

# ***BRAIN SCIENCE***

with

Ginger Campbell, MD

## **Episode #145**

### **Interview with Dr. Maryanne Wolf, author of *Tales of Literacy for the 21<sup>st</sup> Century***

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## **INTRODUCTION**

Welcome to *Brain Science*, the podcast that explores how recent discoveries in neuroscience are helping unravel the mystery of how our brains make us human. I am your host, Dr. Ginger Campbell, and this is Episode 145. You will find complete show notes and episode transcripts at [brainsciencepodcast.com](http://brainsciencepodcast.com).

Last month, we talked with [Dr. Angela Friederici](#) about the brain and language, and this month, we will talk with [Dr. Maryanne Wolf](#) about how our brains change when we learn to read. There is a very important difference between language and reading. Language comes naturally, as long as we are exposed to it during the critical period early in life, but reading and writing are cultural inventions.

This is an idea I first explored way back in [Episode 24](#), when I discussed Dr. Wolf's book, [Proust and the Squid: The Story and Science of the Reading Brain](#). In the early days of this podcast, it was common for me to discuss a book and then have the author come on the show for a follow-up conversation. Thus, I actually interviewed Dr. Wolf in [Episode 29](#). Then, last summer, I returned to the

science of reading in [Episode 136](#), where I discussed [Language at the Speed of Sight](#) by Dr. Mark Seidenberg.

I was unable to reach Dr. Seidenberg to invite him on the show, but reading his book prompted me to reach out to Dr. Wolf, and I discovered that she had written another book called [Tales of Literature for the 21<sup>st</sup> Century](#). Since then, we have been trying to get together, and I'm glad that we were finally able to record today's interview.

Before we get into the interview, I do want to give you an update about my [Facebook Live](#) efforts. This month's effort was aborted due to technical difficulties, and I want to thank those of you who did tune in and let me know that there was no audio. The next *Brain Science Live* will be on Facebook on Thursday, July 5, 2018 at 8:00 p.m. Central Time.

After today's interview, I will tell you more about this, including how you can participate or get the recording of that event.

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## INTERVIEW

**Dr. Campbell:** Maryanne, it is fantastic to have you back on *Brain Science* (I took 'podcast' out of the name a couple of years ago). And, since it's been so long since we talked, and we originally talked 10 years ago...

**Dr. Wolf:** 10 years, that's right.

**Dr. Campbell:** ...about your first book, [Proust and the Squid: The Story and Science of the Reading Brain](#), I was just wondering if you might talk a little bit about what has happened as far as your career and the impact of that book;

because, when I originally talked to you, I think it had only been out a few months.

**Dr. Wolf:** That's correct. Ginger, you were truly one of my first forays into speaking about it publicly. And you are quite right, every book has a life of its own, but this one was a particularly interesting life, since it came as the result of seven years of somewhat Herculean labors in libraries and going over the history of [reading](#) and [brain imaging](#) studies up to that point.

And what was fascinating to me was that I was [Rip Van Winkle](#). Here it was, 2007, I had written what I thought was an apologia for written language and how it changes all of us, and just as I was preparing to publish it, I realized that the very thing, itself, was changing under my fingertips and everybody else's.

So, just shortly before I finished the book, I had to rewrite both the beginning and the end to reflect my absolute concern—and that, remember, was 2006, 2007 when it was published—that what we were calling 'reading' was going to be changing dramatically in the new almost-dominating medium then, and that was the screen. And so, my worries, then, were that I was writing about a phenomenon that was really going to be radically changing over time.

And that is correct; my concerns were, in fact, realized. And I think they run the gamut of small changes in how we behave in our everyday life with reading, to very large, deeper changes in [attention](#), [memory](#), and, very important to me, what will be the formation of the future reading brain in our children, who are being deluged daily by [digital](#) information.

And so, those worries that I had at the very end of the book have all come to roost like chickens on a fence. And I have been, in many ways, following those changes, researching those changes, speaking out about those changes, and, in the last four years, or three years, writing two books about them.

Ginger, you asked me about the book, [\*Tales of Literacy for the 21<sup>st</sup> Century\*](#), that was a direct product of the end of the book, *Proust and the Squid*; the insights that I received there were just the bridge to the next book. And, by the same token, the research that went into *Tales of Literacy*, which is more of an academic book from Oxford Press, became the platform for my most recent book which comes out this August, 2018, which is called [\*Reader, Come Home\*](#).

**Dr. Campbell:** I noticed that listed as an eBook on Amazon, but is that available at all now?

**Dr. Wolf:** It's not available yet.

**Dr. Campbell:** Okay, then I'm not behind.

**Dr. Wolf:** No, you're not behind; in fact, I wish they wouldn't advertise it before it's out, but August 7<sup>th</sup>, it will be out. And the subtitle there is similar to the first subtitle; it is, *The Reading Brain in a Digital World*. And so, I'm coming, almost like a trilogy with these books, about the beginnings of the transition, the research on the transition, and now, my particular take on the insights from that research for our children and ourselves in this moment in time.

So, it had been a kind of great arc—an unlikely one for me—but it has been a true arc in understanding both what reading has represented, what I believe it could represent in the future, and my worries, as they have become more and more real, about those changing reading brains in our young. So, that's the arc, if you will, that connects all three of the books—and, our last interview.

**Dr. Campbell:** So, since the new book is not out yet, and we're focusing on *Tales of Literacy* today, could you give us, if you remember, sort of an overview of that particular book?

**Dr. Wolf:** Sure. Oxford Press has something called [The Literary Agenda](#) series. It is edited by [Phillip Davis](#), who is an extraordinary scholar in literature, and who, himself, just finished a book, that I can't wait to read, on [George Eliot](#).

**Dr. Campbell:** Oh, George Eliot; I finally have read some George Eliot. So, great.

**Dr. Wolf:** Oh, good!

**Dr. Campbell:** After reading *Tales of Literacy*, I had to read [Middlemarch](#).

**Dr. Wolf:** Oh, good! Of course, you have to read *Middlemarch*!

Well, I wrote *Tales of Literacy* because Phillip Davis wanted, for *The Literary Agenda* series, someone to talk about literature and [neuroscience](#), and also, the worries that he knew I possessed about the digital changes that could be happening.

So, what I decided to do was to take Chaucer's [Tales](#) as a kind of [leitmotif](#). So, it begins with the very concrete statement that [literacy](#) alters the brain of every individual, which alters the trajectory of that individual's life, which alters society, which, in turn, alters our species. So, literacy is a really important achievement that changed how we think as a species, but, in this moment of time, is going to change how we think in the future, and we must be vigilant.

So, the book tries to capture through tales; it begins with a [linguist](#) because I wanted everybody to have a vocabulary in which to talk about what are the processes in the reading brain from especially a language and cognitive viewpoint. So, the first 'tale,' if you will, is "A Linguist's Tale."

And then, the second one (well, the next would be chapters three and four), I go into what is a child's tale of the beginnings of oral language and written language and how intertwined they are.

And then, the fourth tale becomes a more elaborated version of what the neuroscience tells us. So, it's "A Neuroscientist's Tale" of the reading brain, and what we know about it in terms of what influences it, what are the processes required for it to move from a very rudimentary circuit that a young child has, that is just devoted to basic decoding, all the way to the great, fully-elaborated deep-reading, expert circuits that you and I, Ginger, possess.

So, "The Neuroscientist's Tale" goes into the elaboration of that circuitry. And I use some of [Plato's](#) work on what it means to name, or to give a name, as a way of looking at some of the processes involved. I think the research that I did on that was really very heavy, and not for everyone. I think some of the people who will find it valuable will find the actual notes as valuable as the tales, themselves.

But that actually then moves into how technology is changing that expert-reading-brain circuit and how I am worried that it is changing the child. So, I give a kind of the 'reading worrier' chapter in there about technology and its changes of us.

**Dr. Campbell:** But you end with a positive note.

**Dr. Wolf:** That's right, I don't want to end on negativity. And so, what I gave (and it was really, kind of, its own separate book, almost; it's a chapter, but it was its own separate tale, if you will) was the future—the hoped-for future of how technology can be a great tool.

And I chronicle an experimental project that I've been involved in with people at [MIT](#), and [Tufts](#), and [Georgia State](#)—in particular, [Stephanie Gottwald](#), my

assistant, who helped write Chapter Three in that book. She is a child linguist, and so, she was very involved in the writing of Chapter Three.

She works with [Tinsley Galyean](#), a former person at MIT, on a project called [Curious Learning](#). And Curious Learning was begun by [Cynthia Breazeal](#) at MIT and myself, and in the very beginning, with [Nicholas Negroponte](#), who, some people might recognize his name from two very important initiatives. One is the [MIT Media Lab](#) which he began, and it has become this extraordinary place for all manner of scholars to come and work on all manner of technological innovations, and the arts, and engineering, etc., etc.

But he also was involved in [One Laptop Per Child](#). And that did not become what he hoped it would—which is he hoped that, just by giving technology and exposing children to technology, they would be able to gain all kinds of knowledge, and really have almost an [autodidactic](#) formation of learning through it; that didn't turn out to be the case. Only [Uruguay](#) was really the reflection of his dream for it.

But nevertheless, he, because of One Laptop Per Child, asked me to come with Cynthia Breazeal one day to MIT and talk about what we could do with technology to help children learn to read—since that was part of the failure in many places; the kids didn't know how to read, so, having a tablet, or a computer, or a laptop in this case, was really just a waste, and it ended up in the garage in many a place.

So, he wanted to know whether I thought that was possible. And I didn't know. And so, it began a great initiative that is still ongoing; it's called "Curious Learning." Nicholas gave us the original funding and then moved on to other projects, so, he's not involved anymore. But it's a project in which we try to help remote regions of the world—especially places where there are no schools, or

schools where there are 60 to 100 kids per teacher—whether tablets can help children learn how to read.

And we have modest success; in some places, much better than that. But, in large part, what we're able to do is help children learn precursors to literacy. And in our original deployment in Ethiopia, some of the kids, in fact, have learned how to read on their own.

I look at that as an ongoing initiative. And in *Tales of Literacy for the 21<sup>st</sup> Century*, I describe how, for us, what it represents is a hoped-for role of technology to help us in literacy in very particular ways; in this case, in remote regions where there are no schools, or inadequate schools, or schools where there are so many needs and not enough teachers. So, places like that are really important.

I also think there are instances in every school where there are some children who will, in fact, be aided by technology in ways that other kids don't need; and my particular research area, [dyslexia](#), is one of them. I think many a child with dyslexia is extremely helped by the multiple exposures to print and letter patterns that a tablet or a laptop can give, that teachers just don't have time to do.

So, that last chapter in *Tales* is really a tale of hope for what I consider the two major wonderful roles in literacy. And one is the [democratization](#) of knowledge, and two is the individualized capacities of some aspects of technology to help especially struggling readers.

So, there are many wonderful evolving roles that technology can play and is playing. By no means do I believe it ever replaces, or should ever be allowed to replace a teacher. A teacher's ability to really ascertain what a child needs is so very important.



The realities of our teachers, however, make most teachers have too great a burden. So, I really look at technology as something that has the capacity for great service, and also great problems when it is either misused, overused, or when the expectations are impossible to place upon it.

**Dr. Campbell:** Right.

The idea that we aren't born to read, in [Mark Seidenberg's book](#), he says that "written language is our first information technology." That's the same idea you had in *Proust and the Squid*, but I think the way he put it is very good. And you again say in *Tales* that it's a cultural invention. Can you talk briefly about why this is such an important principle?

**Dr. Wolf:** The concept is so simple that people, when they read it or hear it, don't understand the serious implications it holds for teaching and for learning. Number one: "We were never born to read;" that's the first line in *Proust and the Squid*, and it is a leitmotif throughout all my work.

What it means is that, unlike oral language, we don't have a genetic program. It's cultural; it's a circuit that the human brain learns to form. And, it can form different circuits; it's plastic, it's malleable. So, once you figure out what that means is that every circuit can be different, and that every circuit reflects the individual learning of the person, the medium that the person is reading on, the writing system that the person is reading in. It even reflects the teaching method—which is its own, real little, but very important story in that one line.

And what I mean by that is the following: If you assume that reading is natural (like some companies even have something called "Read Naturally"), then you don't need to teach [explicitly](#) the elements of the reading circuit; you just will assume that the child will infer the rules, that it's just like language, they'll just

naturally get it, and that, when there's trouble, it's developmental and they'll develop out of it, but that, since it is a natural process, everyone will get it.

Well, the problem with that is that it is not natural. The circuit, for many a child, requires concrete, explicit instruction. So that a child who is learning to read, often as not, if the teacher believes it's natural, they use methods which are, by and large, called [whole-language](#), but what they mean is that they expect the child to pick it all up on their own, and that their job is to give them rich stories, and language, and authentic literature.

All of which is wonderful, but for about 40% of our children, doesn't give them the bottom rungs of the ladder. Basically, they're saying 'Hop up, leap up to the beauty of literature,' and leaving, especially children who are struggling for any reason—whether it's bilingualism, bidialectalism, dyslexia, any of the struggles that we have in all of our classrooms—we are neglecting 40% of our kids. And so, from the standpoint of teaching, that one little line about how important it is to understand that it *isn't* natural, that has implications for the entire life of a child.

So, that's one piece of it. The other piece is my emphasis on the [medium](#). If it's not natural, it means that that circuit is going to be highly influenced by the medium. One of the really interesting researchers in this area is [Patricia Greenfield](#) from [UCLA](#).

And what she said was that every medium has its costs and its weakness, and it will develop cognitive skills, some at the expense of others. So that, the digital world is going to certainly help [visual intelligence](#), but what she and I emphasize is that that can be at the expense of what I call [deep reading](#) and she calls [deep processing](#). And by that, we mean things like [inference](#), [analogy](#), [induction](#), [deduction](#), and very important to me, [critical analysis](#), and [reflection](#).

So, both Patricia Greenfield and I have been very concerned that the fact that there is this unnatural process that has to be learned, it's going to reflect the emphases of the digital medium in ways that we have to be vigilant about. If it's going to be advantaging quick-fire processing of multiple pieces of information, what does that do for the formation of the slower deep-reading processes?

And here, I will come to my absolute fundamental worry. And that is, that in a digital medium, with its advantaging of multitasking, quick integration of multiple pieces of information, you are not allocating time to critical analysis, to analogical thinking (that is, connecting what you're seeing to what you know, consolidating that into knowledge for future reading), and the allocation of time to feeling, to [empathy](#), to entering the perspective of others.

So, the two major worries I have in the medium's reflection in the current deep-reading brain is that less and less time will be allocated to these deep-reading, slower, critical analytic, and empathic processes. That makes us vulnerable in a [democratic](#) society.

It makes us more likely to be swayed by ever-quicker bursts of information from sources that we are comfortable with and that don't challenge us and therefore demand more time to process by us, and we end up with a vulnerability, I believe to [demagoguery](#), to fake news, to facile, unanalyzed information. That is one of the major elements, I believe, that have influenced some of the worst periods of time in the 20<sup>th</sup> century.

**Dr. Campbell:** Yes. I was just going to suggest that we focus on a couple of elements that are a part of this, that you might take for granted. For example, the first one—a real basic idea—Seidenberg was writing about the importance of [phonology](#) in successful reading, and I think that this is something we really can't skip. So, can you talk about why this is important, for just a few minutes?

**Dr. Wolf:** Of course. So, when we talk about reading, we're talking about the formation of what is, in the beginning, a rudimentary [circuit](#) of processes that connect sounds to visual symbols, that is, [letters](#) to [phonemes](#)—the smallest sounds of the language are called “phonemes.” That is the absolute initial entry into the circuit.

That means that two aspects have to be there: our ability to process the letters visually and our ability to process the phonemes of our language—or the language that is in front of us; in this case, we're reading [American Standard English](#). That means, if we're bilingual or bidialectal, we have to know the particular phonemes of that language system that we're reading.

So, the phonemes have to be known by the reader so that they can be connected to those letters, which then becomes the crux of being able to connect letters to sounds, to [words](#), to [meaning](#), to their [syntactic](#) uses, to their meaning at a word level, and a [sentence](#) level, and a [paragraph](#) text level. It all begins with letters and phonemes.

**Dr. Campbell:** Is that the reason why it is so important that children be read to from a young age, so they get all that exposure to this early on?

**Dr. Wolf:** There are two major implications for this. The first is that our children, from zero to five, need to have maximum exposure to the sounds of whatever their first language is, so that they get the concepts and the sounds of their language. But if we are talking about a bi-dialectal or a bilingual family, what we're talking about is knowing what a [book](#) is, knowing the conventions of [print](#), and knowing, very importantly, [vocabulary](#) and concepts. So, zero to five, I cannot emphasize enough how important reading to children is; it is the absolute fundamental basis for moving forward.

Now, let's forget bi-dialectalism and bilingualism for now and just talk about typical children. What that gives, is it gives the [graphemes](#) exposure visually, it gives the phonemes—even through the simplest of things, like *[Mother Goose](#)*, through [alliteration](#) and [rhyme](#), we are getting wonderful exposure to these sounds. All of that is forming these [neuronal networks](#) for sounds, and for the visual forms of the letters, and, very importantly, for the concepts that connect all of these in our words. So, that zero to five, it's absolutely essential.

It has a second implication, and that is that instruction that neglects the teaching of connections between phonemes and graphemes is going to literally leave many of our children behind. We need, in that [kindergarten](#)—that five to seven-year-period beautiful shift that's happening—we need to be explicitly connecting those phonemes that they're going to be reading and those letters. And that cannot be overemphasized.

Phonology and [orthography](#) have to come together in the five-to-seven period. They are being developed, singly, in the zero-to-five period, but they are being connected in that five-to-seven period. And the more concepts, the more vocabulary that child knows, the more the essential act of reading is able to come together.

My colleague, [Connie Juel](#) from Stanford, has always said that one of the problems in early reading programs is the assumption that, after a child decodes it, they know it. That's a really important lesson for all of us. We need that zero-to-five time to be full of the sounds and the meanings of words. It's a beautiful way for children to come to kindergarten on the same level playing field. Unfortunately, it is anything but the case in the United States and elsewhere

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I want to take a few moments to thank everyone who supports *Brain Science* financially via [Premium](#) subscription, [Patreon](#), or direct [donations](#). Your support is essential because, although this show started as a hobby, since my husband died in 2015, the income from *Brain Science* has become an important part of my budget. Without your support, I will not be able to devote the necessary time and energy to continue to create new content. If you would like to learn more about how you can help, please go to [brainsciencepodcast.com/donations](https://brainsciencepodcast.com/donations).

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**Dr. Campbell:** In Seidenberg's book, he bemoans the fact that, even though the scientific evidence for the role of phonology is, from a science point of view, pretty overwhelming—kind of like the evidence for evolution—it is still resisted by people like those who are committed to things like the whole-language method that you mentioned a minute ago. And I was wondering about your take on this. Do you see teachers becoming more receptive to [the science of reading](#)?

**Dr. Wolf:** I hesitate to say this, but I can almost remember the line that Seidenberg used, because it was so memorable. He basically said that the adherents to whole-language methods are these, basically [zombies](#) on the intellectual landscape, impervious to science and [evidence](#). And it was both hysterically funny and really an awful, awful statement about the fact that so many of our teachers really have been, in the past, impervious to evidence, or believing that it went against their loyalty to the methods they were taught in their graduate schools of education.

And here's where it starts: we have many wonderful, well-meaning teachers who come out of schools of education that were basically mid-1970s teachers; they believed in the [Goodmans](#) and [Frank Smiths](#) of this world, who really had, I think good intentions at the time, but no evidence, and they zealously taught that the [imagination](#) of the child was at stake if one taught [the rules of phonics](#). And it

was such a horror to me, personally, that such well-meaning teachers were led astray.

It is not to say that the emphasis on language and literature is misplaced. Those are fabulous emphases, but never at the expense of teaching our children the fundamental rules of [decoding](#) and [blending](#)—as if, by giving rules, we’re doing a disservice to the imagination, instead of giving them the tools to ignite their imagination.

So, I’m really still, I believe, astonished that there are probably, I would say enormous numbers of teachers who believe that their teachers, who were themselves being taught in the ‘70s, that this zealous adherence to the past methods is what they should continue to do out of loyalty to the imagination, or sometimes even to politics. There were really awful things going on in political beliefs that if you did phonics, you were conservative, and if you did whole-language, you were progressive. Oh my gosh, that was an awful disservice to teachers.

But now, we’re here, it’s that 21<sup>st</sup> century, thank God for the neuroscience of reading; because it’s just taught us that the [reading-brain circuit](#) not only embraces all of these emphases, it requires them. It requires emphases on phonics and phonology, it requires multiple exposures to letters and letter patterns and their connection, it requires an understanding of vocabulary and syntax, it requires exposure to literature.

But it does not require [cherry-picking](#), which is what a lot of people are doing nowadays, and giving lip service to *oh, I do phonics*. No, no, no, it is not cherry-picking; it is [systematicity](#), it is explicitness, it is ensuring that the developmental pathway to learning to read is followed carefully, and, literally all the way up into fourth grade, to ensure that [fluency](#) occurs in our kids—which it isn’t.

**Dr. Campbell:** And that was an idea that we didn't talk about last time, which was why we need that [automaticity](#)—why that is so important. Would you want to talk about that for just a minute?

**Dr. Wolf:** Basically, the circuits have to be automatic in the early part, or it can't allocate time to thinking about what is read. So, you need absolute automaticity in putting together your information from phonology with your information from letters, letter patterns, words. You have to put that together so that, then, you can put those two pieces together with vocabulary and information about how words are used in different functions, syntactically, etc.

Basically, that left-hemisphere set of components in the circuit has to be able to come together by about 280 milliseconds, so that afterwards, you can think. So, fluency requires automaticity, not just in one process, it, in my view, requires fluency about knowing what the sounds are, knowing what the letters and letter patterns are, what the sounds made by these letter patterns are, what the meanings of words are, the multiple meanings, the associations, the syntactic function, all of that has to become automatic.

When it is, then you can get to a fluent reader who can comprehend while they decode. So, fluency is not about reading... One of the things that is unfortunate is that a lot of teachers think fluency is a matter of repeated reading. It is only one piece of the recipe of fluency; fluency demands automaticity in all those basic components. And that's a lot of knowledge.

**Dr. Campbell:** So, if a child could read something out loud, it doesn't mean that they've got it, because they might not have any time left over for understanding.

**Dr. Wolf:** Not at all. In fact, one of the more unfortunate, if you will, methods for increasing fluency is an overreliance on repeated oral reading. That just



doesn't hack it; you aren't doing a thing to make meanings automatic, to making the knowledge about the syntax automatic. You have to do your homework as a child and as a teacher to get to about third grade, when you're fluent enough that now you add... You're always thinking, but now you're giving more and time to more sophisticated thought.

Now, here's the rub. About 37% of our kids—barely 37%—are becoming proficient readers by the end of eighth grade. So, we've got about two-thirds of the American population not really proficient. Worse, fourth grade: if they aren't reading fluently by fourth grade, you can just anticipate they're not going to be reading it by eighth grade. Worse, our African American kids: about 61% (same, a little less, but similarly for Latino), our children are not reaching basic levels by fourth grade. We are not doing our work as a country to allow those unconscionable percentages.

**Dr. Campbell:** Yes. So, that could really stop our conversation in its tracks, but I'm going to move on to something else.

**Dr. Wolf:** Well, we've got to change everything by fourth grade; that's the basic line. Zero-to-ten, we need an entire country focused on getting our children fluent by fourth grade, and then, we can do all these wonderful things. But if we don't get them there by fourth grade, for all purposes, it's a vanishing hope—especially for boys who are African American.

**Dr. Campbell:** So—and we are sort of moving back, I guess, toward the digital issue—can you talk a little bit about the role of attention? It's kind of implied that we first have to get this automaticity, but what about the role of attention in reading?

**Dr. Wolf:** One of the things that has been most prevalent in the research is showing how our children are basically having splintered attention, partial

attention. And what happens is, when you give partial attention, you aren't able to consolidate things in memory as well.

I think it was [Linda Stone](#) who used the term “continuous partial attention” to describe our children, with digital screens. And that's really what's happening. They are bombarded by information, which has several effects. On the one hand, it means their attention is never long enough to be learning focused attention in the same way as you and I did, for example. That's one thing.

Perhaps even more important, in terms of what I'm worried about, which is deep reading, if you have less and less background knowledge because you haven't consolidated what you have been attending to and putting it in memory, you won't know what you don't know. In other words, when you read, you are always connecting background knowledge to new knowledge; that's analogy. We are analogy-makers.

When your attention is being bombarded, you don't give as much time to the consolidation of things that will become background knowledge. And that means you are often relying on external servers for your background knowledge, but you don't have the same judgment, if you will, about what it is you do know, what it is you need to look up, etc., etc.

So, I'm worried that the bombardment of information is making attention less focused, less concentrated, which has a longer-term impact on what is remembered, which has an impact on background knowledge, which has an impact on making analogies to new information, which means you aren't being able to infer as well from what you are reading, which then—here is, again, the big worry—means you're less likely to go further and give time to critical analysis. That's the bad news.

**Dr. Campbell:** So, from the standpoint of parents who care about this, we know the guidelines—or many of us know the guidelines—to limit the digital time before the age of two, for one thing, and probably limit it even after that, but do you have evidence that encouraging kids to use real books more makes a difference? Does it matter?

**Dr. Wolf:** Yes. We are getting more and more research on this—thank goodness. Because even when I was writing *Tales*, I felt the research was more mixed than giving us a message, or a set of messages that could give us better direction. And by the time I wrote the new book, we have increased research. There is more research, interestingly, in Europe and in Israel than here, about this.

[Anne Mangen's](#) group, which is part of what's called the [E-Read](#) Network in Europe, I did report a little bit of that in *Tales*. I was with her in January. I had a conference on this topic, and she reported newer evidence, as did the Israeli scholar, [Tami Katzir](#). And Tami was a wonderful PhD student of mine more than 10 years ago, and she has done fantastic research showing that we really are having children who believe they are doing better on the digital screen, but when reading the same material in printed form are doing better in comprehension.

Now, Anne Mangen's group studied older students and more college-age, Tami was studying fourth- and fifth-grade age group, but the results are very similar in that Anne Mangen, for example, had her students read a lusty French novella in print and on screen, and what is happening is that the students are basically not capturing the details in the sequence of the story—of the [narrative](#). So, they are losing the details that would help them construct a better comprehension of the story.

The same thing happened with the younger kids. I sometimes think that a piece of this is that they think of the screen, itself, as impossible to remember. It's

almost the [evanescence](#) of what happens as we watch a screen, and that this is, in some ways, taking away from their ability to get the sequence of details necessary to understand the plot at a deeper level. So, we do see evidence from various groups showing that, while the students perceive themselves doing better digitally, they aren't

**Dr. Campbell:** And I've seen at least one study that was talking about textbooks, and that kids seem to learn more from real textbooks than from digital.

**Dr. Wolf:** It makes sense for some reason, because of the [tactile](#), [kinesthetic](#) version.

**Dr. Campbell:** Right. [Learning theory](#) says the more different [sensory modalities](#) involved, the better you will remember.

**Dr. Wolf:** Right. And even though you can have note-taking on digital, it's not the same. And I tell my own students, the [motoric](#) aspect of their note-taking, I think gives them an extra piece of information for memory consolidation. So, I think that there are a lot of interesting reasons with regard to the extra-sensorial components involved with the print.

But I think, also, Ginger, we are going to be a species that is dependent on the screen. So, one of the things I worry about is, even in my own research, here I am being so critical, and yet knowing that, no matter what criticism I make, we're going to be digital. So, what is it that we can learn from the criticism that we can then help the system address its own weaknesses.

**Dr. Campbell:** That's a good point.

I mean I've decided just about to give up [E-books](#), unless it's just a novel that I don't care that I'm not going to remember any of it.

**Dr. Wolf:** I take my kids along on my long flights. And, bravo, I'm thrilled not to... Even so, I still carry a lot of books with me, but it at least prevents me, when I'm on a European trip, from having to really carry a lot of books. So, there is a real difference that I think we make when we decide what is our chewing-gum reading—which I think is necessary for everybody—but our serious reading. And with serious reading, I want print.

The biggest things that I carry around in my life, if I move—as I am moving, basically, to UCLA—the biggest item, my boxes of books. And I am not leaving them behind. Not only are they my friends, I know, even by picking up a book, where things are that I need to remember: *two thirds of the way down, one-third through the book, probably the lower left...* There is this [spatial memory](#) that also is enhanced in print.

**Dr. Campbell:** And we could really explore some of that if we had more time. But is there anything else you really would like to share before we close?

**Dr. Wolf:** I think one of the things—and I started to say it earlier and I didn't say it well, because it's a very difficult thing to articulate—the last thing I ever thought, when I entered the world of research on the reading brain, was that I would be as worried about adults as I am about children. In my new book, I have even called myself a “farmer of children.” But what I have come to realize is that the adults are changing as much as children.

We are less immersed, we have a less contemplative dimension to our reading. I, myself, am addicted to my digital devices. I believe that my own capacity for [contemplation](#) has atrophied, has given me a lack of cognitive patience, which is the necessary ingredient for [insight](#), imagination, and real contemplative search

for [virtue](#), if you will forgive me saying a word that seems unlike a cognitive neuroscientist. I believe that the reading act is one of our most important antidotes to the loss of virtue.

Virtue is a discipline; it is part of being a critical cognitive human, and it requires not only [cognitive](#) but [affective](#) dimension. So, my biggest worry has shifted from the formation of the reading brain in children to the atrophy of the reading brain in adults; both are equally worrisome to me. We are showing the decline of empathy in our young in some of our studies, but I don't think people are looking at the decline of empathy in adults sufficiently.

I believe we are becoming ever-more conformist to what we know, because we are so bombarded by information that we retreat into the comfortable and the familiar; so much so, that we fail to take on the perspective of ultimate viewpoint and the perspective of other human beings. So, the loss of critical analysis and empathy are two of the most important aspects, two of the most important contributions of the deep-reading brain.

**Dr. Campbell:** So, what is your advice to the adult reader who doesn't want to lose this deep-reading ability?

**Dr. Wolf:** Two things: Preserve time in the morning, when your first tendency is to look where your email is, whether it's on your phone or your laptop, and spend at least 10 minutes, 15 minutes, reading print, whether it's a newspaper, a book of psalms, a book of philosophy, or something that will make you think; think, in the beginning of your day and at the end of the day. And do not either begin or end your day on screens, but rather on something that will slow you down. Because we have all begun to move so fast that we are retreating from the slower processes that lead us to be more thoughtful human beings.

**Dr. Campbell:** And what about (this is sort of my standard question that has evolved over the years from my guests) advice for students that are interested... and, in your case, I would say interested in the science of the reading brain?

**Dr. Wolf:** Anything learned well, learned deeply, connects you to multiple forms of knowledge. And so, I think in my area, the neuroscience of reading, it is intrinsically connected to the history of our species, to our philosophy, to our literature, to our study of language. And I would ask that no student of neuroscience neglects either the in-depth studies that are required to become a neuroscientist today, or its connection to other disciplines, particularly literature, [history](#), and [philosophy](#).

**Dr. Campbell:** That sounds like good advice. It makes me feel guilty that I haven't published an episode of my other podcast in a while. I bet you didn't even know I had another podcast.

**Dr. Wolf:** I don't! What is it?

**Dr. Campbell:** It's called [Books and Ideas](#), and it's where I put the stuff that doesn't fit on this show.

**Dr. Wolf:** Oh, that's so great! Well, you could put this on that one.

**Dr. Campbell:** You might like it. I've had a few philosophers and things. I have a few friends that are Sci-Fi authors, so, they end up on there from time to time.

But my husband died in 2015, and since then, I've been sort of struggling with getting things back together. And keeping one show going has been hard enough. There's no shortage of ideas, there's just shortage of time.

**Dr. Wolf:** Well, that's I think, a leitmotif in this talk, too. In the interest of gaining and saving time, we are losing it.

**Dr. Campbell:** I know. I hate email. It is like the worst time-sink...

**Dr. Wolf:** Yes, it's horrible. It's every single day, I mean I cannot move without feeling unvirtuous because I am leaving some poor soul waiting for a response, so I feel guilty 90% of my day.

**Dr. Campbell:** Well, I'll go days and days without looking at my email and then have to try to get caught up.

**Dr. Wolf:** Oh, my Lord. Well, sometimes I do that and then sometimes I just throw up my hands, *I can't do it*.

**Dr. Campbell:** So, I need to tell you one last thing. I've just started this new thing where I'm doing a *Facebook Live* thing once a month. And what I'm doing is I'm talking about the episode from three months earlier.

So, my first effort I tried talking about my January episode. So, that means I'm going to be telling my listeners to submit questions about this episode. So, I might pass some of those on to you, but if you're too busy, don't worry about it.

**Dr. Wolf:** Okay. We'll just handle it just like that.

**Dr. Campbell:** I'm not expecting the guests to participate in that, or anything, I'm just trying to...

**Dr. Wolf:** I understand. That's a nice thing to do for your audience.

**Dr. Campbell:** Okay, well, it's been great. Maybe we shouldn't go 10 years next time.



**Dr. Wolf:** That would be good!

**Dr. Campbell:** Maybe you could get your publisher to send me your new book.

**Dr. Wolf:** Yes. We'll see how the new book works. There is a proposal for a biliterate brain in there.

**Dr. Campbell:** That sounds really interesting, too.

**Dr. Wolf:** Yes, we might want to do something in a year about that.

**Dr. Campbell:** It sounds like a good plan. Thanks again, Maryanne.

[music]

It was great to talk with Dr. Wolf again and introduce her work to newer listeners. The key ideas we discussed are admittedly pretty straightforward, but I think the episode illustrates the practical value of neuroscience.

As I mentioned in my introduction, reading is a cultural invention, which means it does not come naturally, and we can't assume children will become good readers without help. Fortunately, the neuroscience of reading provides solid evidence about what works. If you are a teacher or have children, I strongly encourage you to go back and listen to [Episode 136](#) to learn more.

Dr. Wolf has spent much of her career developing methods to help children with dyslexia, but more recently, as she told us, she has shifted her focus to the issue of how digital media will affect our reading brains. Given the fact that our brains are plastic, we should all care about how new habits will affect our brains and the brains of our children.

I suspect that this episode will generate a wide diversity of opinions, ranging from those of you who find Dr. Wolf's ideas thought-provoking to those who will complain that the episode was too superficial. I look forward to hearing your feedback, whatever it may be. You can send me feedback at [brainsciencepodcast@gmail.com](mailto:brainsciencepodcast@gmail.com) or submit audio feedback via SpeakPipe at [speakpipe.com/docartemis](https://speakpipe.com/docartemis). And don't forget, you can now submit questions and comments for the upcoming *Brain Science Live* on Facebook.

Last month, when I first announced this effort, I said that there was going to be a three-month lag between the podcast and *Facebook Live*, but since I had to abort this month's effort and I have a conflict in June, there will actually be a five-month lag. That gives you plenty of time to send in questions and feedback. But since you're listening now, whenever that may be, you can send your questions and feedback now, and I will save them to use, as long as I get them before November 1, 2018.

As always, I want to thank you who support my work via [Premium](#) subscriptions, [Patreon](#), and direct [donations](#). Premium and Patreon supporters will have access to recordings of every *Facebook Live* session that I do. These will be audio recordings, unless I start to get feedback that people actually want video.

If you would like to learn more about how you can help keep this show going, please go to [brainsciencepodcast.com/donations](https://brainsciencepodcast.com/donations). Also, since I don't advertise, I appreciate it if you share the show with others, and post reviews, and of course, subscribe in [Apple podcast](#), formerly known as iTunes.

One last thing: I will be taking a group of *Brain Science* fans to Australia in late May of 2019. I will have room for 16 people, and I expect to have details about this trip by next month's episode. If you are interested, please write to me at [brainsciencepodcast@gmail.com](mailto:brainsciencepodcast@gmail.com).

Thanks again for listening. I look forward to talking with you again next month.

[music]

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