Book Publishing Final Research Paper   English

This Is Your Brain on Editing: How Digital Tools Affect the Cognitive Processes Behind Copyediting

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This Is Your Brain on Editing:

How Digital Tools Affect the Cognitive Processes Behind Copyediting

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Written in partial fulfillment of the requirements for

the MA in Writing: Publishing at Portland State University.

May 10, 2016

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Research question:

Considering the majority of publishing professionals are print natives, how are their cognitive processes affected (either positively or negatively) when using digital tools for copyediting and proofreading? Are certain digital tools more likely to yield a positive effect on the cognitive processes of copyeditors and proofreaders? If so, why?

Introduction

Copyediting is an important mechanic in developing content, and it has many functions to do so, including mechanical editing, correlating parts, language editing, content editing, permissions, and typecoding. In recent years, copyediting has almost exclusively become a task that is done by digital means, using computers and software to complete via track changes, callout queries, and typing. Although publishing professionals in recent years have shown a trend toward younger age demographics, a significant portion of them are "digital immigrants" using digital technology to do their daily jobs. In order to study digital technology's effects on copyediting, I analyzed the cognitive building blocks of the mental processes behind the functions of copyediting—such as attention and memory—and compared them to research done in the field of psychology that pertains to digital workspaces.

Copyediting and Cognition

What is copyediting?

It would be simple enough to describe copyediting as "editing copy," preparing written material for publication—for a book, a poster, a website, a blog, etc.—and making sure that it is free of errors. However, copyediting is much more involved. Just as there are different rules of grammar in the English language that people dispute, there are just as many different methods to approach what copyediting is and what it serves,[1] but for time's sake, this paper deals with industry generalizations. *The Chicago Manual of Style* (CMS) is the industry standard that

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[1] Amy Einsohn, "In Conversation with Amy Einsohn," By Carol Fisher Saller, *The Subversive Copyeditor Blog*, November 17, 2011, http://www.subversivecopyeditor.com/blog/2011/11/in-conversation-with-amy-einsohn.html.

equates copyediting to paying attention to grammar, punctuation, and style,[2] and Amy Einsohn expands the definition further in her *The Copyeditor's Handbook*.

Einsohn defines copyediting by its function to serve the author, the publisher, and the reader of any given work, placing emphasis on communication among these three intertwined bodies, using what she calls the "4 Cs" of copyediting: clarity, coherency, consistency, and correctness.[3] Clarity means a manuscript that is clear and easy for the intended reader to understand through sentence structure. Coherency means a manuscript with content that is organized or logical. Consistency means a manuscript in which word use and spelling are treated the same in all cases of an example. Correctness is just that; it means a manuscript that is free of errors in spelling, grammar, and punctuation.

Einsohn also identifies six main tasks in copyediting: mechanical editing, correlating parts, language editing, content editing, permissions, and typecoding.[4] Consider the following example sentence: "The blue fire truck carrying Bob, Dave and Spot sped lazily across the corner and through the neighborhood."

Mechanical editing is the basic assumption for copyediting; it involves conforming to house style and identifying inconsistencies in usage or punctuation. For example, if your house style incorporates CMS conventions, then you will add a serial comma after "Dave" even though it is technically correct English without it.

Correlating parts deals with the coherency side of copyediting; it involves cross-checking different parts of the manuscript to make sure they reference each other correctly or reference other information consistently. For example, a copyeditor looking at correlating parts would

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[2] *The Chicago Manual of Style*, 16th ed. (Chicago: University of Chicago Press, 2010) 70.
[3] Amy Einsohn, *The Copyeditor's Handbook: A Guide for Book Publishing and Corporate Communications* (Berkeley: University of California Press, 2011), 3.
[4] Einsohn, *The Copyeditor's Handbook*, 4–10.

mark that "sped" and "lazily" do not realistically go together in the sample sentence and would change one.

Language editing is the other layperson assumption of copyediting, making sure there is correct grammar, syntax, usage, and diction in the writing. For example, "around the corner" would be more accurate diction than "across the corner."

Content editing does not always fall within every copyeditor's purview, but it is important to make sure there are no internal inconsistencies in facts or any structural or organizational problems in the text. For example, someone doing content editing would at least question why the fire truck is blue and maybe query the author.

Permissions—identifying quotes, lyrics, images, etc. that need permission from other content creators for use—and typecoding—tagging the manuscript's structure for interior or ebook design—involve different processes in the publishing industry and are not often done in the same sitting as general copyediting, so they are not addressed here.

What are the cognitive processes behind copyediting?

It has long been believed that thought and language and are closely related. Copyediting as an action involves a complex network of different cognitive processes to do. The basic building blocks of this complex network are attention and memory. Knowledge, expertise, language, reading, writing, and decision-making all use attention and memory as the basis for their structures in human thought processes.

Attention is the process of selecting stimuli and concentrating cognitive processes on them, filtering information from the environment for a limited capacity to process further.[5] It is often described using a spotlight metaphor; the amount of focus you put into your attention

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[5] Ronald T. Kellogg, *Cognitive Psychology* (Thousand Oaks: Sage Publications, 1995), 69–70.

affects how much information you can filter. You can use a small beam of light, focusing heavily on a small chunk of information or type of stimulus; you can follow each sentence letter by letter, focusing only on make sure every word is spelled correctly. Or you can diffuse the beam to pick up a wider variety of information on a more superficial level; you can read every sentence only on the meaning level, seeing that the content makes sense but missing grammar errors along the way.

Memory, on the other hand, is often studied in terms of short-term, working, and long-term memory, and copyediting requires all three intertwined systems. Retrieval from both short-term and long-term memory are required to hold the information the copyeditor is reading in their head and to reference knowledge of grammar, style, and other parts of the manuscript. Baddeley's model of working memory particularly important in balancing the different processes in involved in copyediting.[6] He saw working memory as three simultaneous processes: the articulatory rehearsal loop—which processes verbal information by repeating—the visual-spatial scratch pad—in which events or solutions are visualized in the mind's eye—and the executive control system—which directs attention to important stimuli and is the beginning of the learning process for long-term memory. There are also two systems of long-term memory that are important for copyediting to take place: declarative and procedural memory.[7] Declarative memory, put simply, is what you know. Divided into episodic memory (your experiences) and semantic memory (the facts you know), it is the rules of grammar, vocabulary, and punctuation that the copyeditor knows and the style conventions they have learned. Procedural memory is knowing how to do something. It is the skills and behaviors in the copyeditor's arsenal, the

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[6] Kellogg, *Cognitive Psychology*, 121.
[7] Kellogg, *Cognitive Psychology*, 121–2.

strategy they use to read through a manuscript, the proper methods to query an author, or the

process of looking up an unknown rule in CMS.

Using knowledge and skill, even copyediting knowledge and skill, requires schema to

identify categories based on previously thought-out parameters—like what a grammar mistake

looks like or the correct way to use a semicolon—and requires scripts to follow a predetermined

set of actions to accomplish—like making a change, marking the text, or querying the author—

and then you use your semantic memory to do so.[8] Retrieval of that semantic memory is also

reliant on different encoding processes. According to the principle of encoding specificity, it is

easier to retrieve that memory when the circumstances or environment cues are the same as when

initially encoded.[9] For example, referencing CMS rules using the online version might make it

more difficult when you learned them via the CMS book. There are also problems that could

arise based on malformed schemas.

As a person learns more about a specific subject and becomes more skillful in that

particular domain of knowledge, the structure and processes of memory are altered.[10] Basically,

the more you know about and practice copyediting, the easier it is to retrieve the relevant data for

use. Mnemonic encoding uses the organization of long-term memory to guide the encoding of

information into meaningful chunks, meaning that patterns that make sense to an expert are

easier to learn, as studied in expert chess players.[11] This is called the principle of retrieval

structure.

The very acts of reading a text and then writing down editorial marks or changes involve

complex cognitive processes. According to the model of discourse formulation (i.e., forming

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[8] Kellogg, *Cognitive Psychology*, 166–75.
[9] Kellogg, *Cognitive Psychology*, 192–7.
[10] Kellogg, *Cognitive Psychology*, 201–2.
[11] Kellogg, *Cognitive Psychology*, 202–7.

thoughts for communication), three different processes happen both sequentially and simultaneously: planning (generating and organizing ideas and setting goals), translating (semantic, syntactic, and pragmatic operations that put ideas into words), and reviewing (reading, evaluating, and editing).[12]

These processes work together to build mental structures to make the effort easier with practice. Different types of text invoke certain schema from past experience, those schema establish goals for the reader to create micropropositions, the schema generalize those propositions to give a summary of the text, which becomes macrostructures that bridge meaning.[13] Going back to the sample sentence, "The blue fire truck carrying Bob, Dave and Spot sped lazily across the corner and through the neighborhood," your experience informs the schema that immediately pop into your head. You have certain expectations based on those schema; for example, the words "fire truck" probably triggered the image of a fire truck, or the name "Spot" might make you assume it is the name of a spotted dog. Both of those thoughts are micropropositions. Then schema coalesce those micropropositions into macroproprositions; you might picture two firemen and a spotted dog riding in a fire truck on their way to fight a fire, even if that was not stated in the original sentence. The whole process is basically a shortcut for you to understand the sentence.

Digital Demographics in the Industry

What are the digital tools used for copyediting?

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[12] Kellogg, *Cognitive Psychology*, 297–301.
[13] Kellogg, *Cognitive Psychology*, 310–1.

Technology is a part of our daily lives, and nearly all copyeditors work primarily with digital tools, if not exclusively, to do their work.[14] Fewer and fewer copyeditors write out proof marks on a printout of a manuscript because of advancing technology, receding resources, global editing practices, and environmental savvy. Regardless of the reason, several types of digital tools exist to assist copyeditors with their work.

To study the effects of digital tools on the cognitive processes behind copyediting, I divided the various digital tools used by editors according to three major functions. There are digital tools that visually track any changes introduced to the text, known as track changes. There are digital tools that allow the editor to comment, query, or suggest changes by connecting a parallel space for notes to specific areas of the existing text, known as callout queries. And there are digital tools that simply allow the editor to type changes directly into the text, possibly allowing users to access the edit history of the document to note what has changed. Many digital tools utilize a combination of these three major functions of digital copyediting, but each has its own pros and cons.

The tool possibly used most in the publishing industry is Word track changes. This tool has the capability of using all three functions of digital copyediting based on setting preferences, but like the name suggests, track changes is the most utilized function. Microsoft Word is a common program; most people have it, making it easily accessible. And its maneuverable settings allow editors all kinds of visual ways to track edits in a manuscript, using different colors based on users, comment bubbles, and easy options to accept or reject changes. Users can choose to view the document with the final markup only, the final markup with visible changes, or the original text only, all without deleting or altering the edits.

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[14] Einsohn, *The Copyeditor's Handbook*, 29.

Most other comparable digital tools for copyediting are in the shadow of Microsoft Word, but they do exist as alternatives. Google Docs has the advantages of being accommodating for collaborative work and free for users with a Gmail or Google Chrome account, but it has fewer options than Word. Its suggestion function is the closest thing it has to a track changes function, allowing users to accept or reject suggested changes, color-coded automatically by user. Its comment feature works well for callout queries, and it automatically tracks edit history by user. InDesign, on the other hand, has its own built-in track changes even though it is rarely used. Once turned on, InDesign track changes work only to show the edit history of the document by user, only visible through the specific track changes window. Its most useful function for editing is callout queries, but users have to create text boxes just to do that, and changes cannot be accepted with a simple click like in Word track changes or the Google Docs suggestion feature. Finally, some publishers have been known to develop their own online system for editing. I used a custom portal to copyedit for Schoolwide's eLearning database. Edits were typed directly into the text, and coding could be applied for web display or functionality, such as HTML and SSML.

What are digital natives/immigrants, and what is the demographic in the industry?

With all the talk of digital tools taking up a task that traditionally has been printed, one can hardly keep from bringing up talk of changing generations and digital natives and digital immigrants or the problems with using such phrasing. Don Tapscott, who popularized the phrase "digital native," defined it as anybody born after 1980.[15] Prensky, who is often attributed with coining the term, rejects such a simple definition and points out a different way to distinguish a digital immigrant—one who is familiar with technology but does not use it more than necessary. At Stockton College, he said that both could refer to people who grew up with technology or

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[15] Nancy K. Herther, "Digital Natives and Immigrants: What Brain Research Tells Us," *Online Magazine*, November/December 2009, 16.

people who did not, but it mostly has to do with how pervasive it is in their lives and how proficient they are with it.[16] There are also the concepts of digital visitors, who only use technology for a specific goal, and digital residents, who use technology largely for social interaction.

There is something to be said about the correlation between the technology one had access to as a child and how pervasive it is in one's adult life. People born in the eighties or later grew up with access to the internet in schools and libraries at the very least. Those born in the nineties or later often had a personal computer in their homes and later had access to cell phones in their teenage years. People born in the early eighties would be in their mid thirties right now.

According to the *Publishers Weekly* 2015 Salary Survey,[17] the median age of publishers and editors was down from forty-two in 2013 to thirty-five in 2014. The median years of experience was down from thirteen years in 2013 to nine years in 2014. In fact, approximately 42 percent of employees who reported to the survey had over ten years of experience in the publishing industry. You cannot assume age by industry experience, but at least that 42 percent most likely belong to the pre-1980 digital immigrant population, considering most people do not start their careers before their early or mid twenties. Of course, *Publishers Weekly* did not survey copyeditors exclusively, and it was a completely self-report way to gather data, meaning it was up to the subjects of the study to submit the information; but I am going to say that a good chunk of practicing editors belong to that generation who did not have a family computer in the house from a young age. Many likely identify as digital immigrants.

What is the expectation?

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[16] Marc Prensky, "Digital Natives, Digital Immigrants," *MarcPrensky.com* (2001): 2–4.
[17] Jim Milliot, "The PW Publishing Industry Salary Survey 2015: A Younger Workforce, Still Predominantly White," *Publishers Weekly*, October 16, 2015.

Studies have long shown a disconnect not only between human performance in reading print versus digital texts but also between the generations known as digital immigrants and digital natives.[18] In comparison to printed text, digital text is known to deny the reader the ability to map information based on the physical space of the text. Digital text is also not as conducive to extended reading, often described as too distracting with different options and actions and hyperlinks. And most people tend to simply prefer reading from a physical book than from an electronic one.

Editing with Digital Tools

What cognitive processes are affected differently by digital tools?

I could not make a direct comparison between the research on cognition and digital copyediting. In order to study how digital tools affect the cognitive processes behind copyediting, I had to focus on the basic building blocks of the cognitive principles behind copyediting. Most of the research focuses on reading using digital formats rather than the specific act of editing. One of the major functions of copyediting requires reading the text on a computer screen, so I had to narrow my search to more specific topics that could translate to tasks related to copyediting. I focused on reading skills related to attention, effort, reading comprehension, and digital tool use.

One research team led by Franziska Kretzschmar at the University of Mainz compared reading effort across print and two different electronic formats: a dedicated e-reader and a

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[18] Ferris Jabr, "Do E-Readers Inhibit Reading Comprehension?" *Salon*, April 14, 2013.

computer tablet.[19] They measured reading effort on a couple of different scales; self-report

preferences (what they said they preferred), eyetracking (meaning they used a camera to measure

how long they stayed focused on the page), and EEG brain activity as a way to gauge language

processing while reading. They had participants from two major age ranges—students in their

twenties and thirties and senior citizens in their sixties and seventies—labeled as young adults

and older adults. Each participant read nine articles across three different genres—scientific,

nonfiction, and fiction—formatted to be the same number of pages across all devices. Just as

predicted, participants in both age groups reported a preference for reading in print; however,

they found that there is no correlation between preference and reading effort when it comes to

the differences between the e-reader and the tablet, especially in the older adult group. Both

groups reported that the tablet had better "readability" than the e-reader, and the older adult

group reported that the tablet gave them a more pleasant reading experience than the e-reader.

Although the younger adult group showed no significant difference across all three methods, the

older adults had significantly longer eyetracking fixations and higher EEG activity on the e-

reader instead of the tablet.

       One study at the University of British Columbia, Canada, studied the effects of textual

environment on reading comprehension.[20] They measured reading comprehension by requiring

the participants to summarize and identify key facts in the three articles they all read, and the

participants were divided into groups based on textual environment. One group read their articles

with an "in-context style," meaning they were designed to look like web pages with graphics and

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[19] Franziska Kretzschmar et al., "Subjective Impressions Do Not Mirror Online Reading Effort: Concurrent EEG-Eyetracking Evidence from the Reading of Books and Digital Media," *PLOS ONE* 8, no. 2 (2013): 1–4.

[20] Luanne Freund, Rick Kopak, and Heather O'Brien, "The Effects of Textual Environment on Reading Comprehension: Implications for Searching as Learning," *Journal of Information Science* 42, no. 1 (2016): 79–83.

layout but no links. The second group read their articles with a "plain-text style," which were quite literally formatted to display as plain text. Then some participants in both groups had a "high-interactivity style," in which their articles not only had hyperlinks in the main texts but also a toolbar that allowed them to annotate and highlight their articles. The study's results showed the highest reading comprehension in the group that had both the plain text and the non-interactive environments. What was surprising was that they found that high interactivity in the plain text group showed lower results than high interactivity in the in-context group.

To take this idea a step further, one research team led by Sandra Wright of the University of Tulsa made its own study comparing printed and digital text.[21] They had second-grade students read storybooks via a paper book and a computer tablet—both of which with access to a dictionary, a thesaurus, and a word pronunciation guide in their respective formats—meaning the students with a print book had the dictionary, thesaurus, and guide in paper format—and then they tested their vocabulary and reading comprehension. They did not detect a significant difference in reading comprehension or vocabulary understanding between the different formats, but they did find out that the students were significantly more likely to use the extra materials when reading the digital books than reading the print books.

How can that effect be made better or worse?

The Mainz study, with older and younger participants reading print, on a tablet, or on an e-reader, showed that the effort in reading across these three devices is not as big a difference as the subjective preference of one over another.[22] Both groups reported concrete preferences for print media, then tablet, then e-readers; but only the older adult group showed statistically

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[21] Sandra Wright, April Fugett, and Francine Caputa, "Using E-readers and Internet Resources to Support Comprehension," *Educational Technology & Society* 16 no. 1 (2013): 367–72.
[22] Kretzschmar et al., "Subjective Impressions Do Not Mirror Online Reading Effort," 5–8.

significant differences across platforms, and that subjective preference did not predict their actual results in engagement. The e-reader they used was a Kindle, and the tablet they used was an iPad. This might simply be a case of which device is easier on the eyes; Kindles are constructed with e-ink to emulate a printed page as much as possible, which is easier on eye strain in well-lit settings.[23] But it might also prove that a simpler digital environment may be ideal for concentration, since Kindles focus on their primary function as a reading tool, while iPads have a whole array of other functions, including internet capabilities, a near infinite pool of apps to choose from, and more in-depth annotation software.

The British Columbia study about textual environment had found that high interactivity in in-context environments was second to low interactivity in plain text.[24] Participants who read their articles on an interface that looked like a webpage were more likely to use their annotation tools than those who read their articles on a plain-text interface that resembled a book page or a Word document in order to help their reading comprehension. However, the participants who did not have the high-interactivity option in the plain text group did not need annotations for an even better level of reading comprehension. Freund and her colleagues believe this has to do with the need to use simpler annotation tools, like highlighting, when the more extensive toolbars need to be learned or gotten used to. But the biggest takeaway from this study is that effective digital reading—and thereby effective digital copyediting—is more than a question of digital versus print, but also how that digital text is presented and contextualized. A simpler reading environment with a simpler set of tools just might be the way to exploit the highest possible reading comprehension while copyediting.

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[23] Nick Bilton, "Do E-Readers Cause Eye Strain?" *The New York Times Bits*, February 12, 2010.
[24] Freund, Kopak, and O'Brien, "The Effects of Textual Environments on Reading Comprehension," 89–91.

The study from the University of Tulsa with second-graders does not on its surface have much bearing in comparing different digital tools used by copyeditors today, but it does have value in pointing out another theme. The students were much more likely to use supplemental materials to help them read when they were using the digital tablet than when they were reading the printed book.[25] It could have had to do with the comparative ease of looking up a definition with a search bar or a click than in a printed dictionary, or it could have been that the computer screen fostered more divided attention towards such tasks. But it is still important to pay attention to this trend. The biggest tool in the copyeditor's arsenal is the mind, but even that cannot completely replace the appropriate reference materials, such as a style guide, a dictionary, or the ever-handy Google to look up the finer points of grammar. Part of keeping accurate in copyediting is to continually reference such materials, and when digital tools can help facilitate that, it is a good thing.

Of the studies where age was a factor, there were not many statistically significant differences between print and digital in young adults and children. And although there were some statistically significant differences in older adults, the question remains as to whether this is due to the level of technology each generation grew up and is comfortable with or whether it is a result of which format is easier on aging eyes.

What does this mean for publishing professionals?

At first glance, these studies seem to indicate that the most ideal environment for working in digital spaces is simple and sparse. Based on that logic, the digital tools that allow copyeditors to type changes directly into the text could most emulate that plain text environment. Unfortunately, copyediting is much more than the mechanics of reading and comprehension.

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[25] Wright, Fugett, and Caputa, "Using E-readers and Internet Resources to Support Comprehension," 372–4.

Track changes requires a greater emphasis on visual cognitive processes while copyediting because the changes are mapped right on the document. With its bubbles pointing to the text and links, it is the method for copyediting on the computer that most resembles the function of the modern web page, with its hyperlinks and graphics and ads displayed all around the text. As the study from British Columbia would suggest, this is not the ideal environment to be concentrating mental power on, since its variety of toolbars and colors are far from a stark, plain text environment. But some of the results in the same experiment suggest an alternative way to approach the subject. Freund and her colleagues discussed the potential reasons why the high-interactivity variable worked better for those who were reading articles that more closely resembled a web page than a plain text document. They attributed the biggest reason to the participants being unfamiliar with the toolbar used, and the in-context web page was a specific cocktail of a boost in familiarity due to context and a textual environment that was amenable to distractions to give them the chance to figure it out.[26]

However, copyediting is not done by participants in an experiment doing a task for the first time in an unfamiliar context; it is done by professionals who have practice using the tools they have. Cognitive psychology has some interesting ways to study expertise as a cognitive process. As someone learns more and becomes more skillful within a particular domain of knowledge—like copyediting—the structure and processes of memory are altered and refined.[27] Memory retrieval becomes easier based on use. As seen in the chess experts, when information is organized in a way that is meaningful, expertise allows people to have greater working memory

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[26] Freund, Kopak, and O'Brien, "The Effects of Textual Environments on Reading Comprehension," 89–90.
[27] Kellogg, *Cognitive Psychology*, 165–6.

and faster retrieval due to how long-term memory is coded. It sounds almost redundant to say this, but the more we practice using these tools, the better we will become at using them.

I could speculate all day about performance and copyediting with different digital tools based on research done on literacy and education, but the fact remains that research that studies more of the cognitive mechanics of copyediting does not yet exist. It would be great to see studies that look at the effects of writing—typing changes and writing queries are based in writing more than reading—across not only print and digital but also in a variety of digital environments. There needs to be more studies that test the effects of digital environments on other cognitive processes, such as decision-making, working memory, and visual language skills. I want to see how studies can replicate the tasks of copyediting, such as crosschecking different sections of a manuscript, referencing materials, or even typecoding (which is now used as an inherently digital process).

Conclusion

Based on the theory behind cognitive processes associated with copyediting, a simple digital environment is ideal for maximum reading comprehension, but a more complex digital environment fosters the use of supplemental tools such as annotations and references. The decreasing number of publishing professionals who identify as digital immigrants may benefit more from such digital environment manipulation than their growing digital native counterparts, but the answer is more complicated than that. With more research into the finer points of the cognitive processes behind copyediting, hopefully we can find out more about the specific functions of copyediting and take advantage of optimal conditions for editors to do their jobs.

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