



Photo by Nico Ciani. The author wears the eye-tracking device she used to discover how fifteen millennials interacted with longform journalism on iPads.

Digital LJ . . .

Reading Screens: What Eye Tracking Tells Us about the Writing in Digital Longform Journalism

By Jacqueline Marino
Kent State University, USA

Abstract: Little is known about how audiences read, watch, or otherwise consume the content in digital longform journalistic works such as the *New York Times's* “Snow Fall: The Avalanche at Tunnel Creek.” These projects often contain thousands of words, as well as photographs, videos, information graphics, and even news applications. There are so many places for the users’ eyes to travel on the digital page that critics have called these longform, multimedia works distracting, showy, and ineffective. To examine how readers feel about such work—and to determine how both the type and arrangement of elements affect readers’ experience of these projects—my research partners and I conducted an eye-tracking study of fifteen millennial readers of digital longform journalism in Ohio during the fall of 2015. Although researchers have been tracking people’s eye movements to discover how they read since the late 1800s, eye tracking has evolved from studying how people read printed words to examining how they interact with words, images, video, and other multimedia elements on websites and mobile devices. In this essay I describe the evolution of eye tracking, as well as the equipment and process used to record the eye movements of the Ohio study’s participants, all of whom interacted with longform digital journalism on iPads. I focus on what we learned about what kind of writing millennials read when they look at digital longform journalism, as well as how they regarded the writing in the projects chosen for the study.

Keywords: eye tracking, digital longform, mobile journalism, audiences

I think I know how I read. Line by line usually, sometimes pausing to picture a description, consider a metaphor, or question a fact. When I'm interested, the reading goes more quickly. I catch myself skimming and force myself to slow down and take . . . in . . . every . . . word. But how I think I read is not how I really read. To learn how I really read, researchers have to watch me do it. They have to measure my eye movements and account for things like interest level, word difficulty, and familiarity with the material.

Even though people have been reading for the past 5,000 years, scientists have only been studying readers' eye movements since the late 1800s. Edmund Burke Huey, in his classic work, *The Psychology and Pedagogy of Reading*, credited the French ophthalmologist Louis Emile Javal with first noting, in 1879, that readers do not read from left to right in uninterrupted sweeps.¹ By observing readers, he noticed that the eye makes short, quick movements and pauses as it traverses a line of text. The quick movements are called saccades. Later research not only upheld their existence but argued that cognition is not occurring to any significant extent during them. The pauses, called fixations, were also confirmed. When the eye pauses long enough, thinking can happen. The importance of these and other reading events have been studied and debated over the past 140 years. Learning how people read, Huey argued, is crucial to the future of reading itself. "The slightest improvement either in the page or in the method of reading means the rendering of a great service to the human race."²

Huey wrote this in 1908, almost a century before everyone started reading most everything on the Internet. While he worried about reading the printed page, his successors are examining the future of reading on mobile screens that fit into pockets and purses, as well as wearable ones that can render unnecessary not just paper but watches.

Despite the greater challenges, readers of today aren't much more helpful when it comes to describing how they read than the readers of Huey's time were. Even though I have been a reader longer than I've been a writer, I can tell you much more about my writing process than my reading one. I can tell you I like a quiet space with natural light. I try to avoid distractions by turning off email and keeping my phone out of sight. When I'm writing journalistic or academic works, I know I need to compile my facts first. Then I begin by writing the main points I want to make in one column and list the details, examples, and descriptions in another. I always start writing what I want to write first, usually the lead or introduction, sometimes a scene or a description. I indulge myself in the beginning because I know I will suffer later.

I can't tell you what I need to begin to read. Reading is automatic, like the way my car starts when I turn the key in the ignition. I can't tell you what

words will catch my eye before they do, how fast I'll breeze over a paragraph or what will cause my reading eye to stop and prompt those mental pictures, ponderings, or questions. When it comes to process, the writer can be trusted more than the reader.

So because readers don't really know how they read, scientists had to develop methods and later machines to accurately observe, record, and measure eye movements. The early methods were awkward, invasive, and often unsuccessful: readers' eyes were watched through a telescope, beams of light were reflected from their eyes at different angles and photographed, sounds of eyelid movements were heard through a microphone and counted. Huey even messed with people's eyes. He molded a plaster of Paris cup to fit their corneas, making them "insensitive by the use of a little holocain, or sometimes cocaine."³ A light celloidin and glass lever connected the cup to an aluminum pointer and created a record of each eye movement on a smoked-paper surface. Huey acknowledged his limitations, and those of other scientists studying eye movements during that time. He said it was impossible for any of them "to get a trustworthy account, by direct observation, of the speed, nature and even number of the eye's movements in reading, of the length and variation of the reading pauses, etc."⁴

While readers still can't tell you how they read, these days technology can get us much further. There are many different eye trackers on the market, most of them nonintrusive and used by academia and industry alike. In 2015, my research partners, Florida International University professors Susan Jacobson, Robert E. Gutsche, Jr., and I developed a protocol to use Tobii Glasses 2, then a new-to-market, lightweight mobile eye tracker worn like glasses, to track eye movements of millennial readers of digital longform journalism on tablet computers. We recruited fifteen participants in Northeast Ohio between the ages of eighteen and thirty-four, eight men and seven women. Ten



Photo by Nico Ciani. Researchers followed the path eye-tracking participants' eyes traveled across the screen. Software captured how long and how often they looked at text, photographs and other elements.

were undergraduate or graduate students from a range of disciplines. Twelve identified themselves as white, two as Asian and one as African-American. All were regular users of tablet computers.

Longform journalism has only recently found a suitable home in the digital world. In the early 2000s, writers for work destined for the web were advised—to quote Steve Krug’s famous web-usability text of the time—“Don’t Make Me Think.”⁵ The web’s natural state is hypertext not narrative, and the best web writing was thought to be short and direct. This writing contrasted the sort of writing one typically finds in magazines and nonfiction books, lengthy works whose authors use characterization, dialogue, and other literary techniques of the fiction writer and the poet. These works plod along masterfully, pulling in the reader with captivating characters, plot twists and riveting action, often using dramatic pacing and building to an arc. Many of these stories found their way to the web, of course, but they didn’t fit well there. Not until the *New York Times* published “Snow Fall: The Avalanche at Tunnel Creek”⁶ in 2012, that is. “Snow Fall,” which won the Pulitzer Prize for Feature Writing, used the journalist’s multimedia tools, as well as the writer’s literary ones. Video, time-lapse maps, animations, and words were fused into a single story that kept readers engaged for an average of twelve minutes,⁷ entralling them with sights, sounds, and narrative.

Jacobson, Gutsche, and I studied fifty works of digital journalism that attempted similar feats of fusion, old-fashioned narrative storytelling seamlessly integrated with pictures, graphics, and videos. We ultimately concluded that literary journalism had entered a new era, one where journalists are experimenting with digital tools to fulfill literary goals.⁸

While researching our article, however, we read the work of some who did not like “Snow Fall” and saw its use of multimedia as excessive.⁹ We wanted to learn how audiences felt about digital longform journalism. With the support of the University of Missouri’s Reynolds Journalism Institute, we launched four studies in 2015 to investigate audience reception to digital longform journalism, including one on eye tracking, which I spearheaded.¹⁰ We consulted other works by researchers who have conducted eye-tracking research on journalism audiences, including those by the Poynter Institute, which began using eye-tracking technology to study online audiences in 1999. Its EyeTrack07 project, Poynter’s expansive study of online news audiences, was of particular interest to us.¹¹

For our study, we looked at digital “longform journalism,” the more generic term for writing of at least 2,000 words infused with multimedia elements, such as photography, video, and infographics. We investigated the number and scope of literary techniques that appeared in both the text and



Screenshot from “Rebuilding Haiti,” published on Rue89. Participants spent a great deal of time on the text in this work funded by the European Journalism Centre.

the multimedia elements of these works. Longform could be literary journalism. It could also be explanatory, investigative, or provide a public service.¹²

For our participants, we chose millennials, news consumers whose ages range from age eighteen to thirty-four, because they access news differently than previous generations, and news producers are eager to appeal to them.¹³ Social media is more likely to be that generation’s main source of news,¹⁴ where they “bump into” news but also where they engage with it.¹⁵ The majority of millennial respondents in a 2015 survey conducted by the American Press Institute and the Associated Press NORC Institute for Public Affairs Research said keeping up with the news is at least “somewhat” important to them and reported accessing news daily.¹⁶ In addition to being in the news audience and the digital audience, we suspected millennials would also be in the audience for longform journalism. After all, studies have shown that younger readers are more likely to have read a book in the past twelve months than those older than thirty.¹⁷ Some have also argued they prefer in-depth journalism to shorter forms.¹⁸

Since growing numbers of consumers are now accessing news on multiple devices, especially mobile devices,¹⁹ we chose to test on one, the iPad. We were interested in learning which elements of digital longform journalism capture and keep the audience’s attention. We picked four projects of varying subject matters and presentation styles:

- “Firestorm,” *Guardian* (UK, 2013)
- “Planet Money Makes a T-shirt,” National Public Radio (USA, 2013)
- “Your Meat Addiction Is Destroying the Planet,” *Verge* (USA, 2013)
- “Rebuilding Haiti,” produced by a team of French journalists funded by the European Journalism Centre and published on Rue89 (France, 2014)

Each piece consisted of at least 2,000 words and several multimedia elements, such as infographics, photographs, and videos. The eye-tracker head unit’s four cameras (two on each eye), recording device, accelerometer, and gyroscope provided precise information on where the participant looked on



Photo by Nico Ciani. While participants interacted with longform journalism on iPads, researchers watched where the participants focused their attention, indicated by a red ring on the researchers' screen.

the screen and for how long, accounting for movement of both the head and the device.

The participants each chose two projects to view. While the participants perused a story on an iPad, user experience designer Christopher Halahan and I watched their real-time gaze patterns on a desktop computer. We watched where they were looking, which was indicated by a red ring moving across our screen (but not theirs). This video was recorded then exported into Tobii Glasses Analysis Software, which tallied all the fixations of at least 300 milliseconds (ms) and classified them into video, text, infographic, or other categories we determined in our content-analysis codebook.

Again, fixations are places where the eye paused. Most scientists agree that visual or cognitive processing occurs during fixations, but they do not agree on how long a fixation must be.²⁰ We followed Poynter's lead in capturing fixations of at least 300 ms because other research has shown that eye movements must fixate on something for at least this length of time in order for cognition to take place.²¹

We only looked at two eye-movement measurements: the number of fixations (fixation count) and the duration of fixations (fixation duration). One thing eye-tracking technology still cannot do is tell why a participant fixated on something. It can only answer the questions of if, when, and how. More fixations on an area of interest could mean that area was more noticeable, or it could mean the participant thought it was more important. Longer fixation duration could indicate a greater level of difficulty for the participant, or it could suggest a greater level of engagement.²² In post-eye-tracking interviews, we asked what the participants liked and didn't like about the story, how they felt about specific elements and whether they planned to return to the story or share it with others and why.

As a writer and a scholar of literary journalism, I was particularly interested

in the role of the text stories in these presentations. All four of them contained many words—the range was from 2,147 to 5,591—and I wanted to know if those words attracted or repelled our young participants. What made them want to read or stop reading? How did the infused multimedia elements distract or enthrall them?

The most important finding to me: Participants did read the text. I suspected this as we watched the red ring travel across lines of text in the real-time video, but I didn't know for sure until we interviewed the participants. In fact, in five of the thirty eye-tracking session interviews, participants said they liked text better than all other elements. "I usually like to read an article and then maybe watch the video afterwards," said a participant who read "Meat Addiction." "Sometimes I find the videos just repeat what the article was already saying."

The data, once analyzed, show the participants as a whole spent a great deal of time fixating on the words in these multimedia projects. In all but one story ("T-Shirt"), the greatest number fixations were on story text (the text in the main story or sidebar story). In "T-Shirt," fixations on video were slightly greater than on text.

The longest fixations were also on story text in two of the projects. However, in "T-Shirt," subjects spent more time watching video (thirty-seven percent of fixation duration time) than reading text (twenty-five percent of fixation duration time). In "Meat Addiction," subjects also spent slightly more time fixating on video (forty-eight percent) than on story text (forty-four percent). In "Firestorm," participants fixated on story text for a longer period (fifty-two percent) than they watched videos (thirty-three percent). In the one project without video, "Rebuilding Haiti," text was the element fixated on the longest (thirty-eight percent), followed by the game (thirty-four percent), which was also text but coded separately as "game."

What those numbers didn't tell us, however, is whether they liked the text they read.



In the *Guardian's* "Firestorm," whole-screen photographs often provide context or an emotional dimension to the words.

From the interviews, we learned some did and some didn't. For the majority of our thirty sessions—all but five projects—some other element was more appealing to the participant than text. The participants told us they read to learn about the topic and appreciated writing that was clearly written, informative, and well integrated with other elements, such as photographs and infographics.

About "Firestorm," one participant said, "It's very text heavy, but it's not very text-overwhelming. Because I think the way it's structured where you just kind of read a bit and then you have to do something like scroll up to get to the next bit. It keeps you awake. It's not just a giant page of text."

"Firestorm" is the story of how one family survived a bushfire in the Tasmanian city of Dunalley. Readers liked how the text appears on the left side screen on top of a photograph or infographic that fills the entire screen. The images provide context or an emotional dimension to the text on the screen it shared. For example, early in the story, the author explains how the weather on the day of the bushfire (hot, dry, and windy) and other conditions (a lot of brush and foliage) set the stage for the fire. The photograph underneath the words shows the brush-filled landscape. When one scrolls down, a map of Tasmania appears (with cities indicated), along with text about fire starts



Photo by Nico Ciani. On heat maps like this one, researchers saw what elements on the iPad screen attracted the most attention from participants.

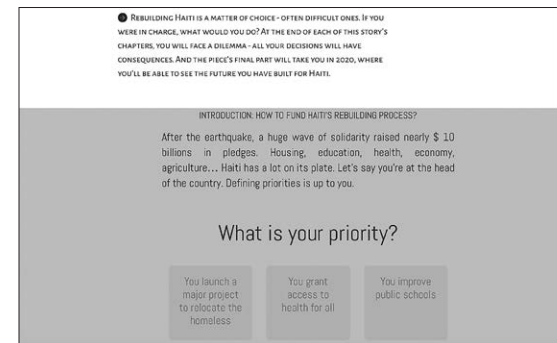
around the state. After the next scroll, the map becomes an infographic showing fire-danger ratings of various cities, including Dunalley, which is also mentioned in the text on that page.

Later in the piece, the photographs provide a more emotional dimension. For instance, the author explains how terrifying it was for Bonnie, the Holmes' daughter who wasn't there, to not to know if her parents and children survived the fire. Then the reader sees the photographs Tim Holmes shot, those of the children clinging to the jetty, and sent to Bonnie to tell her

they were alive. "The fact that they're [photos] in the background, along with the text, almost paints a picture in your brain," a participant said. "It gives you context with what you're reading. It's not just words on a screen."

Giant blocks of text evoked dread when they appeared mid-scroll. It was the opposite with photographs. This was especially true in "Rebuilding Haiti." That story relays the difficulties associated with rebuilding the nation after a 7.0 magnitude earthquake hit in 2010 through text, photographs, and an interactive game that gives the decision-making power to the audience.

"It took me longest to read the sections of text, but the parts I was most interested in were the photos and captions with the photos," one participant



Screenshot from "Rebuilding Haiti," published on Rue89. Participants said they liked being asked to make decisions in this game. One said, "It wasn't just a game for game's sake. There was information I was getting by playing the game."

said. "So every time a photo was coming up, I was interested to see what was going on in the photo. The [story] text helped me put context to the photo but I liked reading the [text on the] photos more."

While the pairing of text and photographs is not new, the way audiences interact with these elements on the mobile screen is more complex than how a reader peruses both elements on a printed page. Participants in our eye-tracking study spoke most highly of stories where the elements were placed on the page in ways that enlightened and delighted them. The way we classified each element—photograph, video, story text, etc.—was necessary for our purpose of quantifying, but we have learned that users do not look at longform digital journalism as a sum of identifiable parts. They look at them all when they look at, read, watch, scroll, and share that story.

In the last chapter of "The Psychology and Pedagogy of Reading," Huey relays "the wildest of speculations," a time when reading is displaced by other means of communicating. Some argue "writing and reading may be short-circuited, and an author may talk his thought directly into some sort of graphophone-film book which will render it again to listeners, at will; re-

producing all the essential characteristics of the author's speech, which, as we have seen, are not recorded by written language and which the reader must construct for himself at a considerable expense of energy."²³

The technology to do all of this now fits into our pocket, but words have not disappeared. They still fulfill a purpose, one that images and sound cannot supplant. Not yet. Those words still make us think, and many of us welcome that particular expense of energy.

Jacqueline Marino is an Associate Professor at the School of Journalism and Mass Communication at Kent State University. She studies the digital evolution of storytelling and teaches courses in feature writing and the business of journalism. She wrote the book, White Coats: Three Journeys through an American Medical School (Kent State University Press, 2012).



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