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ROOM FOR DEBATE
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Does the Brain Like E-Books?

By THE EDITORS

Mario Tama/Getty Images Curling up with a Kindle.

Writing and reading — from newspapers to novels, academic reports to gossip magazines — are migrating ever faster to digital screens, like laptops, Kindles and cellphones. Traditional book publishers are putting out "vooks," which place videos in electronic text that can be read online or on an iPhone. Others are republishing old books in electronic form. And libraries, responding to demand, are offering more e-books for download.

Is there a difference in the way the brain takes in or absorbs information when it is presented electronically versus on paper? Does the reading experience change, from retention to comprehension, depending on the medium?

- Alan Liu, English professor
- Sandra Aamodt, author, "Welcome to Your Brain"
- Maryanne Wolf, professor of child development
- David Gelernter, computer scientist
- Gloria Mark, professor of informatics

A New Metaphor for Reading

Alan Liu *is chairman and professor of English at the University of California, Santa Barbara, where he researches the relation between literature and information culture. He is head of the Transliteracies U.C. Multi-Campus Research Group on online reading practices and technologies.*

Initially, any new information medium seems to degrade reading because it disturbs the balance between focal and peripheral attention. This was true as early as the invention of writing, which Plato complained hollowed out focal memory. Similarly, William Wordsworth's sister complained that he wasted his mind in the newspapers of the day. It takes time and adaptation before a balance can be restored, not just in the "mentality" of the reader, as historians of the book like to say, but in the social systems that complete the reading environment.

Right now, networked digital media do a poor job of balancing focal and peripheral attention. We swing between two kinds of bad reading. We suffer tunnel vision, as when reading a single page, paragraph, or even "keyword in context" without an organized sense of the whole. Or we suffer marginal distraction, as when feeds or blogrolls in the margin ("sidebar") of a blog let the whole blogosphere in.

Current forms of digital media behave nothing like 'books' or 'libraries,' and cause users to swing between two kinds of bad reading.

My research group on online reading (the University of California Transliteracies Project) has come to realize that we need a whole new guiding metaphor. So many of today's commercial, academic and open-source reading environments are governed by metaphors of what I call "containing structures."

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For example, they want to be online "books," "editions," "encyclopedias," "bookshelves," "libraries," "archives," "repositories" or (a newer metaphor) "portals." Such structures are supposed to make intuitive the relation between individual documents and other documents. But, frankly, many of those structures didn't work too well even in the golden age of print.

(Show me one person who has made a serendipitous discovery while wandering the library stacks, and I will show you a thousand whose eyes glazed over at the sheer anomie, inefficiency, and meaninglessness of it all.) They especially don't work well now when stretched to describe online technologies that actually behave nothing like a book, edition, library and so on.

My group thinks that Web 2.0 offers a different kind of metaphor: not a containing structure but a social experience. Reading environments should not be books or libraries. They should be like the historical coffeehouses, taverns and pubs where one shifts flexibly between focused and collective reading — much like opening a newspaper and debating it in a more socially networked version of the current New York Times Room for Debate.

The future of peripheral attention is social networking, and the trick is to harness such attention — some call it distraction — well.

A Test of Character

Sandra Aamodt *is a former editor in chief of Nature Neuroscience. She is co-author of "Welcome to Your Brain: Why You Lose Your Car Keys but Never Forget How to Drive and Other Puzzles of Everyday Life."*

Electronic reading has become progressively easier as computer screens have improved and readers have grown accustomed to using them. Still, people read more slowly on screen, by as much as 20-30 percent. Fifteen or 20 years ago, electronic reading also impaired comprehension compared to paper, but those differences have faded in recent studies.

Reading on screen requires slightly more effort and thus is more tiring, but the differences are small and probably matter only for difficult tasks. Paper retains substantial advantages, though, for types of reading that require flipping back and forth between pages, such as articles with end notes or figures.

Distractions abound online — costing time and interfering with the concentration needed to think about what you read.

To a great extent, the computer's usefulness for serious reading depends on the user's strength of character. Distractions abound on most people's computer screens. The reading speed reported in academic studies does not include delays induced by clicking away from the text to see the new email that just arrived or check out what's new on your favorite blog. In one study, workers switched tasks about every three minutes and took over 23 minutes on average to return to a task. Frequent task switching costs time and interferes with the concentration needed to think deeply about what you read.

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Electronic book readers like the Amazon Kindle share characteristics with both paper and computers. Anecdotal evidence suggests that people may read as quickly on electronic readers as they do on paper. The screen technology, electronic ink, avoids some disadvantages of monitors, such as backlighting and flicker, but it remains awkward to scan through multiple pages.

Electronic readers can be held in a comfortable position, but their contrast is closer to that of a newspaper than to black-on-white print, and illustrations tend to have poor resolution. As technology continues to improve, we can probably expect to see electronic reading become as useful as paper for most purposes.

Beyond Decoding Words

Maryanne Wolf *is the John DiBiaggio Professor in the Eliot-Pearson Department of Child Development at Tufts, and the author of "Proust and the Squid: The Story and Science of the Reading Brain."*

After many years of research on how the human brain learns to read, I came to an unsettlingly simple conclusion: We humans were never born to read. We learn to do so by an extraordinarily ingenuous ability to rearrange our "original parts" — like language and vision, both of which have genetic programs that unfold in fairly orderly fashion within any nurturant environment. Reading isn't like that.

Each young reader has to fashion an entirely new "reading circuit" afresh every time. There is no one neat circuit just waiting to unfold. This means that the circuit can become more or less developed depending on the particulars of the learner: e.g., instruction, culture, motivation, educational opportunity.

Franka Bruns/Associated Press

Equally interesting, this tabula rasa circuit is shaped by the particular requirements of the writing system: for example, Chinese reading circuits require more visual memory than alphabets. This "open architecture" of the reading circuit makes the young reader's developing circuit malleable to what the medium (e.g., digital online reading, book, etc) emphasizes.

And that, of course, is the problem at hand. No one really knows the ultimate effects of an immersion in a digital medium on the young developing brain. We do know a great deal, however, about the formation of what we know as the expert reading brain that most of us possess to this point in history.

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In brief, this brain learns to access and integrate within 300 milliseconds a vast array of visual, semantic, sound (or phonological), and conceptual processes, which allows us to decode and begin to comprehend a word. At that point, for most of us our circuit is automatic enough to allocate an additional precious 100 to 200 milliseconds to an even more sophisticated set of comprehension processes that allow us to connect the decoded words to inference, analogical reasoning, critical analysis, contextual knowledge, and finally, the apex of reading: our own thoughts that go beyond the text.

This is what Proust called the heart of reading — when we go beyond the author's wisdom and enter the beginning of our own.

I have no doubt that the new mediums will accomplish many of the goals we have for the reading brain, particularly the motivation to learn to decode, read and experience the knowledge that is available. As a cognitive neuroscientist, however, I believe we need rigorous research about whether the reading circuit of our youngest members will be short-circuited, figuratively and physiologically.

For my greatest concern is that the young brain will never have the time (in milliseconds or in hours or in years) to learn to go deeper into the text after the first decoding, but rather will be pulled by the medium to ever more distracting information, sidebars, and now,perhaps, videos (in the new vooks).

The child's imagination and children's nascent sense of probity and introspection are no match for a medium that creates a sense of urgency to get to the next piece of stimulating information. The attention span of children may be one of the main reasons why an immersion in on-screen reading is so engaging, and it may also be why digital reading may ultimately prove antithetical to the long-in-development, reflective nature of the expert reading brain as we know it.

We can learn a great deal from a similar transition that the ancient Greeks made from orality (Socrates) to literacy (Aristotle). Socrates worried that the young would be deluded by the appearance of truth in seemingly impermeable text to think that they knew something before they had ever begun.

The habitual reader Aristotle worried about the three lives of the "good society": the first life is the life of productivity and knowledge gathering; the second, the life of entertainment; and the third, the life of reflection and contemplation.

For me the formation of the "good reader" follows a similar course. I have no doubt that the digital immersion of our children will provide a rich life of entertainment and information and knowledge. My concern is that they will not learn, with their passive immersion, the joy and the effort of the third life, of thinking one's own thoughts and going beyond what is given. Let us bring our best thought and research to preserving what is most precious about the present reading brain as we add the new capacities of its next iteration.

The Book Made Better

David Gelernter*, a professor of computer science at Yale University, is the author of "Judaism: A Way of Being," which will be published in November. In a recent conversation at Edge.org he discusses his role in the invention of lifestreaming and "the cloud" in computing.*

All reading is not migrating to computer screens. So long as books are cheap, tough, easy to "read" from outside (What kind of book is this? How long is it? Is this the one I was reading last week? Let's flip to the pictures), easy to mark up, rated for safe operation from beaches to polar wastes and — above all — beautiful, they will remain the best of all word-delivery vehicles.

I assume that technology will soon start moving in the natural direction: integrating chips into books, not vice versa. I might like to make a book beep when I can't find it, search its text online, download updates and keep an eye on reviews and discussion. This would all be easily handled by electronics worked into the binding. Such upgraded books acquire some of the bad traits of computer text — but at least, if the circuitry breaks or the battery runs out, I've still got a book.

Technology will soon start moving in the natural direction: integrating chips into books, not vice versa.

Of course, onscreen text will change and improve. But the physical side of reading depends not on the bad aspects of computer screens but on the brilliance of the traditional book — sheets bound on end, the "codex" — which remains the most brilliant design of the last several thousand years. Technologists have (as usual) decreed its disappearance without bothering to understand it. They make the same mistake clever planners have made for half a century in forecasting the death of cars and their replacement by spiffier technology. The problem is, people like cars.

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The most important ongoing change to reading itself in today's online environment is the cheapening of the word. In teaching college students to write, I tell them (as teachers always have) to make every word count, to linger on each phrase until it is right, to listen to the sound of each sentence.

But these ideas seem increasingly bizarre in a world where (in any decent-sized gathering of students) you can practically see the text messages buzz around the room and bounce off the walls, each as memorable as a housefly; where the narrowing time between writing for and publishing on the Web is helping to kill the art of editing by crushing it to death. The Internet makes words as cheap and as significant as Cheese Doodles.

Of course there are great stylists writing in English today (take John Banville or Martin Amis). Of course, word processors could be the best thing that ever happened to prose, and "cloud" computing will soon offer readers the chance to consult any text in any library anywhere.

The tools (as usual) are neutral. It's up to us to insist that onscreen reading enhance, not replace, traditional book reading. It's up to us to remember that the medium is not the message; that the meaning and music of the words is what matters, not the glitzy vehicle they arrive in.

The Effects of Perpetual Distraction

Gloria Mark *is a professor in the Department of Informatics, University of California, Irvine. She studies human-computer interaction.*

When PC's first entered the home in the 1980s, a number of studies comparing the effects of reading on an electronic display versus paper showed that reading was slower on a screen. However, displays have vastly improved since then, and now with high resolution monitors reading speed is no different than reading from paper.

So what is different? It is not just a matter of comparing reaction times or reading comprehension; it's the entire experience. Reading a Google book enables the reader to search for words or passages throughout the text. It's effortless to skip to a juicy section or to go back and reread a memorable part. Contrast how long it takes to skim to a particular passage in a paper book, unless of course it is bookmarked or the page corner is bent.

When online, people switch activities an average of every three minutes (e.g. reading email or IM) and switch projects about every 10 and a half minutes.

Hypertext offers loads of advantages. If while reading online you come across the name "Antaeus" and forget your Greek mythology, a hyperlink will take you directly to an online source where you are reminded that he was the Libyan giant who fought Hercules. And if you're prone to distraction, you can follow another link to find out his lineage, and on and on. That is the duality of hyperlinks. A hyperlink brings you to information faster but is also more of a distraction.

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Reading online is thus not just about reading text in isolation. When you read news, or blogs or fiction, you are reading one document in a networked maze of an unfathomable amount of information. My own research shows that people are continually distracted when working with digital information. They switch simple activities an average of every three minutes (e.g. reading email or IM) and switch projects about every 10 and a half minutes. It's just not possible to engage in deep thought about a topic when we're switching so rapidly.

My own preference? I'd much rather curl up in an easy chair with a paper book. It's not only an escape into a world of literature but it's an escape from my digital devices. When I'm reading a paper book I'm not tempted to self-interrupt and begin surfing the Internet. But I grew up with paper books.

I wonder about young people, who do not know of a life before the Internet, and who, growing up "digitized," might not prefer reading online where they are the pilots of their own information pathways. More and more, studies are showing how adept young people are at multitasking. But the extent to which they can deeply engage with the online material is a question for further research.

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