to music but are also affecting the movie industry and the written word.

Last century, one of the major threats to popular literature was the introduction of the pocket book. Pocket books were first manufactured in Germany (1931) and then in Great Britain (1935) by Penguin Books. In the United States, the first pocket books appeared in 1939. Cheaper paper, small size, and gluing instead of stitching allowed these books to be sold at a comparatively low price (initially around 25 cents!). Because the words "Pocket Books" referred to the brand of product sold by Simon and Schuster, the term "paperback books" was then popularized, partly by the Beatles number 1 song "Paperback Writer." We seem to have survived paperback books, both mass-produced and trade versions, only to be threatened again by e-books.

E-books are the electronic version of printed literature. E-books are available in several formats, a fact that serves to fragment their worldwide market. E-books may be "protected" or be found on public domain Websites. Proponents of e-books list their advantages over print as follows: easily searched and cross-referenced, easier to move and transport, little storage space required, possible adjustment of font size, embedded animations, cheaper price, and, perhaps, more environmentally friendly (all of these features are found in the electronic version of *American Journal of Neuroradiology* [AJNR]). Many e-books take advantage of text-to-speech programs that allow individuals with a disability or those only wanting to listen the possibility of using them. E-books are relatively cheap because about 20% of the price of a regular book represents expenditures in printing, binding, and transportation. Currently e-books are not widely used and account for only about 3% of all literature sales. Most are produced at the same time as their print versions, but some are available only electronically, with their paper versions offered as a print-on-demand service (similar to AJNR's *Special Collections*).

Today, most major publishers offer many of their products, particularly bestselling ones, on e-books. Huge efforts such as Project Gutenberg¹ and Online Books Page from the University of Pennsylvania² offer free and paid e-books. The Library of Congress hosts the World Digital Library,³ but as of this writing, only a rather disappointing 1170 items were found in it (the site contains more items other than books, such as maps). The Europeana project⁴ is a similar start-up collection. This last project generated much interest when the server failed on its opening day as reported on November 21, 2008 by the *New York Times*.

Most of the disadvantages of e-books are related to the fact that a piece of hardware (computer or a mobile device such as e-reader or iPhone [Apple, Bothell, Washington]) is needed to

access them. Current disadvantages of e-readers include the need for electrical power, relatively low-resolution screens, lack of color in some, a limited number of books and magazines available, fragility if dropped, inability to be read in strong or weak lighting situations, and, of course, these run a greater risk of being stolen than do books. Because e-readers require many materials to be built, their environmental impact is thought to be higher than that of paper books. In addition, constant changes to formats and resolution make them less durable than paper books. There are many e-readers, but today the market is dominated by: the Sony Reader Digital Book and Amazon's Kindle (which comes in 2 different sizes) (both at www.amazon.com). The larger Kindle DX is presumably geared toward the textbook market. The basis of these e-readers is e-paper.

As e-readers are designed to simulate books, e-paper is designed to simulate printed ink on conventional paper. The difference between your computer or iPhone screen and e-paper is that the latter is not backlit. One can easily read a regular book because light reflected by its pages results in high contrast between the white background and the dark ink used for letters. E-paper utilizes the same principles and, unlike computer screens, is not backlit. While the high background-to-letter contrast found in conventional paper allows one to read a book under a wide range of lighting conditions, the gray background and nearly black letters of e-paper can only be distinguished in better light conditions (the E-Ink Corporation⁵ is developing whiter background e-paper currently). A benefit of reflective screens (e-paper) is that they avoid "computer fatigue."

Electronic paper has been available since the 1970s. Electrophoretic displays use electricity to arrange "ink" particles in the display and form letters or pictures (the Sony Reader and Kindle use this type of display). There are other types of e-paper, but they all share the fact that once a page is "printed" on the screen, no more energy is drawn from the batteries, thus making them last very long. Once a page is refreshed, power is needed to rearrange the water/oil interfaces that form letters and pictures. This low-energy consumption is why e-paper is also used for some portable game devices (Game Boy; Nintendo, Kyoto, Japan), mobile telephones, and remote controls. Because power is not always on, they may be used in airplanes most of the time.

Major disadvantages of e-paper include its relatively low refresh rates (pages are slow to "turn" and magnify) and its current inability to display colors (generally only 16 shades of gray are available). One of the beauties of e-ink is that when it is applied to incredibly thin and flexible electrophoretic plates, it can be mounted in all kinds of materials, including T-shirts! Experts predict that e-paper will soon achieve superb resolution, ultrafast refresh cycles, and the ability to display colors (Samsung and Fujitsu already manufacture different versions of color e-paper, which are not widely available). Thereafter, e-paper may be used in picture frames and even televisions. It is also easy to imagine carrying the daily newspaper in a roll of e-paper that can be updated constantly via wireless Internet (the Kindle already partly does this). Although e-paper is expensive when compared with traditional paper, many experts feel that by 2015 its price will decrease considerably. Apple will soon be introducing its color e-reader (iTablet). Plastic Logic

is in the process of creating a large-size e-reader that supports a wide variety of formats.

It is conceivable that in the near future, the entire electronic contents of the *AJNR* will fit into a single e-reader. Currently, a *New England Journal of Medicine (NEJM)* subscription is available for the Kindle. Unfortunately, you must pay both the *NEJM* and Amazon fees. Springer is said to offer more than 30,000 electronic books (though I have never used one). Elsevier has 4800 e-books and plans to have 80% of its contents in this fashion by 2012.⁶ Blogs and RSS feeds may be displayed in some e-readers. It seems that all biomedical publishers are embarking on some activity related to making their contents available on e-readers. The general press has hailed the Kindle as the savior of newspapers. There is no question that the specialized biomedical press will follow a similar road

in the near future. Our on-line publisher, HighWire Press, is currently also exploring this option, and we will let our readers know when it becomes available.

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