

their nature poses a deep challenge to standard views on action and action understanding.

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#### REFERENCES

- Buccino, G., Vogt, S., Ritzl, A., Fink, G. R., Zilles, K., Freund, H. J., & Rizzolatti, G. (2004). Neural circuits underlying imitation learning of hand actions: An event-related fMRI study. *Neuron*, *42*, 323–334.
- Casile, A., & Giese, M. A. (2006). Nonvisual motor training influences biological motion perception. *Current Biology*, *16*, 69–74.
- Catmur, C., Walsh, V., & Heyes, C. (2007). Sensorimotor learning configures the human mirror system. *Current Biology*, *17*, 198–210.
- Cattaneo, L., Sandrini, M., & Schwarzbach, J. (2010). State-dependent TMS reveals a hierarchical representation of observed acts in the temporal, parietal, and premotor cortices. *Cerebral Cortex*, *20*, 2252–2258.
- Iacoboni, M., Woods, R. P., Brass, M., Bekkering, H., Mazziotta, J. C., & Rizzolatti, G. (1999). Cortical mechanisms of human imitation. *Science*, *286*, 2526–2528.

## A CHACUN SON

### Words Onscreen: The Fate of Reading in a Digital World

By Naomi S. Baron. New York, NY: Oxford University Press, 2015. 320 pp. Hardcover, \$24.95; Kindle, \$9.99.

Welcome, prowlers of digital media:

1. A heads-up on what your search and scan of this book review might deliver.
2. Naomi Baron is critical of reading electronic books and even other text.
3. Her argument for printed media and claim that people actually prefer printed books is eclectic but too dependent on introspection and anecdotes.
4. She does not consider that the limited experience of the readers with electronic books might be an important factor.
5. More digital experience and advances in technology and human–computer interaction will probably favor electronic media.

6. Her advocacy of continuous reading might offer a memorable artistic experience but might not be conducive to comprehension, learning, and memory.

Welcome, continuous readers:

My dear reader, what medium are you using to read this book review? Are you paired with this physical journal in a library (yes, Martha, libraries still exist, even some without cafes) or a copy you just received by snail mail? Or did you access the journal and this book review electronically? By now, it appears you are somewhat committed to continue reading this review. What reading strategy are you following, and what do you expect to obtain from the review? According to Naomi Baron, the author of *Words on Screen: The Fate of Reading in a Digital World*, reading a book in a digital medium is fundamentally different from reading traditional printed books. She expertly systematizes empirical evidence and speculative discourse to convince us that reading strategy and experience will probably differ for ePaper and printed paper (pPaper) media. Print is more likely to promote continuous linear reading, whereas you would be more likely to search and sample from the virtual version.

Are you able to concentrate completely on what I am saying? Added to the strategy difference, you will also be more vulnerable to extraneous distractions via your device when reading electronically. For Baron, the delivery medium will probably make a difference in your experience, evaluation, and memory of this review, and a book's delivery format will ensure an even larger difference. Given her eclectic survey of the literature, it is surprising that Baron did not cite Marshall McLuhan's classic aphorism, "The medium is the message." I do not think she would agree with McLuhan's dismay that literacy compromised the native's raw experience of the world. It would be foolish to extend his argument to propose that digital media has also compromised our raw experience of text.

#### Continuous Reading

Baron tackles the difficult charge of accumulating evidence specifically corroborating the case for a greater value for printed books compared with electronic books. She proposes two prominent advantages of print: continuous reading and concentration. Continuous reading is a valuable endeavor. With print, the reader becomes immersed in the book and the characters therein and develops empathy, which of course translates into value for the reader in the real world. Books of serious fiction have high value be-

cause they encourage people to empathize with others and develop the skill of empathizing, which then will make them better citizens.

About 10% of continuous reading appears to consist of mind wandering, or mindless reading. We have all experienced becoming aware of being zoned out even though our eyes were moving across the printed page as usual, and we did not have the foggiest idea of what we just read (Reichle, Reineberg, & Schooler, 2010). Although arguments have been made for positive features of mind wandering, such as a potential for creative thought, it reveals that continuous reading or printed books might not have as much concentrated attention as previously believed. Perhaps continuous reading along with accompanying mind wandering provides a respite from the data-intensive world we live in.

Electronic media, on the other hand, allow the reader to scan the text while perhaps multitasking with other applications on the device such as messaging, e-mail, or Angry Birds (or whatever app is currently hot). Baron also considers rereading (reading the book again after a first reading) an advantage of printed books over their electronic counterparts. Rereading a book at another stage in life can give us insights into who we were then and who we are now. I wonder, however, whether a similar understanding might occur in simply reading another book in the same genre as one we read earlier. Genre would be tightly defined because we cannot expect a reading of *King Lear* to reflect on our memory of reading of *Romeo and Juliet* a few decades earlier. We can agree that a goal of voluntary reading affords pleasurable experiences accompanied by valuable memories. An important question is whether continuous reading of print and the accompanying concentration justify a safeguarding of printed books, even in the digital age.

It is currently popular to attribute our ease of navigating our world to Bayesian inference and predictive coding (Clark, 2013; Friston, 2010). Bayesian inference heavily weights prior experience, which works well in a fairly constant environment. The fewer surprises we have the better. As stated by Clark (2013, p. 195), “We color-code consumer products, we drive on the right (or left), paint white lines on roads, and post prices in supermarkets. At multiple time-scales, and using a wide variety of means (including words, equations, graphs, other agents, pictures, and all the tools of modern consumer electronics) we thus stack the dice so that we can more easily minimize costly prediction errors in an endlessly empowering cascade of contexts from shopping and socializing, to astronomy, philosophy, and logic.” Rereading would

certainly limit surprises and could conceivably enhance comprehension.

I believe we all can agree that reading’s value is intimately tied to learning. Witness the enormous emphasis reading instruction programs place on comprehension and learning. One might question how Baron’s view of concentrated continuous reading optimizes comprehension and learning. In a recent book providing a thorough meta-analysis of learning, Fiorella and Mayer (2015) found eight learning strategies that significantly improve learning and memory: summarizing the text, creating maps and organizing the text, drawing based on the text, imagining based on the text, self-testing, self-explaining, teaching, and enacting the text. All of these depict learning from text as a generative activity; continuous reading seems to be the antithesis of using these strategies, unless it is embellished to include them or similar ones.

Much of Baron’s evidence for print is derived from preferences expressed in various surveys conducted by her and others, spoken and written anecdotes, and casual remarks. These preferences give Baron strong evidence that printed matter is not losing the battle with electronic text and that printed books will be present for some time. Baron notes these subjective impressions and observations with appropriate caveats about how misleading our introspections can be, but she fails to emphasize how they usually represent a population with more experience with printed than electronic books. And, of course, for all of us who are old enough to read this review, our experience began solely with print well before electronic text was introduced. A personal anecdote comes to mind. We had a colloquium with a visiting IBM engineer who criticized the scroll mouse (this was many years ago). Before he could complete his criticism, one of our computer scientists blurted out, “I love my scroll mouse.” I am not going to debate the value of the scroll mouse but am simply making the point that individual differences are pervasive enough that we could believe they make the world go around. Importantly, our experience in many ways determines partially if not almost completely our preferences. Obviously, the computer scientist had mastered the scroll mouse with lots of time on task, and it served his purpose very well. Moreover, he might have overinterpreted the value of the mouse itself as opposed to his acquired expertise (which might have been as accomplished with many other input devices). Most importantly for both Baron’s surveys and my anecdote, user preference or satisfaction does not always predict objective performance (Nielsen, 2012).

We are not surprised that Baron has experienced a greater value of printed matter as opposed to electronic media. However, this does not mean that there are not upsides to electronic media that overshadow the upsides of printed matter. She has clocked her 5,000 hours to become an expert with printed matter. Thus, it might simply mean that Baron has built her expertise embedded in the medium of printed matter and has yet to accomplish that same expertise with electronic material. Achieving expertise with digital texts might make her an advocate of electronic material in the same way that she is an advocate of printed matter.

In the nascent stage of the Cognitive Revolution, Gibson and Levin (1975) devoted a chapter of their classic book *Psychology of Reading* to reading's different purposes. (In the digital age, one can purchase this book for 65 cents on Amazon.) To experience a book in the same manner as we experience a painting, music, or other form of art, continuous reading of print may be the ideal medium. This view probably contrasts with the author's, who cites Vladimir Nabokov (1980):

Curiously enough, one cannot read a book: one can only reread it. A good reader, a major reader, an active and creative reader is a rereader. . . . When we read a book for the first time the very process of laboriously moving our eyes from left to right, line after line, page after page . . . stands between us and artistic appreciation. . . . But at a second, or third, or fourth reading we do, in a sense, behave towards a book as we do towards a painting [which we take in with our eyes on first contact]. (p. 110)

One can quibble with Nabokov's qualitative distinction between text and paintings. Eye movement recordings, probably not known to Nabokov, reveal parallels between eye movements in reading and those in viewing paintings. In both cases, the viewer makes saccadic eye movements between periods of short fixations. Although our processing of paintings and books might differ, it is unlikely to be due to the laborious movements of the eyes in these two venues. No doubt one could propose that a more elaborate narrative must be constructed in reading text than in viewing a painting. On the other hand, the construction of the narrative might be more difficult for the painting because there are fewer constraints in a painting relative to the usually direct input in text.

Baron stumbles a few times by not considering our tunnel vision during reading. She finds value in

seeing both pages of an open book simultaneously. It cannot be the printed text we benefit from, however, because we do not see more than about six or eight characters on either side of our fixation point. Baron also puts too much faith in speed-reading. If someone tells you she is speed-reading more than 1,000 words a minute, she is not reading all the words. Even if we grant a reader four fixations a second and three words per fixation, she is reading 720 words per minute. She uses strategies to selectively read "important" information and to organize and remember what she has read. Baron mentions a new technology that can increase your reading speed with no loss of comprehension. This RSVP reading technique has been pervasive in psycholinguistic experiments for several decades.

As a reviewer, Baron thinks she is doing the author of a submission a disservice by reading the manuscript in electronic form rather than on paper. This could well be the case, but I can promise her that with sufficient time on task and guidance from the applications themselves or colleagues, she would find that an electronic paper offers many resources that allow a conscientious and informative review for both the author and the editors. Resources such as comments, tracking, and easier access to relevant literature, which I am confident she uses in her own writing, are just three of the many possibilities a reviewer can use when reviewing a paper.

Baron often fails to temper her criticism of electronic media with its positive virtues. She finishes a sentence with the French phrase *A chacun son*. With the paper version of her book the reader can do one of two things: continue reading without disambiguating the phrase or turn to some electronic device that allows a search for its meaning. On an electronic device, however, a touch will probably bring up a dictionary or a Web search. One of the biggest benefits of electronic books is that you have access to the world's information at your fingertips, which is not possible with a printed book. A reader could always choose to simultaneously read a paper book while connected to a desktop, laptop, or mobile device, but this strategy would seem to require too much of a duplication of effort. It probably creates a timesharing or multitasking situation, which is something to be avoided.

#### *Multitasking*

I believe Baron's most valid complaint is that we have more difficulty focusing and are much more easily distracted when we are reading electronically than

when we are reading in the traditional manner. Multitasking is not a recent burden, however, as witnessed by John D. MacDonald's (1955, p. 146) description of an adolescent: "Sue, on the floor, was making an intricate ceremony out of doing her nails, her history homework, and watching television." One cannot deny that if your electronic device is alive to the impulses of the Internet, then certainly e-mail and messaging can be disruptive. People even use applications that prevent these interruptions or simply turn off outside influences. Certainly, multitasking is something we all do more than we did previously simply because the technology is available to make it possible. Of course we do not want to live like Luddites, but there is no doubt that many research findings are substantiating the negative consequences of multitasking.

In his recent book *The Organized Mind*, Daniel Levitin (2015) summarizes some of what the field has found. Although we might have the opposite impression, multitasking is not doing two things at once. At best, we switch from task to task, which is easy to do because the prefrontal cortex has a novelty bias. Pointedly, multitasking appears to increase the hormones cortisol and adrenaline, which produce stress and overstimulation, respectively. Switching between tasks releases a hit of dopamine, resulting in a loss of focus. So we should be concerned by the cadre of teenagers busily engrossed with their phones even while sharing a communal space. Even these skilled teens are not good multitaskers, and those who do it most may actually be poorer at it.

The digital world with multiple demands and therefore the need for multitasking is here, however, and for most of us it is necessary to embrace it. Though aware of the negative consequences of multiple simultaneous demands imposed by the digital world, I am optimistic that we can achieve some level of expertise in the same manner as our computer scientist mastered the scroll mouse. Perhaps 5,000 hours of focused practice will achieve the same miracle documented in individual dedicated domains such as chess, music, and sports. Some reasonable guidelines on organization, such as those given by Levitin, can also soften the pressure. As suggested by a reader, the emotional demands imposed by this world can be treated by "therapists, counselors, pastors, alcohol, drugs, pills, life coaches, self-help books, and I've lost track of how many new religions per day. And many of the aforementioned remedies are available digitally online!"

#### *Personal Experiences and Preferences*

I just like the feel of printed books. I miss the paper while turning the page. I enjoy the smell of paper and ink. These are just a few of many answers people give when comparing print and electronic media. I have a fond memory of Bill Estes describing exactly how he can find the journal location of a specific article on his bookshelf. Another close friend described the following: "I looked over my collection of books. I don't think any two of them are alike. My original Julian Jaynes hardback is not like any other book I have. Its cover, its font, the binding, the page brightness, and the smell, not to mention the combined impression of these things, are totally unique. I still remember the location on the page where I made initial underlinings and notations. The multi-sensory physicality of that reading is not at all like my memory of reading and annotation of Nabokov's autobiography, 'Speak Memory,' for example."

Observations such as these are easy to find, but for now we will not find many favoring electronic media. My wife just reported that she loves her iPad with its smelly, feely leather cover. Also, when a reader is relaxed in a prone position with a printed book, one side is always more poorly illuminated. But these impressions are not tied to a specific book that was read electronically. How might we design interactions with ebooks that could create experiences similar to those we have with printed books. We mentioned the ease of highlighting and making comments with an ebook. We could embellish these notes with unique characteristics for each new book by changing the color, size, and font of the text and our comments. In addition, we could call up unique music and eventually, with technological innovation, add voice narration of the text, our own speech, and olfactory, tactile, and kinesthetic experiences. In the near future, we might have similar wonderful fuzzy feelings about the multisensory experience of electronic media that many readers have about traditional print. In addition, reinstating the original context could enhance memory and learning (state-dependent retrieval).

A fundamental question is, How do we glean information, knowledge, and expertise from the world around us? YouTube videos have proven to be an excellent source. Who would tackle a household task today, such as fixing a leaky sink, without first consulting a YouTube video? Tennis, golf, and bowling coaches must be losing students because of the ease of watching a YouTube video lesson in slow motion. No one, let alone Naomi Baron, is going to deny the



impact of technology on our lives. All of it may not be for the better, but it is difficult for me to even begin to appreciate how representing our words on screen is inferior to our traditional media of written material. Of course, we will not deny poets and printers their art form in print, but it is worth stating that electronic media are evolving not only to represent their art but also to provide novel alternatives of representation. But in terms of the business of day-to-day gleaning of information, knowledge, and expertise, thank you silicon, Internet, and Google for immersing us in more of this stuff than we can possibly handle. There are no free lunches, however, and these gifts also bear their own set of challenges for navigating the digital landscape.

Baron uses several informal observations; please allow me to do the same. The new generation of cognitive scientists being hired in business and academia embody different perspectives from our tradition of psychological inquiry. Our new hires in psychology, for example, are telling our building manager to take out the bookshelves in their assigned offices because they do not own or buy books. This relates to the title of Baron's second chapter, "TL;DR," which means "too long; didn't read." We are also well aware of the related opinion, "TO;DR," which means "too old; didn't read."

It is also the case that there is no reason you should have more eyestrain with an electronic format than with a physical book. Early displays that required front lighting certainly could be a very bad experience, but with today's improved displays, the quality of the visual input is better than what you would get with a physical book. We go to a lot of expense to print books in very large print for seniors and those who are visually impaired, but type font size is easily adjusted on an electronic reader.

Baron proposes that it is difficult to devote your attention to a small screen when there are so many possible interruptions. On a solo bike ride north from West Palm Beach to an island on the west coast of Florida, I did not want to carry a big book with me but had to have my iPhone with my cycling app, map, and of course a phone for peace of mind. On my iPhone was the biography of Steve Jobs, and when I arrived at my destination, I was able to find a secluded beach and spend a few hours reading this engaging biography by Walter Isaacson.

Perhaps the biggest advantage of electronic media is what they provide for all of us who are necessarily handicapped in different situations. One of my favorite examples involves knowledge of vocabulary,

a process central to comprehension. When you are reading electronically it is easy to access the meaning of words you do not know. As a child I thought it would be cool if you could be automatically given the meaning of an unknown word anytime you heard or saw it in print. I did not imagine it would be possible, but now, with electronic media, it is perfectly natural. And there are many applications that help bootstrap children into reading comprehension by providing not only the definitions but also elaborate uses of the words and sentences and how they might relate to what they are reading.

In addition, it is easy to highlight material that you find relevant and that you would want to return to. There are sophisticated search functions that allow you to access particular content, which you cannot do in a physical book.

#### *Media and Genre*

We have seen that, *ceteris paribus*, there may be no qualitative difference to warrant a distinction between print and electronic media. To extend this thesis, I argue that there is nothing sacred about written language versus spoken language. I recently made a distinction between formal and informal language; these two forms can be delivered in either medium. The following table provides a taxonomy revealing the potential independence of language modality (spoken vs. written) and formal (nonconversational) versus informal (conversational) dialog. Given that both spoken and written language can be used naturally in most situations, it might be argued that it is the formal versus informal genre of the linguistic occurrence rather than its oral or written medium that is important. Similarly, many comparisons between printed and electronic text might also be reduced to formal and informal language.

	Spoken language	Written language
Formal language	TED Talk Lecture MOOC	Book Article Newspaper
Informal language	Spoken conversation TV dialog Fiction films	Texting Instant messaging Light fiction writing

#### *Retrospective*

Baron's book arrives amid a recent flurry of laments about the rapid incursion of the electronic age that surely signals society's demise or at least a poorer

quality of life. Nicholas Carr's (2008, 2010) caveats, Susan Greenfield's (2011) predictions of doom, and Baron's (2010) previous apprehensions presage a concern with our prized books being transformed into electrons. Why rest on these trepidations, however, when we can reach far back in time and find Socrates' concern with the consequences of written language replacing spoken language, the anxieties roused by the printing press, and any other concern about the latest cognitive artifact to arrive on the scene? Cognitive artifacts extend our reach in the world and beyond, and it is uncertain how the blending of the human and the artificial will play out. It is certain, however, that the game will be played. For now, Google Glass is passé but the Apple Watch may indeed fill that perceived void.

Electronic books and the electronic world open up a set of new horizons and make the exchange of information, knowledge, and expertise much more accessible. For example, one of our book reviewers quickly retrieved an electronic version of the book he agreed to review. He was able to read the book and initiate a book review quickly rather than waiting for a hard copy of the book to arrive by snail mail. (Not surprisingly, Amazon and Google are developing drone technology to have physical books delivered almost immediately.) Also, he was able to access other important information to facilitate the review, also something that would not be possible if we were limited to simply the physical material of journals and books and information that would have to be transmitted by snail mail rather than at the speed of light. Most importantly, we were able to make his review public well before its formal publication (Simonton, 2015). Baron will appreciate that this review was made available electronically perhaps a year before its publication in paper form.

The digital age is here, and people would be well advised to embrace it. A counterargument might be, "What's the hurry? Slow down and smell the roses." In Goethe's reworking of the German legend, Faust mortgaged his soul to the Devil, Mephistopheles, for unlimited knowledge and worldly pleasures. I do not think we are doomed to make a similar pact to benefit from the impact of technology on our lives.

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#### References

- Baron, N. (2010). *Always on: Language in an online and mobile world*. Oxford, England: Oxford University Press.
- Carr, N. (2008, July). Is Google making us stupid? *The Atlantic*, 301(6).
- Carr, N. (2010). *The shallows: What the Internet is doing to our brains*. New York, NY: W.W. Norton.
- Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences*, 36, 181–253. doi:10.1017/S0140525X12000477
- Fiorella, L., & Mayer, R. E. (2015). *Learning as a generative activity: Eight learning strategies that promote understanding*. New York, NY: Cambridge University Press.
- Friston K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews: Neuroscience*, 11, 127–138.
- Gibson, E. J., & Levin, H. (1975). *The psychology of reading*. Cambridge, MA: MIT Press.
- Greenfield, S. (2011). *You & me: The neuroscience of identity*. London, England: Notting Hill Editions.
- Levitin, D. J. (2015). *The organized mind: Thinking straight in the age of information overload*. New York, NY: Dutton.
- MacDonald, J. D. (1955). *April evil*. Greenwich, CT: Fawcett.
- Nabokov, V. (1980). *Lectures on literature*. San Diego, CA: Harcourt Brace Jovanovich.
- Nielsen, J. (2012, October 8). User satisfaction vs. performance metrics. Retrieved from <http://www.nngroup.com/articles/satisfaction-vs-performance-metrics/>
- Reichle, E. D., Reineberg, A. E., & Schooler, J. W. (2010). Eye movements during mindless reading. *Psychological Science*, 21, 1300–1310.
- Simonton, D. K. (2015). Collaborating creators still have personal psychologies. *American Journal of Psychology*, 128, 403–417.