

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Textual reading in digitised classrooms: Reflections on reading beyond the internet

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ARTICLE INFO

Keywords:

Reading on paper and screens
 Long-form reading
 PISA
 Reading comprehension

ABSTRACT

Discussions of digital technologies in education should take into consideration the role of analogue technologies – such as print books – especially when it comes to *reading*. Empirical research (Delgado et al., 2018; Kong et al., 2018; Clinton, 2019; Singer & Alexander, 2017) shows that paper supports comprehension better than screens, especially when reading longer and more complex texts. PISA 2019 shows that reading performance has declined in many countries, and teenagers report a significant drop in leisure reading. This article reviews and discusses these findings, in light of how reading and literacy have been redefined on the premises and affordances of digital technologies, and calls for a heightened attention to important aspects of reading that are now being marginalized – namely, those that are least compatible with digital technologies.

1. Introduction

For a fruitful discussion about the future of reading education in increasingly digitised classrooms it is necessary to bring our implicit assumptions about the key terms “reading”, “text” and “technology” into conscious awareness.

How we read, is inextricably linked with what we read, and with the media, technologies and devices we use when we read (Baron, 2015; 2021; van der Weel, 2011). Over a very short time in the history of reading, we have moved from reading primarily with the medium of the print book, to reading on an increasing number of screen-based media: laptops, tablets, smartphones (Balling et al., 2019; Baron, 2021; Barzillai et al., 2018; Wolf, 2018). Key questions pertain to how and to what extent the transition from primarily paper-based to primarily screen-based reading affects reading practices – what we read and how we read – but especially how it affects reading performance, especially of school-going children. The answers to such seemingly simple questions depend on a number of prior assumptions that tend to go unchallenged in today’s discourses on reading, whether by scholars, scientists, practitioners or policy makers. It is the primary objective of this article to bring such assumptions into conscious awareness, as they obscure significant distinctions and differences within and between modes and purposes of reading, types of texts, features and affordances of technologies.

The first problem facing anyone intending to discuss the issue, is conceptual, relating to definitions of core terms. The topic “technology and reading” is multi-faceted and complex, requiring a nuanced approach and precise explication of a number of key

Rethinking educational practices and responsibilities in the light of digitalisation. Editors: Lisa Paleczek, Eva Pözl-Stefanec, Kathrin Otrell-Cass (University of Graz). We look forward to hearing the outcome of the review process. Kindest wishes, on behalf of both authors, Anne Mangen.

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<https://doi.org/10.1016/j.ijer.2022.102036>

Received 1 October 2021; Received in revised form 17 June 2022; Accepted 23 June 2022

Available online 29 June 2022

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concepts, such as “reading”, “text”, and “technology”. With the transition from paper to various screen devices, the variety of texts – or information – that we encounter during any single day, has increased exponentially. This transition also affects what we – implicitly or explicitly – conceive reading to be. It makes a huge difference in an assessment of fluency (as in PISA 2018; OECD, 2019) if by “reading” we refer to the processing of short sentences appearing on the screen or if we rather mean the reading of longer, literary prose. It matters for the development of theoretical and methodological paradigms in reading research, as well as for strategic choices regarding the use of devices in classrooms (not to mention national reading promotion campaigns), whether the term “reading” primarily denotes engaging with single, linear texts, or – for instance – critical reading across multiple texts.

The lack of precision entrenched in the term “reading” is mirrored in similar conceptual challenges in defining “text.” Does “text” refer to multimodal texts, including images, tables and other visual information in addition to written text? Or does it denote written/verbal texts only? If so, which genres or text types are referred to – are they narrative, expository, informational? Or are they perhaps fictional, or literary? And what role does text length play?

Even the term “technology” is not as clear-cut as it may seem: there are substantial differences between reading on a laptop computer, a tablet (such as an iPad) and an e-reader (e.g., Kindle) (see e.g. Benedetto et al. 2013, Siegenthaler et al. 2012). The differences pertain to visual ergonomics in various display technologies (e.g., lighting/luminance issues), but also to other ergonomic aspects such as weight, size, foldability,¹ and haptic experience (Köpper et al., 2016; Mangen, 2008). Moreover, although not always recognised as such, a paper book is as much a reading technology as any digital device (Kovač et al., 2019).

So should we hold on to definitions of text and reading that were originally created for a reading culture dominated by paper technology or should we adopt new definitions, based on the actual practices of young people today, based on their use of the latest, digital, devices? Given this choice of options, on the face of it, the answer seems easy. Classical book-based concepts of literacy offer no suitable preparation for the new – digital – realities. New media require new forms of literacy. One book after another has been published suggesting what shape such new forms of literacy – or literacies – might take. Or should we in fact opt for a hybrid solution, based on a combination of historical paper practices and current digital ones?

Instead of receiving the consideration they deserve, many of these and other such questions have only been implicitly answered in public discourse, as well as in policy making and in research on reading. We argue that it is the third, hybrid, approach that offers the most promising basis for developing sound reading education policies. Meanwhile, however, over the past few years, the discourse on reading and literacy has in fact to a large extent come to be defined by the reading modes, texts (or information types; or semiotic modalities), and reading purposes that emerge as a direct consequence of digitalization (see e.g. the most recent *Handbook of Reading Research* (Moje et al., 2020) for an authoritative overview of the most prominent developments in the field). Hence, particular attention has been paid to the reading of multiple texts across media, critical reading to assess and integrate information from various sources, hypertext reading, and multimodal text reading. Such a reconceptualization of reading on the premises of digital technology is aptly illustrated by the PISA 2018 modelling of the large-scale reading assessment as “internet reading” (OECD, 2021a). While obviously important in an era of increasing digitalization, such a focus obscures a number of vital aspects of reading and marginalises them in public discourse – namely those which are least compatible with the digital format. These pertain in particular to what we term “higher-level reading skills”, and are typically related to the reading of single texts that are longer, linear, and (potentially) more complex – whether they are literary, expository, or other genres/text types.

In this article, by bringing existing assumptions into conscious awareness, we problematize the ways in which reading (and literacy) is being defined and operationalized in PISA and, by implication, in much cognitive reading research, as well as in policy-making. Combining an overview of current trends in research on reading and literacy with a critical perspective on some of the scholarly and pedagogical implications of such trends, our aim is to show how key aspects of reading, namely those that are least compatible with digital technologies, are being marginalized. Substantiating our claims with evidence from empirical research on paper vs. screen reading, as well as research on the role and importance of long-form reading for a host of higher-level cognitive skills, we contend that this is a problematic development that warrants heightened awareness – in research as well as in policy and practice. In what follows, we will argue for a reorientation of the discourse on reading and digitalization that better acknowledges the importance of what we will call higher-level reading skills, for individuals as well as for societies.

2. Higher-level reading skills in a digital era

In an integrative framework for reading research (Mangen & van der Weel, 2016)², we have made an attempt to flesh out the inherent complexity and multi-dimensionality of reading. Importantly, the framework is based on the assumption that reading is multisensory and embodied interaction with a technology or device. To adequately account for the effect of the substrate and affordances of any medium or device on various (cognitive and experiential) aspects of reading, we propose a more comprehensive as well as fine-grained conceptualization of reading – one that takes into account not only low-level technical skills and functional aspects of literacy, but also processes pertaining to experiential and affective-embodied engagement with more complex, and typically longer, texts, such as novels. Among the many types of reading our model is designed to cover, we would like to concentrate primarily on *textual* (as against multimodal) reading, and more specifically on *higher-level reading*.

By ‘higher levels of reading’ we mean cognitive and affective-emotional engagement with written texts that goes well beyond

¹ https://en.wikipedia.org/wiki/Foldable_smartphone.

² The integrative framework built on research carried out in the E-READ COST Action (www.ereadcost.eu), funded by the EU in the period 2014-2018, and involving reading scholars and scientists from a number of disciplines across the EU.

decoding and the mere search, location and extraction of information (Garfinkle, 2020; Kovač et al., 2022; Wolf, 2016). It also extends beyond the ongoing generation of inferences on the basis of prior knowledge and explicit or implicit information in texts. Importantly, higher-level reading skills are central to critical thinking (Wolf, 2016, 2018). Higher-level reading includes skills and habitual practices such as testing different interpretations, finding patterns and unusual language in the text, detecting and differentiating different meanings, subtexts, contradictions, biases and ideologies, or connecting the text with other texts or cultural backgrounds. It includes the often complex affective-emotional facets entailed in the reading of literary texts – whether long-form reading of novels, or engaging with shorter literary texts in the form of poems or short stories. Higher-level reading is also the foundation for critical thinking (Garfinkle, 2020; Hari, 2022; Kovač et al., 2022; Rose, 2013).

All reading education should always ultimately aim at higher levels of reading that facilitate thinking. It is worth emphasizing that this does not imply that we downplay the importance of basic literacy skills. Achieving advanced reading skills obviously depends on the prior achievement of basic reading skills – such as decoding, and reading fluency (Wolf, 2008, 2016). Reading skills and practices are self-reinforcing and central to personal development over the course of an entire lifetime: “Getting children to read at their grade level is [...] a critical factor in setting them up for future literacy” (Rea, 2020). However, we would not be doing a service either to the individual or to society if basic and/or functional literacy was regarded as a final goal rather than as a window opening onto higher levels of reading and the corresponding cognitive and intellectual achievements. Basic literacy skills must as far as possible be turned into a background routine in order to allow cognitive resources to be reserved for higher reading aims (Wolf, 2016).

The importance of sustained reading – in the narrow sense, as referring to the processing of written text, not multimodal and multimedia conglomerates – of longer, linear texts, such as novels, anthologies, monographs and textbooks is unquestionable. Long-form reading of, in particular, narrative texts – in the form of books – is consistently found to bolster and predict superior reading skills, as compared to the reading of other types of texts (Jerrim & Moss, 2019; Mol & Bus, 2011; OECD, 2021a; Torppa et al., 2020). Reflecting this importance, Naomi S. Baron dedicated a chapter to the reading of single texts in her most recent book-length review of the field of print and digital reading (Baron, 2021, Chapter X). However, in spite of the repeated stress on its importance, the role of long-form, single text reading is conspicuously absent from the modes of discourse about reading characterizing large-scale assessments such as PISA, and also much of the cognitively inspired reading research, where, inspired by, e.g., the RESOLV framework (Britt et al., 2017; Rouet et al., 2017),³ it has become commonplace to consider reading as “problem-solving”. Short for REading as problem SOLVing, RESOLV is a model for reading comprehension focusing on how readers experience and adapt contextual aspects of the reading situation (e.g., relating to the reading task, the social and/or the communicative context), and then describing how these aspects guide the reading comprehension process.

Literacy scholars, as well as large-scale reading assessments such as PISA, consistently apply a broad and inclusive concept of “reading” akin to multimodal + critical + digital literacy – i.e., a definition of reading modelled after “reading on the internet”. It is understandable that, to a certain extent, digitally delivered reading tests should take advantage of the affordances of the technology to adapt the testing to individual students’ abilities and performance. Nevertheless, we must keep in mind that adding animations and sounds, hyperlinks, and focusing on scenarios with multiple texts, flags a definition of reading in which the reading of longer, linear texts – e.g., novels – is marginalized. In the same vein, multimodal and multimedia texts are typically privileged in literacy research, at the cost of exclusively written texts.

The need for ‘internet reading’ skills is self-evident. However, the trend to marginalize the reading of longer, linear texts is highly problematic, for reasons that we will explicate in the following. We argue for the urgent resurrection of a narrow definition of reading as referring to engaging with written materials, in which sustained engagement with linear texts over an extended period of time is perhaps particularly important (see e.g., Hari 2022, Wolf 2018). Especially in light of the negative trends in leisure (book) reading reported in PISA (OECD, 2021a) and other (national) reading statistics (e.g., for Germany: <https://de.statista.com/statistik/daten/studie/171231/umfrage/haeufigkeit-des-lesens-von-einem-buch/>; for The Netherlands, see Hisgen & van der Weel, 2022), we need to make sure that long-form reading of linear, written texts is given due attention in the scholarly and policy-guiding discourse on reading and literacy. A better grasp of the particular role of long-form, sustained reading of written texts will also contribute to improving our understanding of the implications of digitalization for reading – at a cognitive and affective-emotional as well as at a societal and cultural level.

3. The social dimension

An important step towards a more nuanced, and more comprehensive, understanding of how digitalization affects reading, is a reminder of what reading is and does, for individuals as well as for societies and cultures. In an educational context reading naturally has a special status as the means to learn/teach other subjects. This privileged status has had one significant but very unfortunate side effect. That is the prevalence in the domains of reading research, educational practice and policy making of a rather narrowly functional, or even instrumental, view of reading. Especially cognitive reading research is dominated by a narrow emphasis on reading as, essentially, a form of problem-solving (e.g., Britt et al. 2017). Students’ performance in problem-solving aspects of reading is what has become the chief focus of high-stake, influential reading assessments such as PISA. Such a narrow view fails to take into account the way reading, and higher-level reading in particular, is the main gateway to *thinking* (Garfinkle, 2020; Rose, 2013). It is important that

³ Short for REading as problem SOLVing, RESOLV is a model for reading comprehension focusing on how readers experience and adapt contextual aspects of the reading situation (e.g., relating to the reading task, the social and/or the communicative context), and then describing how these aspects guide the reading comprehension process (Rouet et al., 2017).

the goals to be achieved in reading education are set higher than mere literacy. This also has implications for how reading is conceptualized and assessed, as well as for policy making and the development of curricula across the educational spectrum.

Being a good reader entails a number of other dimensions and processes beyond the simple uptake of information, and even beyond the ability to critically evaluate potentially conflicting facts and statements across multimedia texts encountered on the internet. In light of the mounting problem with fake news (e.g., Hari 2022), the heightened focus on critical literacy is understandable. However, such a focus threatens to make other, equally important, aspects of reading less visible – e.g., the cognitive persistence required to follow longer stretches and lines of argument (Rose, 2013; Wolf, 2016, 2018); the ability to imagine people and places in narratives based on various techniques of description (Magyari et al., 2020; Oatley, 1999, 2016); and the capacity to contemplate and dwell on phenomena and events occurring in long stretches of literary texts (Burke, 2010; Wolf, 2018).

Reading is a complex, multi-factorial and multi-purpose interaction/engagement with textual symbols – or, rather, a multitude of such processes. Learning to read, therefore, is effortful. It does not stop at the decoding or fluency level, where a (beginning) reader is able to make the connection between the letters and their corresponding sounds, and to quickly recognize letters and words (see, e.g., Snowling & Hulme 2005). Reading is a life-long process with ever more dimensions (Hisgen & van der Weel, 2022; Wolf, 2008, 2016). As we have suggested above, the ultimate aim of learning to read should not be basic literacy, but to turn the basic decoding process into a routine so that cognitive effort can be spent instead on higher levels of reading that facilitate thinking. This is even more important because the success – or otherwise – in reading education is not just relevant for the individual student; it has direct repercussions for society at large (van der Weel, 2011; Wolf, 2008). Reading education is always the first step towards the creation of a particular type of society. Present-day society is built on the human capacity to think that was brought about by the reading education received by earlier generations and the reading habits it facilitated and encouraged. Present-day reading education needs to take responsibility not just for the education of individual students but also for society. The responsibility is of course not solely that of reading educators. Society at large needs to stimulate reading and the development of particular reading habits, and to provide the infrastructure for them. In this connection it is useful to refer to the concept of Reading Health with the associated Reading Health Index that has been proposed elsewhere (Gerčar and van der Weel, 2022) as a means to set policy goals for reading and monitor reading practices in any society at any level of aggregation.

Higher-level reading skills are thus important for a wide variety of reasons beyond the immediate, functional, educational goals. Enhanced reading activities – that is, reading beyond decoding simple texts for practical purposes – have been associated with wellbeing, educational achievements, socio-economic status, social integration, reduced crime (OECD, 2021a), mental health (Billington, 2019; Boyes et al., 2016), and, indeed, longevity (Bavishi et al., 2016). Furthermore, higher-level reading activities have been shown to improve and reinforce the development of linguistic competence, empathy, social cognition and perspective-taking (Castano et al., 2020; Dodell-Feder & Tamir, 2018; Keen, 2007; Kidd & Castano, 2013; Leverage et al., 2010; Mumper & Gerrig, 2017; Wolf, 2018; Zunshine, 2006), focus and attention, cognitive patience (Baron, 2021; Wolf, 2016, 2018), our grasp of the complexity of humans and situations (Mar & Oatley, 2008), the ability to detect analogies and patterns and drawing inferences (Wolf, 2018), evaluating different points of view, knowledge beyond the immediate purpose, and, finally, creativity, imagination and mental imagery (Brosch, 2018). Higher-level reading is a central mechanism for personal development, and it is central for critical thinking.

Given the wide range of benefits of good critical and analytical thinking for individuals and for society, the neglect of higher-level reading skills in PISA is to be deplored.

4. The neglect of higher-level reading skills in PISA

The effectiveness and general significance of (long-form) print reading for the development and refinement of reading skills, is beyond doubt, and well-established in research. Yet the digitalization of educational contexts continues and has, in many countries, accelerated in the time since 2009, with schools at all levels implementing screen technologies for learning across the curriculum – often at the cost of print textbooks (see for the U.S. e.g., Lang, 2021; the same trend can be observed everywhere). Reflecting this dominance of digital over paper-based reading in educational systems as well as in society overall, PISA 2018 replaced the paper-based reading test with a digital test. While the reading construct is claimed to remain largely the same, the digital platform does introduce a number of significant changes in how reading is conceptualized and assessed. The PISA reading literacy framework defines reading as “understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one’s goals, to develop one’s knowledge and potential and to participate in society” (OECD, 2019, p. 28). Such a definition may seem broadly applicable and in line with most approaches to reading and literacy. However, the transition of the assessment to a digital platform reveals a marked shift in focus with potentially wide-ranging implications. The digital delivery of the 2018 PISA test motivated and justified several major changes to the ways in which reading is assessed: (1) a greater emphasis on multiple-source texts; (2) the inclusion of increasingly multimodal materials which best reflects reading on the internet; (3) a stronger focus on reading as information processing for the purpose of efficient navigation and access, critical evaluation and knowledge acquisition. Hence, there is less focus on the reading of a single text, and no narrative texts are included. In other words, PISA appears to have gradually adapted its framework and definition of reading in direct response to the features of a digital platform. It now measures skills geared towards the perceived demands of the new digital reality, including ‘scenarios’ – that is, clusters of multimodal material that can present conflicting information on a topic, requiring readers to navigate between digital resources in which the textual modality is only one part (and often not even the dominant one). Often, these scenarios contain instances of conflicting information, so that readers are required to critically evaluate the information and source.

The skills entailed in navigating such ‘scenarios’ are no doubt also important today, and should be a *part* of what counts as “reading skills”. However, they must be supplemented with skills pertaining to the reading of longer, linear, single (narrative and expository)

texts. When an influential reading assessment such as PISA defines reading as “reading on the internet” and leaves out a range of vital aspects of reading, it sends a strong signal that the reading to be in focus is, merely, that which can be done on a computer. This is a move that warrants heightened awareness from scholars and scientists, as well as from practitioners and policy makers. There can be little doubt of a ‘PISA effect’: that which is tested will be taught. Given that it is print reading skills that predict and scaffold digital reading skills, and not vice-versa, the recent changes in the PISA framework should therefore be questioned.

5. Technologies, reading and/or literacy

What can we currently say about the impact of digitalization on reading? The first thing to notice, is that research in this field is heterogeneous, in terms of terminology, as well as theoretically and methodologically (Baron, 2015, 2021; Coiro, 2021; Mangen & van der Weel, 2016; Trasmundi et al., 2021). Such a heterogeneity makes it difficult to establish a clear sense of the extent to which the medium makes a difference. However, the publication of several meta-analyses (Clinton, 2019; Delgado et al., 2018; Kong et al., 2018) during the past couple of years has contributed to a better understanding of this issue, at least with respect to a certain aspect of reading, namely, reading comprehension of linear texts. The most comprehensive of the meta-analyses (Delgado et al., 2018) included 54 studies (N = 171,055 students) published between 2000 and 2017, and found an advantage of paper over digital reading for the reading of informational, but not for narrative, texts. Delgado et al. (2018) also found that the screen inferiority had in fact increased rather than decreased, during the roughly 20-year period studied. Hence, the picture is clear with respect to the reading of single and relatively short (typically less than 2000 words) informational texts without any digital enhancements (e.g., hyperlinks, animation, sound, interactivity): paper gives better support for reading comprehension.

The findings from the Delgado et al. (2018) meta-analysis are referenced in the PISA 2018 report, along with a few other studies showing a superiority of paper for other aspects of reading (e.g., Mangen et al. 2019). However, the overall impression – from the PISA 2018 report, as well as from much cognitively oriented research on reading and digitalization – is that results such as those from the meta-analyses (Clinton, 2019; Delgado et al., 2018; Kong et al., 2018) are considered to concern a merely minor, even marginal, aspect of reading and literacy. What continues to be in focus, is the potential in digital technologies to tailor information, tasks and tests for the diversity of students, and to find ways to train students’ critical thinking, reading and literacy by using digital material – often multimodal texts from multiple sources.

There is, moreover, little evidence that higher-level reading skills such as those on which this article focuses, are recognized in school curricula – not even in subjects such as language arts and literature. A large observational study in Norway, for instance, showed that the reading of literature in 9th grade classrooms consisted mainly of the reading of excerpts (that is, shorter texts), and that the purpose of the reading was to place the piece of literature in the correct historical period, to identify the use of various literary devices and tropes (e.g., metaphor, symbol, contrast), and to exemplify these in order that the students could use them in their own writing (Gabrielsen et al., 2019). Literary reading, in other words, was limited to the occasional use of short texts, which served merely as exemplars for students’ own writing – typically, on computers.

The downward trend in reading shown by the PISA 2018 results involves a decline in three spheres in any admixture depending on geographical area: in the time spent on long-form reading, in reading motivation and in reading performance. Reading statistics indicate that today’s media environment is not particularly conducive to developing reading skills (e.g., Read NZ, 2019, pp. 6-7). It has been shown that as much as one quarter of the American population does not read books (see <https://www.pewresearch.org/fact-tank/2021/09/21/who-doesnt-read-books-in-america/>). A third of the German adult population reads in a book less than once per month (<https://de.statista.com/statistik/daten/studie/171231/umfrage/haeufigkeit-des-lesens-von-einem-buch/>). Reading skills in the Netherlands declined from PISA 2015 to 2018, with motivation at an all-time low – lowest of all participating OECD countries (OECD, 2019; Gubbels et al., 2019). As we have seen, the PISA 2018 findings corroborate this picture, showing a similar trend across a large number of countries. This troubling trend is suggestively coincident with the rise of the popularity of the digital media. There are many reasons why a causal relationship may be suspected. Much empirical research has shown that, as the ‘Stavanger Declaration Concerning the Future of Reading’ puts it, the technology used for reading is ‘not neutral’. As already mentioned, empirical research (e.g., Delgado et al. 2018, Clinton 2019, Kong et al. 2018) has conclusively shown that paper supports comprehension better than screens, especially in the case of longer and more complex texts. These meta studies do not focus on identifying the causes, but the body of research clearly suggests a number of culprits. Until recently most research attention has gone to how the screen as a reading substrate differs from paper. Laptop and tablet (iPad) screens have, for example, been found to tire the reader more easily than paper (Benedetto et al., 2014; Jeong, 2012; Siegenthaler et al., 2012). This is – or was, since screen technology has significantly improved in recent years – the result of lower resolution, slow refresh rates, and backlighting. It has also been established that such features as scrolling and hypertext – characteristic of most digital substrates – require cognitive resources over and above what paper reading requires (DeStefano & LeFevre, 2007). This ‘cognitive overhead’ results from the way scrolling and hypertext confuse the user’s spatial orientation, in turn affecting memory (which is intimately connected with location). The mental need for things (including information) to have ‘a physical address’ is more generally connected to our embodied cognition (Fincher-Kiefer, 2019; Laughlin, 2016; Mangen, 2008; Shapiro, 2010; Shapiro & Stolz, 2019; Trasmundi et al., 2021). We may find it harder to cope with screen devices because their haptic affordances do not correspond with the way we experience the material world, also pointing to the role of embodied cognition.

6. Deep reading vs. the digital infrastructure

The most likely explanation for the negative correlation between extensive digital reading and reading skills is actually the invisible elephant in the room: the grip of the digital infrastructure on our existence. This expresses itself in numerous ways. To begin with,

much if not most of the reading we do on screens is of *short snippets of texts* appearing in a variety of contexts. We check the news, updates on social media, and search for particular information, switching fast and seamlessly between a range of various sources of multimedia messages in which written text – if at all present – may have a marginal place. Such “reading on the prowl” (Baron, 2015, p. 22) has largely replaced the extensive, long-form reading of exclusively written texts, such as novels in books, or longer texts in print textbooks. The disappearance of long-form reading is evident also in higher education, where university professors are assigning shorter and/or less complex texts because they realize that students are unprepared for the careful reading of potentially challenging long-form texts (Baron & Mangen, 2021).

Digital media are often used as a *replacement for textual information*, in education as well as for leisure. Examples include YouTube and Ted Talk videos and, of late, audiobooks (Baron, 2021; Baron & Mangen, 2021). Here the fact that other modalities than text are less cognitively demanding plays an important role. Audiobooks are a case in point. In her summary of research in this field, Baron (2021) observes that studies in psychology have overwhelmingly concluded that we remember more when we read than when we listen (e.g., Furnham 2001, Schüler et al. 2013). Plausible reasons pertain to the durability of writing vs. the ephemerality of sound, the fact that the reader (but not the listener) is in control of her pace, the ease of re-reading (compared with re-listening), the ability to skim or skip passages (in reading) and the ways in which written texts “typically provide visual landmarks dividing the reading into chunks, including periods, new paragraphs, sub-headers, or page breaks. [...] Audio books tend to be an unbroken stream” (Baron, 2021, p. 182). However, where comprehension is concerned, no systematic effect of modality was found (Clinton-Lisell, 2021; Singh & Alexander, 2022).

Digital media and the digital infrastructure also make *overriding attentional demands*, taking precedence over other (leisure) pursuits, leaving less time available for reading (e.g., Johnson 2019). Algorithms underlying the social media, for example, make it hard for us to log off, and polarize societies by sorting us into groups of like-minded people: the “echo-chambers” where views and understanding of reality – however skewed – are nurtured and amplified, without any reality check other than that provided by social media. As also Schleicher is forced to acknowledge, “those algorithms are not a design flaw, they are how social media works” (OECD, 2021a, p 3).

Even when digital media are used for reading, the *competing attractions of the multimodal digital environment* are major contributors to distraction. Frequent use of digital media reduces expectations of and tolerance for length and active cognitive engagement. A key claim of the so-called Shallowing Hypothesis (Annisette & Lafreniere, 2017) is that increased use of digital technologies has led to a decline in reflective thought. In particular, social media – prompting frequent and intermittent engagement with snippets of decontextualized multimedia messages, along with expectations of instant responses and “rewards” (e.g., likes) – are thought to promote rapid, shallow thought if used too frequently. Such shallowing can have implications for a variety of cognitive tasks. Studies have found that frequent use of social media is negatively correlated with reading comprehension (Duncan et al., 2015; Pfof et al., 2013), self-reported sense of distraction during academic reading (Levine et al., 2007), ability to correctly select reliable sources among conflicting information (Macedo-Rouet et al., 2020) and, more broadly, academic performance (Lee & Wu, 2013; see Huang 2018 for a meta-analysis). Also, digital text forms can be presented in a much more alluring way than static print. The use of color and movement, and the option of having the text read aloud all appeal to the distractable brain, thus detracting from the attractiveness of printed text. Reading on screens also neglects the embodied and multisensory dimensions of reading.

If *digital text is not taken as seriously as paper*, as is suggested by, for example, Delgado et al. (2018), this is likely to be exacerbated in the online condition. Many contributing factors may be surmised. The ephemeral nature of digital texts allows both their form and content to be readily changed without warning; they can be here today, gone tomorrow. In this way, digital media and the digital infrastructure may be said to undermine the authority of text. The fact that anyone can publish online and be an ‘author’ could also well be regarded as ‘cheapening authorship’. Moreover, digital text might suffer from the lack of predictability and reliability of the user interface compared to paper. Every time the hardware and software are updated, users need to familiarise themselves again with the interface. Such unpredictability may serve to undercut textual authority (van der Weel 2019, 2020).

Lastly, digital media and the digital infrastructure foster an *unrealistic sense of agency and control*, contributing to overconfidence and inaccurate calibration – that is, poor metacognition/-comprehension – of one’s own reading. Overconfidence on the part of screen readers has been demonstrated in empirical research, with adults (Ackerman & Goldsmith, 2011) as well as children (Halamish & Elbaz, 2020). The fact that screens are often regarded, both by the young readers themselves and by their teachers (as well as many media critics) as their natural realm contributes to overconfidence in the digital condition (van der Weel, 2020).

7. What reading do we want, and need, in the future? Some concluding thoughts

The abiding faith in the potential of digital technologies to bolster perhaps especially critical reading has yet to be backed by empirical evidence. In contrast, what is established beyond any reasonable doubt in research is the robust contribution of long-form, print reading – of books; often narrative – in the development and honing of a range of important reading skills (Cunningham & Stanovich, 1990; Mol & Bus, 2011). This continues to be the case even in a time of increasing digitalization. Pfof et al. (2013), for instance, found that the best readers in a longitudinal study read books frequently, while the poorest readers did not read much, and instead used digital devices extensively. The poorest readers did not read books, and Pfof et al. (2013) even found their digital media use to have a negative impact on reading performance. Duncan et al. (2016) similarly found that reading of – printed – books predicted reading comprehension ability whereas digital reading did not. Extending this line of research and using the PISA 2009 database with data for more than 250 000 teenagers from across 35 OECD countries, Jerrim and Moss (2019) found evidence that teenagers who spend more time reading, specifically *fiction texts* (typically, novels and stories in books), have significantly stronger reading skills than peers who do not read, or read less, fiction. The authors call it the “fiction effect”, since no associations were found between the

frequency of reading non-fiction, news, magazines, or comics, and reading skill (Jerrim & Moss, 2019). A recent longitudinal study from Finland corroborates these findings. Torppa et al. (2020) looked at associations between leisure reading (of books, magazines, newspapers, and digital reading) and reading skills of 2 525 students aged 7 to 16. They found that (paper) book reading in particular predicted better reading comprehension, whereas digital reading was negatively correlated with reading skills.

In light of such established knowledge, it is timely to make a few observations related to a webinar (OECD, 2021b) following the publication of the 2019 PISA report, *21st century readers: Developing literacy skills in a digital world* (OECD, 2021a). Here, Andreas Schleicher, Director for the Directorate of Education and Skills in OECD, presented some findings regarding the relationship between use of digital technology in various school activities, and students' performance on the PISA 2018 reading test. Calling it "perhaps the most disturbing finding from this report" (OECD, 2021b, 11'23"), he presented a slide showing that, the higher/more frequent the use of digital technology in the classroom, the worse the students performed on the digital reading test. Dr. Schleicher apparently found these results very surprising. However, such negative associations between frequent digital technology use and reading skills could be seen already in the OECD report *Students, Computers and Learning – Making the Connection* (OECD, 2015), which compared students' reading performance in the digital PISA reading test 2009, reported in *Students Online* (OECD, 2011), with the ordinary PISA 2009 reading test, which was then still paper-based. Whereas the results showed that *some* use of digital technologies in schools seemed to be slightly better than no use at all, the conclusion was clear: "PISA results show no appreciable improvements in student achievement in reading, mathematics or science in the countries that had invested heavily in ICT for education" (OECD, 2015, p. 15). Frequent use of digital technologies, in fact, was associated with significantly poorer student performance on the key measures (OECD, 2015, p. 16).

Adding to this rather glum picture, PISA 2018 data also revealed that, in all the participating countries, students who reported that they read books more often on paper than digitally, performed significantly better on the reading test (OECD, 2021a). The paper readers also reported spending more time than screen readers reading for enjoyment, which is a well-known factor contributing to the development of reading skills (e.g., Smith et al. 2012, Sullivan & Brown 2015). Based on these results, Dr. Schleicher concluded in the abovementioned webinar that "performance and enjoyment seems somehow related to the format, and the materials in which we read [...]" (OECD, 2021b, 29'35"). Clearly, paper-based reading still has an important role in an increasingly digitized world, and the question of which technology – paper books or digital devices – to use for which types of texts, reading context and learning purpose, warrants more careful consideration than is commonly the case, among scholars of reading and literacy, as well as among practitioners and policymakers. As it is, it remains to be seen what is left of the reading of textual information, let alone a single text, in the next PISA cycle in which reading is the main domain – in 2027.

These critical remarks notwithstanding – we do not of course oppose the use of digital technologies in general. It makes no sense to blame the digital media for all misfortune befalling long-form deep reading. Historically, long-form reading has probably been in decline at least since the advent of the mass media, in particular television (e.g., Knulst & Kraaykamp 1998). Though research is needed to establish a firm correlation, if not a causal relationship, with any certainty it is likely that especially people from, typically, lower socio-economic backgrounds replaced reading by, in particular, watching television (see e.g. <https://www.nytimes.com/2018/10/26/style/digital-divide-screens-schools.html>). To the extent that deep reading depends on long-form reading, this also marks the start of the decline of deep reading (Garfinkle, 2020). It bears emphasizing that today again the attraction of screens is especially strong for disadvantaged children, carrying the danger of a secondary (=cognitive) 'digital divide' (<https://www.nytimes.com/2018/02/11/opinion/america-digital-divide.html?module=inline>).

The solution to these challenges is of course not a wholesale return to paper in each and every reading situation. However, we need to make sure that long-form reading of linear, written texts is not further marginalized in the scholarly and policy-guiding discourse on reading and literacy. As Baron concluded, in her 2015 book, *Words On Screen*: the real question is whether the affordances of reading on screen lead us to a new normal. One in which length and complexity and annotation and memory and rereading and especially concentration are proving more challenging than when reading in hardcopy. One in which we are willing to say that if the new technology does not encourage these approaches to reading, maybe these approaches are not so valuable after all. Is this the new normal we want? (Baron, 2015, p. 235)

The years that have passed since the publication of Baron's book have only served to make this an even more pressing question. If we want the ability to read longer, more complex, single texts – whether narrative, literary or others – to be among the so-called 21st century skills, we need to critically reconsider the PISA-driven conceptualization of reading and acknowledge – and perhaps even privilege – modes of reading which go beyond the Internet.

References

- Ackerman, R., & Goldsmith, M. (2011). Metacognitive regulation of text learning: On screen versus on paper. *Journal of Experimental Psychology: Applied*, 17(1), 18–32. <https://doi.org/10.1037/a0022086>
- Annisette, L. E., & Lafreniere, K. D. (2017). Social media, texting, and personality: A test of the shallowing hypothesis. *Personality and Individual Differences*, 115, 154–158.
- Balling, G., Begnum, A. C., Kuzmíčová, A., & Schilhab, T. (2019). The young read in new places, the older read on new devices: A survey of digital reading practices among librarians and information science students in Denmark. *Participations*, 16(1), 197–236.
- Baron, N. S. (2015). *Words on screen: The fate of reading in a digital world*. USA: Oxford University Press.
- Baron, N. S. (2021). *How we read now: Strategic choices for print, screen, and audio*. Oxford University Press.
- Baron, N. S., & Mangen, A. (2021). Doing the reading: The decline of long long-form reading in higher education. *Poetics Today*, 42(2), 253–279. <https://doi.org/10.1215/03335372-8883248>
- Barzillai, M., Thomson, J., Schroeder, S., & van den Broek, P. (Eds.). (2018). *Learning to read in a digital world*. John Benjamins Publishing Company.
- Bavishi, A., Slade, M. D., & Levy, B. R. (2016). A chapter a day: Association of book reading with longevity. *Social Science & Medicine*, 164, 44–48. <https://doi.org/10.1016/j.socscimed.2016.07.014>
- Benedetto, S., Drai-Zerbib, V., Pedrotti, M., Tissier, G., & Baccino, T. (2013). E-readers and visual fatigue. *PLoS One*, 8(12), e83676.

- Benedetto, S., Carbone, A., Drai-Zerbib, V., Pedrotti, M., & Baccino, T. (2014). Effects of luminance and illuminance on visual fatigue and arousal during digital reading. *Computers in Human Behavior*, 41, 112–119.
- Billington, J. (2019). *Reading and mental health*. Springer Nature.
- Boyes, M. E., Leita, S., Claessen, M., Badcock, N. A., & Nayton, M. (2016). Why are reading difficulties associated with mental health problems? *Dyslexia*, 22(3), 263–266. <https://doi.org/10.1002/dys.1531>
- Britt, M. A., Rouet, J., & Durik, A. M. (2017). *Literacy beyond text comprehension: A theory of purposeful reading*. Routledge.
- Brosch, R. (2018). What we 'see' when we read: Visualization and vividness in reading fictional narratives. *Cortex*, 105, 135–143. <https://doi.org/10.1016/j.cortex.2017.08.020>
- Burke, M. (2010). *Literary reading, cognition and emotion: An exploration of the oceanic mind*. Routledge.
- Castano, E., Martingano, A. J., & Perconti, P. (2020). The effect of exposure to fiction on attributional complexity, egocentric bias and accuracy in social perception. *PLOS ONE*, 15(5), Article e0233378. <https://doi.org/10.1371/journal.pone.0233378>
- Clinton-Lisell, V. (2021). Listening ears or reading eyes: A meta-analysis of reading and listening comprehension comparisons. *Review of Educational Research*, Article 00346543211060871.
- Clinton, V. (2019). Reading from paper compared to screens: A systematic review and meta-analysis. *Journal of Research in Reading*. <https://doi.org/10.1111/1467-9817.12269>. Online first.
- Coiro, J. (2021). Toward a multifaceted heuristic of digital reading to inform assessment, research, practice, and policy. *Reading Research Quarterly*, 56(1), 9–31.
- Cunningham, A. E., & Stanovich, K. E. (1990). Early spelling acquisition: Writing beats the computer. *Journal of Educational Psychology*, 82, 159–162.
- Delgado, P., Vargas, C., Ackerman, R., & Salmerón, L. (2018). Don't throw away your printed books: A meta-analysis on the effects of reading media on reading comprehension. *Educational Research Review*, 25, 23–38. <https://doi.org/10.1016/j.edurev.2018.09.003>
- DeStefano, D., & LeFevre, J. A. (2007). Cognitive load in hypertext reading: A review. *Computers in Human Behavior*, 23(3), 1616–1641. <https://doi.org/10.1016/j.chb.2005.08.012>
- Dodell-Feder, D., & Tamir, D. I. (2018). Fiction reading has a small positive impact on social cognition: A meta-analysis. *Journal of Experimental Psychology General*, 147(11), 1713–1727. online first.
- Duncan, L. G., McGeown, S. P., Griffiths, Y. M., Stothard, S. E., & Dobai, A. (2016). Adolescent reading skill and engagement with digital and traditional literacies as predictors of reading comprehension. *British Journal of Psychology*, 107(2), 209–238.
- Fincher-Kiefer, R. (2019). *How the body shapes knowledge: Empirical support for embodied cognition*. American Psychological Association.
- Furnham, A. (2001). Remembering stories as a function of the medium of presentation. *Psychological Reports*, 89, 483–486.
- Gabrielsen, I., Blikstad-Balas, M., & Tengberg, M. (2019). The role of literature in the classroom: How and for what purposes do teachers in lower secondary school use literary texts? *L1 Educational Studies in Language and Literature*, 19, 1–32. <https://doi.org/10.17239/L1ESLL-2019.19.01.13>
- Garfinkle, A. (2020). *The erosion of deep literacy*, 43. National Affairs (Spring).
- Gerčar, & van der Weel, A. (in prep.). 2022 Reading health and the reading index.
- Gubbels, J., van Langen, A., Maassen, N., & Meelissen, M. (2019). *Resultaten PISA-2018 in vogelvlucht*. Universiteit Twente. https://ris.uwente.nl/ws/portalfiles/portal/160130971/Resultaten_PISA_2018_in_vogelvlucht.pdf.
- Halamish, V., & Elbaz, E. (2020). Children's reading comprehension and metacognition on screen versus on paper. *Computers & Education*, 145, Article 103737. <https://doi.org/10.1016/j.compedu.2019.103737>
- Hari, J. (2022). *Stolen focus: Why you can't pay attention*. London: Bloomsbury Publishing.
- Hisgen, R., & van der Weel, A. (2022). *De lezende mens: De betekenis van het boek voor ons bestaan*. Amsterdam: Atlas Contact.
- Huang, C. (2018). Social network site use and academic achievement: A meta-analysis. *Computers & Education*, 119, 76–83.
- Jeong, H. (2012). A comparison of the influence of electronic books and paper books on reading comprehension, eye fatigue, and perception. *The Electronic Library*, 30(3), 390–408.
- Jerrim, J., & Moss, G. (2019). The link between fiction and teenagers' reading skills: International evidence from the OECD PISA study. *British Educational Research Journal*, 45(1), 181–200. <https://doi.org/10.1002/berj.3498>
- Johnson, S. (2019). The fall, and rise, of reading. *Chronicle of higher education*, April 21. <https://www.chronicle.com/article/the-fall-and-rise-of-reading/>.
- Keen, S. (2007). *Empathy and the novel*. Oxford University Press.
- Kidd, D. C., & Castano, E. (2013). Reading literary fiction improves theory of mind. *Science*, 342(6156), 377–380. <https://doi.org/10.1126/science.1239918>
- Knulst, W., & Kraaykamp, G. (1998). Trends in leisure reading: forty years of research on reading in the Netherlands'. *Poetics*, 26(1), 21–41.
- Kong, Y., Seo, Y. S., & Zhai, L. (2018). Comparison of reading performance on screen and on paper: A meta-analysis. *Computers & Education*, 123, 138–149. <https://doi.org/10.1016/j.compedu.2018.05.005>
- Kovač, M., Phillips, A., van der Weel, A., & Wischenbart, R. (2019). What is a Book? *Publishing Research Quarterly*, 35(3), 313–326.
- Kovač, M., Mangen, A., Schüller-Zwierlein, A., & van der Weel, A. (in prep.). 2022 Higher-level reading manifesto.
- Köpper, M., Mayr, S., & Buchner, A. (2016). Reading from computer screen versus reading from paper: Does it still make a difference? *Ergonomics*, 59(5), 615–632.
- Lang, J. M. (2021). Why We Need to Rethink Digital Reading. *Chronicle of Higher Education*. June 21 <https://www.chronicle.com/article/why-we-need-to-rethink-digital-reading>.
- Laughlin, T. M. (2016). *Reading and the body: The physical practice of reading*. Springer.
- Lee, Y. H., & Wu, J. Y. (2013). The indirect effects of online social entertainment and information seeking activities on reading literacy. *Computers & Education*, 67, 168–177.
- Leverage, P., Mancing, H., & Schweickert, R. (Eds.). (2010). *Theory of mind and literature*. Purdue University Press.
- Levine, L. E., Waite, B. M., & Bowman, L. L. (2007). Electronic media use, reading, and academic distractibility in college youth. *Cyber Psychology & Behavior*, 10(4), 560–566.
- Macedo-Rouet, M., Salmerón, L., Ros, C., Pérez, A., Stadler, M., & Rouet, J. F. (2020). Are frequent users of social network sites good information evaluators? An investigation of adolescents' sourcing abilities. *Journal for the Study of Education and Development*, 43(1), 101–138.
- Magyari, L., Mangen, A., Kuzmičová, A., Jacobs, A. M., & Lüdtkke, J. (2020). Eye movements and mental imagery during reading of literary texts with different narrative styles. *Journal of Eye Movement Research*, 13(3).
- Mangen, A. (2008). Hypertext fiction reading: Haptics and immersion. *Journal of Research in Reading*, 31(4), 404–419.
- Mangen, A., & van der Weel, A. (2016). The evolution of reading in the age of digitisation: An integrative framework for reading research. *Literacy*, 50(3), 116–124.
- Mangen, A., Olivier, G., & Velay, J. L. (2019). Comparing comprehension of a long text read in print book and on Kindle: Where in the text and when in the story? *Frontiers in Psychology Cognitive Science*, Article 38. <https://doi.org/10.3389/fpsyg.2019.00038>
- Mar, R. A., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science*, 3(3), 173–192.
- Moje, E. B., Afferbach, P. P., Enciso, P., & Lesaux, N. K. (2020). *Handbook of reading research*, V. Routledge. <https://doi.org/10.4324/9781315676302>. Volume.
- Mol, S. E., & Bus, A. G. (2011). To read or not to read: A meta-analysis of print exposure from infancy to early adulthood. *Psychological Bulletin*, 137(2), 267–296. <https://doi.org/10.1037/a0021890>
- Mumper, M. L., & Gerrig, R. J. (2017). Leisure reading and social cognition: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, 11(1), 109–120. <https://doi.org/10.1037/aca0000089>
- Oatley, K. (1999). Why fiction may be twice as true as fact: Fiction as cognitive and emotional simulation. *Review of General Psychology*, 3(2), 101–117.
- Oatley, K. (2016). Fiction: Simulation of social worlds. *Trends in Cognitive Sciences*, 20(8), 618–628.
- OECD. (2011). *PISA 2009 results: Students on line: Digital technologies and performance (Volume VI)*, VI. OECD. <https://doi.org/10.1787/9789264112995-en>. Vol.
- OECD. (2015). *Students, computers and learning*. OECD Publishing. <https://doi.org/10.1787/9789264239555-en>
- OECD. (2019). *PISA 2018 results (Volume I): What students know and can do*. OECD. <https://doi.org/10.1787/5f07c754-en>
- OECD. (2021a). *21st-Century Readers: Developing Literacy Skills in a Digital World*. OECD. <https://doi.org/10.1787/a83d84cb-en>

- OECD. (2021b). *21st-century readers: Developing literacy skills in a digital world – webinar*. OECD. <https://www.oecd.org/education/21st-century-readers-a83d84cb-en.htm>.
- Pfost, M., Dörfler, T., & Artelt, C. (2013). Students' extracurricular reading behavior and the development of vocabulary and reading comprehension. *Learning and Individual Differences*, 26, 89–102. <https://doi.org/10.1016/j.lindif.2013.04.008>
- Rea, A. (2020). How serious is America's literacy problem? *Library Journal*. <https://www.libraryjournal.com/detailStory=How-Serious-Is-Americas-Literacy-Problem>.
- Rose, E. (2013). *On reflection: An essay on technology, education, and the status of thought in the 21st century*. Canadian Scholars' Press.
- Rouet, J. F., Britt, M. A., & Durik, A. M. (2017). RESOLV: Readers' representation of reading contexts and tasks. *Educational Psychologist*, 52(3), 200–215.
- Schüler, A., Scheiter, K., & Gerjets, P. (2013). Is spoken text always better? Investigating the modality and redundancy effect with longer text presentation. *Computers in Human Behavior*, 29, 1590–1601.
- Shapiro, L. (2010). *Embodied cognition (16116091)*. Routledge.
- Shapiro, L., & Stolz, S. A. (2019). Embodied cognition and its significance for education. *Theory and Research in Education*, 17(1), 19–39. <https://doi.org/10.1177/1477878518822149>
- Siegenthaler, E., Bochud, Y., Bergamin, P., & Wurtz, P. (2012). Reading on LCD vs e-Ink displays: Effects on fatigue and visual strain. *Ophthalmic and Physiological Optics*, 32(5), 367–374.
- Singh, A., & Alexander, P. A. (2022). Audiobooks, print, and comprehension: What we know and what we need to know. *Educational Psychology Review*, 34, 677–715. <https://doi.org/10.1007/s10648-021-09653-2>
- Smith, J. K., Smith, L. F., Gilmore, A., & Jameson, M. (2012). Students' self-perception of reading ability, enjoyment of reading and reading achievement. *Learning and Individual Differences*, 22(2), 202–206. <https://doi.org/10.1016/j.lindif.2011.04.010>
- Snowling, M. J., & Hulme, C. E. (2005). *The science of reading: A handbook*. Malden, MA: Blackwell Publishing.
- Sullivan, A., & Brown, M. (2015). Reading for pleasure and progress in vocabulary and mathematics. *British Educational Research Journal*, 41(6), 971–991. <https://doi.org/10.1002/berj.3180>
- Torppa, M., Niemi, P., Vasalampi, K., Lerkkanen, M., Tolvanen, A., & Poikkeus, A. (2020). Leisure reading (but not any kind) and reading comprehension support each other—a longitudinal study across grades 1 and 9. *Child Development*, 91(3), 876–900. <https://doi.org/10.1111/cdev.13241>
- Trasmundi, S. B., Kokkola, L., Schilhab, T., & Mangen, A. (2021). A distributed perspective on reading: Implications for education. *Language Sciences*, Article 101367. <https://doi.org/10.1016/j.langsci.2021.101367>
- van der Weel, A. (2020). Behind the screen looms a new Gutenberg revolution. *TXI*, 1–8.
- van der Weel, A. (2011). *Changing our textual minds: Towards a digital order of knowledge*. Manchester University Press.
- van der Weel, A. (2019). Literary authorship in the digital age. In I. Berensmeyer, G. Buelens, & M. Demoor (Eds.), *Cambridge handbook of literary authorship* (pp. 218–234). Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781316717516.014>.
- Wolf, M. (2008). *Proust and the squid: The story and science of the reading brain*. New York: Harper Perennial.
- Wolf, M. (2016). *Tales of literacy for the 21st century*. Oxford University Press.
- Wolf, M. (2018). *Reader, Come Home: The Reading Brain in a Digital World*. Harper.
- Zunshine, L. (2006). *Why we read fiction: Theory of mind and the novel (061026093)*. Ohio State University Press.