

Literary Reading on Paper and Screens: Associations Between Reading Habits and Preferences and Experiencing Meaningfulness

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ABSTRACT

The increasing use of digital technologies has implications for reading. Online and on-screen reading often consist of engaging with multiple, short, multimedia snippets of information, whereas longform reading is in decline. Meta-analyses have identified a screen inferiority when reading informational texts, but not narrative texts. The mode effect is explained by reference to the Shallowing Hypothesis, postulating that increased screen reading leads to a propensity to skim and scan rather than carefully read, since digital reading material is typically composed of short, decontextualized snippets of multimedia content rather than long, linear, texts. Experiments have found support for the Shallowing Hypothesis when reading expository/informational texts, but the impact of increased habituation to screens on, specifically, literary reading, is largely unknown. It is plausible that shallow modes of reading, prompted by increased screen use, may compromise one's capacity to engage deeply with literary texts and, in turn, negatively affect readers' motivation and inclination to engage in slower, more reflective, and more effortful reading. This article presents the results from three experiments exploring associations between reading behavior, medium preferences, and the reading of a short literary text on paper versus screen. Although mixed, the results revealed an overall pattern for the role of medium: more frequent reading of short texts on screen predicted less inclination to muster the cognitive persistence required for reading a longer text, and engage in contemplation on the deeper and personally relevant meaning of the literary text. Educational implications of these findings are discussed.

Introduction: Changing Reading Patterns and Habits in the Digital Age

The ongoing transition from reading on paper to reading on digital devices has a number of potentially far-reaching implications, and understanding the role of digitization for our modes of reading is of fundamental importance. The impact of digitization on reading is a complex and multifaceted research area (see Baron, 2020 for an overview), ranging from controlled experiments comparing the effects of the medium (paper versus screens) on, for example, comprehension or recall, to survey studies about students' medium preferences and reading habits, to ethnographic studies on people's reading behavior across media and texts. The focus of the present study is on the potential correlations between readers' self-reported reading preferences, habits, and behavior, and experiential aspects after reading a literary short story on paper versus on screen.

Reading and media use statistics reveal that digitization affects reading patterns and habits across the Western world (Gelles-Watnick & Perrin, 2021; Statista, 2022; van der Weel & Mangen, 2022). For adults as well

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as for younger readers, reading of short, digital, multimedia texts is becoming the norm, whereas the sustained reading of longer, linear texts, typically in books, is in decline (Baron, 2015, 2021; Kovač & van der Weel, 2018; OECD, 2019; Rideout & Robb, 2019; Twenge et al., 2019).

The waning of pleasure reading reported is reflected in international large-scale reading and literacy surveys with children (10–11-year olds; PIRLS¹) and teenagers (15-year olds; PISA²). In several countries, reading performance has declined since 2009 (when reading was the main domain, like in 2018). This dwindling is accompanied by a significant drop in the number of teenagers reporting that they enjoy reading for pleasure (OECD, 2019). 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, 2021). 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). Another large-scale international reading assessment, PIRLS, shows the same trend (Mullis et al., 2023): pleasure reading is in decline, whereas online reading of multimodal and multimedia texts on screens, as in social media, is increasing. In light of evidence showing the plausibly unique contributions of pleasure reading to reading skills (e.g., Jerrim & Moss, 2019; Mol & Bus, 2011; Pfof et al., 2013; Torppa et al., 2020), the impact of digitization on the habits and processes of reading warrants empirical scrutiny.

The present study contributes to current research on the impact of increasing digitization on reading by exploring the associations between reading media habits, narrative engagement, and meaning-seeking responses—what we term “reading for meaning”—when reading a literary short story on paper versus on screen. Reading for meaning, in this context, refers to an engagement with a text which goes beyond the mere comprehension of its semantic content. As such, it is associated with what is in media psychology referred to as *eudaimonic* motives, reflecting a type of textual engagement that is aimed at the “search for and ponder life’s meaning, truth and purposes” (Oliver & Raney, 2011, p. 985). Eudaimonic motives, that is, the search for meaningful (media) experiences that can contribute to personal growth and insight, are typically contrasted with hedonic (pleasure-seeking) motives, where readers look for more short-term, immediately gratifying and, above all, *pleasurable* experiences in their engagement with media and texts.

Our application of the terms eudaimonic and hedonic derives from definitions in media psychology, which in turn is based on positive psychology (see Kjell, 2011) and originates in thinking in ancient Greece about the good life (e.g., Aristotle, 1962). In relation to (media) stories, hedonic experiences are characterized by positive affect, pleasure,

and amusement, whereas eudaimonic experiences allow “us to grapple with life meanings, to realize our connections, and to feel grateful for our life’s poignancies.” (Oliver et al., 2017, p. 268). According to Oliver (2008, p. 42), eudaimonic motives for media/text use consist in a wish or need for “greater insight, self-reflection, or contemplations of poignancy or meaningfulness (e.g., what makes life valuable)”. Thus, in her study on readers’ preferences for reading sad books (i.e., narratives evoking feelings of sorrow in readers, by depicting tragic events), Koopman (2015) notes that eudaimonia is not about feeling *better* but about “feeling more complete, acquiring a broadened or deepened perspective of what it means to be human” (p. 21).

Central to our present research is the observation that eudaimonic experiences of gratification, in terms of helping us deal with life’s vicissitudes, rest on the reader’s ability and propensity to be absorbed into the text being read (Oliver et al., 2017, p. 268). Given what is known about the associations between reading enjoyment, pleasure reading, and reading skill (Duncan et al., 2016; Pfof et al., 2013; Torppa et al., 2020), one may wonder whether the current dominance of cognitive engagement with snippets of multimodal audiovisuals on screens, at the cost of sequential reading of single monomodal texts extending over several pages, may affect our propensity for absorption in literary texts. As for the label “literary”, this implies that the text selected as stimuli in the present experiments—namely, *Flight*, by Doris Lessing (1957)—is characterized by a degree of “literariness”, that is, by textual features and stylistic devices that deviate from ordinary language and everyday communication, hence prompting an effect of defamiliarization in the reader (Miall, 2006). As such, literariness can be conceptualized as a combination of the esthetic and the unconventional (Koopman & Hakemulder, 2015), and is often operationalized in contrast to genre or popular fiction, which to a higher degree is written in line with linguistic and stylistic conventions (Schwerin & Lenhart, 2022). Important for the present study is the assumption that literary texts may stimulate readers to reflect on the story and its implications for their personal lives, whereas texts low in literariness may be less conducive to such reading (Koopman & Hakemulder, 2015).

In the present study, we ask the question: what happens to the literary reading experience when readers’ ability to be absorbed declines?

Reading Comprehension on Paper and Screens

Recent technological advances, in particular the emergence of handheld devices such as touchscreen tablets (e.g., iPad) and e-readers (e.g., Kindle), have prompted scholarly interest in the role and impact of screen affordances on cognitive and emotional aspects of reading. Nevertheless, as observed by Coiro (2021), the multifaceted nature of the topic, and

the theoretical and methodological heterogeneity of the studies make it difficult to get a clear overview.

However, at least with respect to the effect of screen affordances on linear, single-text comprehension, the emergence of meta-analyses (Clinton, 2019; Delgado et al., 2018; Kong et al., 2018) and a review (Singer & Alexander, 2017) provide more clarity on the issue. Taken together, these overviews have identified a screen inferiority effect for comprehension when reading linear, informational texts but not for narrative texts.³ This effect is particularly pronounced for longer and more complex informational texts that require scrolling. The most comprehensive of the three meta-analyses (Delgado et al., 2018), comprised 54 studies ($N=171,055$ students) published between 2000 and 2017. It revealed an advantage of paper over digital reading. A comparable effect of medium on reading comprehension is reported in the two other meta-analyses (Clinton, 2019; Kong et al., 2018). Interestingly, the screen inferiority effect was consistent across studies using only informational texts, or a mix of informational and narrative texts, whereas there was no effect of medium in studies using only narrative texts (Delgado et al., 2018). More recent meta-analyses focusing specifically on the reading comprehension of narrative texts have confirmed this picture: compiling results from 32 studies ($N=2239$), Schwabe et al. (2022) found no negative effect of digital media on reading comprehension when reading narrative texts. Delgado et al. (2018, p. 35) conjecture that this may relate to how “[c]omprehending informational texts, compared to narratives, requires higher level processing, such as using complex academic vocabulary and structures, and these texts are less connected to real world knowledge, which makes them harder to comprehend.” Moreover, Delgado et al. (2018) found that the advantage of paper-based reading had in fact increased rather than decreased during the period 2000–2017. Perhaps surprising, this finding undermines the claims about the younger generation representing so-called “digital natives”, for whom reading on a screen is the new normal. Hence, it is claimed, they have developed superior screen reading performance as compared to older readers (see Prensky, 2001, for the original claim, and Bennett et al., 2008, and Helsper & Eynon, 2010, for critically examining the empirical evidence in support of “digital natives”).

Delgado et al. (2018) offer two hypotheses to explain the screen inferiority: The Shallowing Hypothesis and the Metacognitive Deficit Hypothesis. The shallowing hypothesis can be traced to Nicholas Carr, who in *The Shallows* (2010⁴) conjectured that increased use of the Internet promotes a shallowing of our mode of thought: The more we read on screens, the more we acquire a reading habit of quick and shallow skimming and scanning of texts. Eventually, this habit may “bleed over” to our modes of reading also on paper: “When we read for hours on a screen whose characteristics involve a rapid speed of information

processing, we develop an unconscious set toward reading based on how we read during most of our digital-based hours. If most of those hours involve reading on the distraction-saturated Internet, where sequential thinking is less important and less used, we begin to read that way even when we turn off the screen and pick up a book or newspaper” (Wolf, 2018, p. 79; see also Baron, 2021). The Shallowing Hypothesis, then, posits that our daily, extensive reading on digital media promotes a superficial way of relating with textual information, often entailing quick and superficial interactions driven by an urge for immediate rewards (Delgado et al., 2018). This may make it difficult to engage in more cognitively challenging modes of reading requiring sustained attention, such as the reading of a literary short story, irrespective of medium.

This tendency is closely related to the second hypothesis, having to do with metacognition—that is, the ability to monitor and control one’s own comprehension when reading. As we are facing challenges mobilizing cognitive patience (Wolf, 2018)—that is, the stamina and cognitive persistence required for engaging deeply with complex texts, we also seem to have difficulties gauging and calibrating our own reading on screens. Several studies (e.g., Ackerman & Lauterman, 2012; Halamish & Elbaz, 2020; Ronconi et al., 2022) have found that there is a tendency to overestimate our comprehension when reading on screens as compared to reading on paper, resulting in less accurate prediction of our own performance and insufficient time devoted to the reading task. The Metacognitive Deficit Hypothesis, then, posits that readers’ self-monitoring of their comprehension, including managing adequate time, attention and effort to the text, and task at hand, is poorer when reading on screen than when reading on paper.

In a recent experiment, Delgado and Salmerón (2021) tested both the Shallowing Hypothesis and the Metacognitive Deficit Hypothesis when reading somewhat lengthy texts (3010 words, distributed across four pages) on paper versus on screen. Aiming to disentangle the cognitive processes underlying shallow screen reading, they assessed students’ attention and meta-cognitive calibration when reading a longer text on paper versus on screen, with or without time restrictions. Using mind-wandering measures (the probe-caught technique to measure task-unrelated thoughts [TUT]), the study tested participants’ on-task attention when reading on paper versus on screen. Delgado and Salmerón (2021) found support for the shallowing hypothesis for reading on screen under time pressure. These results prompt the authors to propose that “screens themselves could activate an effortless cognitive style, characterized by lack of on-task attention, superficial processing, and lessened metacognitive monitoring.” (p. 2).

Similar to most other experiments comparing paper and screen reading, Delgado and Salmerón (2021) used expository/informational texts as stimuli. However, it may be that such calibration may be particularly difficult when

reading *literary* texts on screens, due to the abovementioned literariness, that is, they display a range of devices and elements that deviate from common language use and break with reader expectations (e.g., Miall & Kuiken, 1994).

Moreover, an increased habituation to reading decontextualized snippets of texts (often containing links and animations, for instance, on social media) may compromise one's capacity to engage deeply with literary texts of whatever length—whether on screen or on paper—with, potentially, a detrimental effect on eudaimonic responses. The three studies reported in this article aim to shed further light on these issues, and to test the Shallowing Hypothesis on the reading of a 3- to 5-page-long literary short story on paper versus on screen.

Shallow Reading and Hedonic Versus Eudaimonic Responses

The key claim of the Shallowing Hypothesis is that increased use of digital technologies has led to a decline in reflective thought. In particular, social media—prompting short-term engagement with snippets of decontextualized multimedia messages, along with expectations of instant responses and “rewards” (e.g., likes)—is claimed 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., 2016; Pfost et al., 2013), self-reported sense of distraction during academic reading (Levine et al., 2007), the 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).

However, the implications of increasing digitization—and, hence, frequency of engagement with social media—and shallowing modes of reading for the experience of literary texts are yet to be systematically addressed. In light of what is known about the contribution of (long-form) literary or fiction reading on reading skills and academic performance in general (e.g., Cunningham & Stanovich, 1997; Mol & Bus, 2011; Sullivan & Brown, 2013), this is a gap that needs to be filled. Moreover, recent research has shown that long-form literary reading in *print*—as opposed to on screen—is particularly beneficial, whereas extensive engagement with digital social media has shown to be negatively correlated with reading achievement (Duncan et al., 2016; Merga & Roni, 2017; Pfost et al., 2013; Torppa et al., 2020). 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). In a longitudinal study with data from more than 2500 students followed from age 7 to 16, Torppa et al. (2020) found evidence that more frequent reading of books predicted better reading comprehension, and that extensive digital reading—often entailing use of social media—was negatively affecting reading skills. It is plausible, they argue, that “intensive reading of superficial digital material instead of print reading is likely associated with comprehension problems and may even augment them.” (Torppa et al., 2020, pp. 878–879). In another study, Zebroff and Kaufman (2017) explored relations between adolescents' reading, social media use—in particular, text-messaging practices—and literacy achievement. Results showed no correlations between social media texting and literacy, but book reading time yielded more positive links with literacy achievement than all the other practices explored in the study. The authors conclude that

reading complex novels, untangling metaphors in poems, or pondering philosophical arguments appear to be quite distinct practices from the kind of reading that usually occurs on screens (with the possible exclusion of e-books), especially when one considers ultra-brief formats such as text messages. (p. 2212).

Literary reading of various types of texts and genres entails cognitive and affective processes that may cue hedonic as well as eudaimonic responses. Simply put, hedonic responses are typically associated with often short-term effects from (light) entertainment, such as fun and happiness, pleasure, suspense, and instant gratification (Bartsch & Oliver, 2016). Eudaimonic responses, by contrast, are associated with long-term effects related to one's sense of meaningfulness in life, purpose, authenticity, reflection, and insight. Hedonic concerns are termed “pleasure seeking”, whereas eudaimonic concerns are “truth seeking” (Oliver & Raney, 2011). Applied to reading, reading formulaic popular fiction characterized by stereotypes and a high degree of predictability would typically invite hedonic experiences, whereas engaging with complex novels, metaphors, and philosophical arguments (Zebroff & Kaufman, 2017) may be assumed to elicit eudaimonic responses in the reader. As such, they may instill in the reader a propensity for what has been termed “meaningful contemplation” (Oliver & Raney, 2011)—a motivation to ponder and reflect on questions of meaningfulness and relatedness. By means of various linguistic, stylistic, and semantic features contributing to make such texts deviate from everyday discourse, such texts typically challenge our assumptions and expectations, and require a heightened—and often slowed-down—attention to the text

(Koek et al., 2019), in ways that short messages, for instance on social media, do not.

In their study testing the shallowing hypothesis, Annisette and Lafreniere (2017) provide some indications of associations between extensive social media use and types of engagement with esthetic objects (e.g., literature). Specifically, they explored correlations between social media and texting behavior, use of reflective thought, life goals, personality traits, and demographics. Results showed that participants who were frequent users of social media and texting were less likely to engage in reflective thought and placed less weight on moral life goals. Of particular relevance to the present study, they found that heavy social media users placed greater importance on “morally shallow” life goals (e.g., image and hedonism) than goals related to morality. Interesting and closely related research questions pertain to whether reading habits and medium preference are correlated with eudaimonic and/or hedonic aspects of literary reading, and whether the reading medium makes a difference for the reading experience, beyond often-tested aspects such as comprehension or absorption.

Elaborating the existing research mainly addressing the Shallowing Hypothesis and the Metacognitive Deficit Hypothesis, the present study addresses the following questions, which are largely unexplored in the current research literature: Does it make readers more or less inclined to read for meaning if they read a literary short story on a screen compared to on paper? Calling this *the Medium Matters hypothesis*, we anticipate that the more frequently participants report that they read on screen, the less likely they are to report high scores on our measure of eudaimonic aspects of reading. Additionally, we address the question whether media habits affect one’s inclination to read for meaning? Calling this *the Habituation hypothesis*, we anticipate that the more frequently participants report that they read short-form texts on screen, the less likely they are to report an inclination to read for meaning (i.e., eudaimonic response).

Based on the above research, our hypotheses are as follows:

- H1: Reading on screen correlates negatively with reading for meaning (Medium Matters hypothesis).
- H2: The more one is exposed to short-form texts on screen, the less one is inclined to reading for meaning (Habituation hypothesis).

The Present Research

We conducted three experiments. In a Pilot, we explored whether reading on paper is associated with higher scores on self-report reading experience scales for transportation, attention, imagery, and eudaimonic responses, and better scores on a memory task as compared to reading the same

story on screen. To assess focused attention on the story world, we use the operationalization of Kuijpers et al. (2014), explained in more detail down below. Transportation here is defined and assessed as “a feeling of entering a story world, without completely losing contact with the actual world” (Kuijpers et al., 2014, p. 93). For mental imagery generated during the reading, we use Fialho’s (in prep.) questionnaire. And finally, to measure eudaimonic responses, we adopted a questionnaire used in media psychology (Oliver & Bartsch, 2010).

Second, we examined a way to reduce such a difference between reading on screen and reading on paper by giving participants an instruction that would focus their attention. Third, we expected negative correlations between self-reported screen reading and the reading experience scales. Building on the conclusions of the pilot, we focused more closely on the role reading habits in Study 1. We attempted a more specific measurement, distinguishing reading longer and shorter texts, different genres, and difference between preference and actual habit; we also needed to adapt the measure of the pilot study, enhancing the level of measuring from nominal to interval and ratio, allowing us to enter more of these reading habit variables into a regression analysis. Study 2 was to replicate Study 1, with a different group of participants.

Pilot Study

In this study, we aimed to find out whether reading medium—that is, reading on paper versus digitally—affects eudaimonic responses. We predicted that reading on screen would be less conducive to search for a deeper meaning in a literary story than reading that same story on paper. Second, in case there is such a difference between reading on paper and on screen, we wanted to know whether we would be able to reduce the gap between the two mediums by using an attention focusing assignment. Third, we explored the relation between reader background variables and distinct dimensions of readers’ responses to the story. As one of the aspects of readers’ background, we assessed reading habits; we were particularly interested in the role of reading on screen as opposed to reading on paper as a habit.

Method

Participants

Students at Utrecht University collected the data for this study: they asked friends and family to participate, resulting in a very diverse sample ($N=66$). Ages ranged from 14 to 67, $M_{age}=30$ ($SD=14.4$). 16 were male, 35 female, 15 missing. The participants were asked to do the assignment at home.

Materials

For this experiment, we used a Dutch translation of the short story “Flight” by Doris Lessing (1957). The rationale for the text selection was that while it is not too complex, it does have various layers of meaning and several gaps or indeterminacies that can stimulate reflection and discussion. Lessing’s story is listed among the recommended materials for meetings of the *Readers’ Collective* for Shared Reading in Belgium (Lezerscollectief, 2015). Moreover, it has clearly led to quite some discussions on the internet.

The story is about an old man who seems to have a hard time accepting that his granddaughter has fallen in love and consequently that she may be leaving home soon. The urge for freedom that the granddaughter might feel, and the grandfather’s need to hold on to her is symbolized throughout the text by the pigeons that he keeps, and that he either keeps locked up or lets fly off. Motivations and emotions of the characters are left open and to be inferred by the readers. The behavior of the man is discernibly unpleasant, but could well be seen as a way to conceal his love and pain. The tears his granddaughter sheds at the end of the story could be interpreted as either her own sorrow for leaving him and the prospect of having to miss him in the near future; her pity for him being left alone shortly; or sadness for his disagreeable behavior and hurtful remarks.

Important for our purpose was to select a somewhat lengthy literary text requiring sustained cognitive engagement across several pages. Counting 1905 words, Lessing’s short story is not particularly lengthy. However, it is certainly longer than most texts we expected our participants to typically read on their smartphones, tablets or laptops. Also, given the restricted time we deemed appropriate to ask participants to voluntarily participate, this text seemed a good compromise between our research purposes and practical constraints.

Design and Procedure

We used a 2×2 factorial design (screen versus paper x normal versus mindful reading) with participants being randomly assigned to one of the four groups. The participants were briefly instructed on the purpose, assured that the data would only be used for educational and scientific purposes, and that the data collection and storage would be anonymous. Half received the text on paper. The other half were sent the text as a PDF in their mailbox. In each of these two groups, half were given a specific instruction, the formulation of which was based on the one used in a study by Johnson et al. (2013; see also Holmes et al., 2008). The other half read the text without an instruction. Participants in the former group were told they were to do an attention exercise first, that is, a series of four assignments. For instance, they were to close their eyes and imagine a lemon: its weight, its temperature, how it feels on the outside, how it feels to let it roll up and down in their hand, and how it feels to squeeze it

a bit. Based on the research of Johnson et al. (2013), we expected that this attentional focus would deepen reading experiences in terms of transportation and empathy for story characters. In case results would reveal a difference between reading on screen and reading on paper, this “imagery generation” instruction was expected to reduce that difference.

After reading the story, participants were to respond to 24 statements using five-point scales, ranging from “Strongly disagree” to “Strongly agree.” The items were based on studies by Oliver and Bartsch (2010) and were aimed to assess dimensions of eudaimonic appreciation and hedonic enjoyment. Next, participants were presented with 16 items assessing aspects of imagery, items that were generated in a study by Fialho (in prep.). We used the subscales of the Story World Absorption Scale (Kuijpers et al., 2014) to assess differences in attention and transportation. Three simple recall questions were included to check whether participants read the text. This was followed by another recall test that was to assess to which degree participants paid attention to the surface structure, which can be seen as a proxy for literary reading (see Zwaan, 1991). Twelve sentences from the story were presented with each time one word written in capitals. The question for the participants was whether these words actually occurred in the sentences in the story. Half of the words were correct, whereas the other half were incorrect.

The final part of the questionnaire pertained to demographics (age and gender) and reading habit. In a so-called Author Recognition Test (ART), a list of 34 names of authors was presented (Koopman, 2016). Participants were asked to mark which names they knew to be author names. They were also informed that some of the names were fake, discouraging them to mark names they were unfamiliar with. The ART is known to be a reliable indication of “print exposure” and a better proxy for reading frequency than self-report questionnaires. Finally, some questions were taken from a questionnaire by Baron et al. (2017), containing questions about the number of hours people read for work, pleasure (including news), whether they prefer reading on paper or on screen, whether that differs for short and long texts, and what percentage of reading for school and pleasure takes place on paper and screen.

Results

Reliability analyses yielded satisfactory results for the scales for attention (0.89) and transportation (0.83). Conducting an analysis of variance (ANOVA) revealed no significant differences between the four conditions on those scales. As far as we know, the questionnaires on eudaimonic responses and imagery were not tested before and certainly not in the Dutch translation, while the measures for attention and transportation were (Kuijpers et al., 2014). For this reason, we ran a factor analysis on the imagery and eudaimonic items.

Factor analyses revealed three subdimensions for eudaimonic responses: being moved (e.g., The story was gripping), personal insight (e.g., The story made me think about the purpose of my life), and memorability (e.g., This story is unforgettable). The factor analysis on the imagery items yielded two subdimensions: one with an emphasis on purely sensory experiences (e.g., I could vividly imagine the sounds in the story) and the second focusing on experiences that were dominantly oriented toward the characters (e.g., I could vividly imagine the characters).

The ANOVAs showed no indication that the main factors in this study (medium and instruction) had the predicted effects. No significant differences were found on any of the dependent variables: not on the dimensions of eudaimonic responses, not on the two dimensions we found for imagery, not on attention or transportation, nor on recall of surface structure.

Next, we ran two regression analyses. In one, we investigated the degree to which reading habits could predict scores on the dimensions of eudaimonic responses. In the second we included other variables, to test the role of the medium, instruction, ART scores, gender, age, transportation, attention, the two subscales for imagery, self-reported reading frequency, and the percentage of time participants reported reading on screen rather than on paper. As to this last potential predictor, two items were used: percentage of time reading on screen for work/school and for pleasure.

In the first set of regression analyses, we looked at which of the background variables helped predict eudaimonic responses (Table 1). Two factors (hedonic and expressiveness) could not be predicted with any of the variables that we entered in the analysis. Of the remaining three variables, two (being moved and memorability) correlated negatively with screen reading for pleasure. None of the other background variables (i.e., ART-scores, self-reported reading frequency, gender, and age) were included in the model. In other words, those background variables were not helpful in predicting the levels of eudaimonic responses, while the habit of reading on screen did. The third eudaimonic subscale, personal insight, correlated negatively with self-reported reading frequency and reading the text on screen. The negative relation with reading frequency is hard to explain. One would expect people with a high reading frequency to be more willing to look for meaning in the text. It may depend on where one reads these texts. As to medium: reading the story on screen was negatively associated with participants' willingness to look for meaning in the text. This does confirm our prediction based on the Medium Matters hypothesis (H1).

In a second series of regression analyses, we investigated whether eudaimonic responses could be predicted by both background variables and the response variables that we assessed (i.e., transportation, attention, and the two subscales for imagery). The results are presented in Table 2. For two of the three eudaimonic subscales, we found that the

TABLE 1
Pilot

Variable	Unstandardized coefficients		Standardized coefficients		
	<i>B</i>	<i>SE B</i>	<i>B</i>	<i>t</i>	<i>p</i>
<i>(a) Regression eudaimonic responses using background variables only: Moving</i>					
Step 1					
% of screen reading: Pleasure	-0.13	0.00	-0.53	-3.51	.001
Note: $F(1, 31) = 12.29, p < .001, R^2 = .28$.					
<i>(b) Regression eudaimonic responses using background variables only: Personal insight</i>					
Step 1					
Reading frequency	-0.03	0.02	-0.36	-2.11	.043
Step 2					
Reading frequency	-0.03	0.02	-3.64	-2.20	.032
Medium	-0.46	0.22	-3.31	-2.05	.050
Note: $F(2, 29) = 4.56, p < .019, R^2 = .24$.					
<i>(c) Regression eudaimonic responses using background variables only: Memorable</i>					
Step 1					
% of screen reading: Pleasure	-0.01	0.00	-0.55	-3.69	.001
Note: $F(1, 31) = 13.64, p < .001, R^2 = .30$.					

self-reported percentage of screen reading time for pleasure played a negative role. It seems that the more people read on screen, the less they are inclined to feel moved by the story; nor do they consider reading it a memorable experience. In addition to this role of habitual reading on screen, we see that imagery (observation) contributed positively to memorability, and transportation contributed positively to being moved by the story. Personal insight could be predicted solely by the degree of transportation.

The expected effects of the medium and instruction on readers' responses were not registered. However, the correlational results do suggest a potential role for reading habits in the way readers perceive the literary text (hence, neither the Medium Matters hypothesis nor the Habituation hypothesis was supported by these results). In follow-up studies, we wanted to find out more about this. For this purpose, we needed to develop a measure containing more items on interval or ratio level so we could try to be more specific about the correlation between specific aspects of reading habits and eudaimonic responses. Based on the pilot study, it was hypothesized that the more participants read on screen, the less they are likely to report eudaimonic responses (the Medium Matters hypothesis). Also, we wanted to be specific about the length of texts that participants habitually read on

screen or text, investigating the assumption that it is especially short texts read on screens that is undermining meaningful responses to literature (the Habituation hypothesis).

The participants of this pilot study may have been diverse in terms of age group, and potentially also in educational background. It is possible that this led to some additional variation in the data that we cannot account for. Hence, for subsequent studies we wanted to use more homogenous samples.

Part of our hypotheses seemed in hindsight difficult to test. In particular, it was impossible to monitor whether the participants actually did the imagery boosting assignment. Therefore, in our next studies, we removed this element from the procedures.

Study 1

Participants

The study was conducted in the context of a mandatory introductory course on Literary Studies at Utrecht University. Students attended a guest lecture on empirical studies of literature, and in advance they were asked to participate in the experiment as a first encounter with this discipline.

TABLE 2
Pilot

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(a) Regression eudaimonic responses using background and response variables: Moving</i>						
Step 1						
% of screen reading: Pleasure	-0.01	0.00	-0.55		-3.60	.001
Step 2						
% of screen reading: Pleasure	-0.01	0.00	-0.50		-3.86	.001
Transportation	0.43	0.12	0.46		3.54	.001
<i>Note: F(2, 29) = 15.24, p < .001, R² = .51.</i>						
<i>(b) Regression eudaimonic responses using background variables only: Personal insight</i>						
Step 1						
Transportation	0.43	0.12	0.54		3.46	.002
<i>Note: F(1, 29) = 11.95, p < .002, R² = .29.</i>						
<i>(c) Regression eudaimonic responses using background and response variables: Memorable</i>						
Step 1						
% of screen reading: Pleasure	-0.01	0.00	-0.54		-3.50	.001
Step 2						
% of screen reading: Pleasure	-0.01	0.00	-0.53		-3.78	.001
Imagery: Sensory	0.36	0.14	0.37		2.62	.014
<i>Note: F(2, 29) = 10.75, p < .001, R² = .59.</i>						

They were asked whether they would allow the researchers to use their responses for educational and research purposes only. It was emphasized that the data would be anonymized and that participation was voluntary. There was no registration of who did not participate. This resulted in a sample of 49 participants, including 9 males, 34 females (6 missing) with a $M_{Age} = 20.0$ ($SD = 2.5$). The participants were asked to do the assignment at home.

Procedure

We used a procedure similar to the one in the pilot study. Participants were randomly assigned in two groups instead of four, since we dropped the instruction variable. One group read the story on paper, the other on screen.

Results

We ran factor analyses on the items for eudaimonic responses and for imagery. This resulted in five subscales for eudaimonic responses: impressiveness (e.g., “I found this story impressive”), memorability (“I found this story unforgettable”), hedonic responses (“I found this story enjoyable”), personal insight (“this story made me think about the purpose of my life”), and emotional expressiveness (“I found this story moving”). Looking at the imagery items, factor analyses suggested three subdimensions: sensory experiences (“Often when I read the story, descriptions of smells suggest colors, descriptions of colors suggest feelings, and so on”), character sounds (“While reading the story, I could hear the dialogues and/or voices as though I were listening to an actual conversation”), and sensory experiences focused on the characters (“While reading the story I could almost feel the physical experiences of the character(s) in my body”). One last factor was too hard to interpret; these items were not used in the analyses.

Comparing the group who read on screen with those who read the text on paper, we found no significant differences on any of the response variables. The experimental manipulation did not seem to have affected attention, transportation, imagery, nor eudaimonic responses.

As in Study 1, we ran regression analyses to see whether background variables, including the reading habits pertaining to screen and paper reading, could help predict to what degree participants had eudaimonic experiences in response to the story. Table 3 presents the results. As can be seen, all dimensions of eudaimonic responses could be predicted by reading habit measures. The pattern that is revealed in the table suggests that reading short stories on screen has a negative relation with eudaimonic responses (this holds for impressiveness, memorability, and personal insight). As a behavior, reading longer stories on screen has a positive relation with memorability. As a preference, it has a positive relation with emotional expressiveness. Interestingly, that same

variable, a preference for reading longer stories on screen, has a negative relation with *hedonic* responses to the Lessing story, a result that one might have expected. Although hedonic responses probably do not exclude eudaimonic responses, they can be seen as their counterpart.

In the second series of analyses, we investigated how eudaimonic responses could be predicted, looking at background variables as well as other response dimensions (i.e., transportation, attention, and the imagery subscales). Taking a look at Table 4, we see a similar pattern as before, though less pronounced. Still, in four of the five dimensions, we see a role for reading on screen as either a habit or a preference. Impressiveness is negatively related to reading short stories as a behavior, while being positively related to transportation and gender. Memorability is negatively related to reading short text on screen for study or work purposes as a preference and negatively related to reading short stories on screen as a behavior, while being positively related to sensory imagery. As before, hedonic responses were negatively related to a preference for reading longer stories on screen. Personal insight was negatively related to reading short texts on screen as a behavior, while the behavior of reading longer texts on screen for study or for work purposes as a behavior had a positive relation with personal insight. Two response variables showed a positive relation with personal insight: attention and character-focused sensory experiences. Only one eudaimonic subscale was unaffected by screen reading habits: emotional expressiveness was explained by character-focused sensory experiences and character sound imagery.

Although, again, expectations about differences in eudaimonic responses to reading on screen or on paper were not confirmed, we do find indications that reading habits may be associated with the degree to which the text was perceived as meaningful. In a follow-up study, we wanted to see whether this pattern would emerge in another sample.

Study 2

Participants

The data were collected in the English language equivalent of the course mentioned in Study 1. Therefore, the questionnaire and the text were presented in English. We decided not to include the ART, because many of the author names in this instrument are Dutch. Again, students were told that participation would be voluntary and anonymous, and that in case they decided they wanted to retract their data, we would not include them in the study. None did. This resulted in a sample of $N = 52$, including 7 males, 32 females (13 missing), with a mean age of 20.3

TABLE 3
Study 1

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(a) Regression eudaimonic responses using background variables only: Impressiveness</i>						
Step 1						
Screen/behavior short stories	-0.25	0.09	-0.43		-2.90	.006
Step 2						
Screen/behavior short stories	-0.22	0.08	-0.38		-2.69	.011
Gender	0.57	0.26	0.31		2.19	.035
<i>Note: F(2, 37)=7.05, p<.003, R²=.28.</i>						
<i>(b) Regression eudaimonic responses using background variables only: Memorable</i>						
Step 1						
Screen/behavior short stories	-0.26	0.09	-0.41		-2.81	.008
Step 2						
Screen/behavior short stories	-0.25	0.09	-0.40		-2.89	.006
Screen/behavior long stories	0.49	0.20	0.34		2.49	.018
<i>Note: F(2, 37)=7.58, p<.002, R²=.29.</i>						
<i>(c) Regression eudaimonic responses using background variables only: Hedonic</i>						
Step 1						
Screen/preference long stories	-0.88	0.37	-0.36		-2.38	.022
<i>Note: F(1, 39)=5.69, p<.022, R²=.13.</i>						
<i>(d) Regression eudaimonic responses using background variables only: Personal insight</i>						
Step 1						
Screen/behavior short texts	-0.25	0.12	-0.31		-2.02	.050
<i>Note: F(1, 39)=4.09, p<.050, R²=.09.</i>						
<i>(e) Regression eudaimonic responses using background variables only: Emotional expressiveness</i>						
Step 1						
Screen/preference long stories	0.73	0.31	0.35		2.36	.024
<i>Note: F(1, 39)=5.55, p<.024, R²=.12.</i>						

(*SD*=2.4). Again, the participants were asked to do the assignment at home.

Results

We first conducted factor analyses on the response items. We found factors that differed from those of Study 1. Among the items aimed to assess eudaimonic responses, we distinguished subscales for impressiveness, meaningfulness, moving, and hedonic. Based on the results of the factor analyses on the imagery items, we decided to work with four subscales: one focusing on sound, one on

picturing, one on sensory experiences, and one on transportation imagery.

Next, we ran a univariate analyses of variance with age and gender as covariates to examine whether there were significant differences in (self-reported) experiences between the group that read the text on screen and the group that read on paper. On two of the measures, we found a significant difference: the screen group scored lower on perceived meaningfulness as reported by the participants than the print group (for screen, *M*=2.26, *SD*=0.75; for print, *M*=3.20, *SD*=0.86; *F*(1,37)=11.228, *p*=.002, η^2 =.233); on sensory imagery we found lower

TABLE 4
Study 2

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(a) Regression eudaimonic responses using background and response variables: Impressiveness</i>						
Step 1						
Transportation	0.32	0.10	0.48		3.33	.002
Step 2						
Transportation	0.28	0.09	0.41		2.98	.005
Screen/behavior short stories	-0.19	0.08	-0.34		-2.44	.020
Step 3						
Transportation	0.27	0.09	0.41		0.31	.004
Screen/behavior short stories	-0.17	0.08	-3.02		-2.27	.030
Gender	0.53	0.25	0.27		2.10	.043
Note: $F(3, 35) = 8.24, p < .001, R^2 = .41$.						
<i>(b) Regression eudaimonic responses using background and response variables: Memorable</i>						
Step 1						
Imagery sensory	0.43	0.11	0.53		3.79	.001
Step 2						
Imagery sensory	0.50	0.10	0.63		5.22	.001
Screen/preference short texts study/work	-0.27	0.07	-0.48		-4.03	.001
Step 3						
Imagery sensory	0.48	0.09	0.59		5.15	.001
Screen/preference short texts study/work	-0.22	0.07	-0.40		-3.32	.002
Screen/behavior short stories	-0.16	0.07	-0.26		-2.17	.036
Note: $F(3, 35) = 15.02, p < .001, R^2 = .56$.						
<i>(c) Regression eudaimonic responses using background and response variables: Hedonic</i>						
Step 1						
Screen/preference short texts study/work	-0.90	0.38	0.36		2.38	.023
Note: $F(1, 37) = 5.66, p < .023, R^2 = .12$.						
<i>(d) Regression eudaimonic responses using background and response variables: Personal insights</i>						
Step 1						
Attention	0.42	0.10	0.58		4.36	.001

(continued)

TABLE 4
Study 2 (continued)

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
Step 2						
Attention	0.42	0.09	0.58		4.59	.001
Screen/preference short texts study/work	-0.24	0.10	-0.29		-2.33	.025
Step 3						
Attention	0.45	0.08	0.61		5.29	.001
Screen/behavior short texts	-0.40	0.11	-0.48		-3.61	.001
Screen/behavior long texts study/work	0.23	0.08	0.38		2.83	.008
Step 4						
Attention	0.31	0.08	0.42		3.63	.001
Screen/behavior short texts	-0.44	0.10	-0.53		-4.55	.001
Screen/behavior long texts study/work	0.27	0.07	0.44		3.74	.001
Imagery: Character sensory	0.37	0.11	0.40		3.43	.002
<i>Note: F(4, 34) = 15.99, p < .001, R² = .65.</i>						
<i>(e) Regression eudaimonic responses using background and response variables: Emotional expressiveness</i>						
Step 1						
Imagery: Character sensory	0.47	0.12	0.53		3.81	.001
Step 2						
Imagery: Character sensory	0.60	0.13	0.68		4.68	.001
Imagery: Character sounds	-0.29	0.12	-0.35		-2.40	.022
<i>Note: F(2, 36) = 11.05, p < .001, R² = .38.</i>						

scores for the screen group as compared to the print group (for screen, $M=4.04$, $SD=0.87$; for print, $M=4.65$, $SD=0.81$; $F(1, 37)=4.632$, $p=.038$, $\eta^2=.111$).

In the regression analyses using only readers' background variables, we found that all the four subscales for eudaimonic responses revealed a role of reading on screen or on paper (Table 5). The level of impressiveness that participants experienced is negatively correlated with the behavior of reading longer news texts on screen and a preference for reading longer texts in general on screen. However, the behavior of reading longer stories on screen was positively related to experiencing impressiveness. Meaningfulness was

affected positively by a preference for reading longer stories on screen and the percentage of time that participants reported reading from paper. Also, as the ANOVAs already suggested, reading on screen is associated with lower levels of meaningfulness. The behavior of reading longer news texts on screen was negatively associated with hedonic responses. And self-reported levels of reading on paper had a positive relation with the experience of being moved.

As in the pilot and Study 1, we wanted to see how the overall picture of the role of screen reading habits and preferences would change if we entered variables like transportation into the analyses, likely candidates to

TABLE 5
Study 2

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(a) Regression eudaimonic responses using background variables only: Impressiveness</i>						
Step 1						
Screen/behavior long news	-0.21	0.08	-0.40		-2.62	.013
Step 2						
Screen/behavior long news	-0.23	0.07	-0.44		-3.01	.005
Screen/behavior long stories	0.27	0.11	0.35		0.24	.021
Step 3						
Screen/behavior long news	-0.19	0.07	-0.37		-2.65	.012
Screen/behavior long stories	0.52	0.15	0.67		3.44	.002
Screen/preference long texts	-0.37	0.16	-0.46		-2.30	.028
Step 4						
Screen/behavior long news	-0.16	0.07	-0.31		-2.30	.028
Screen/behavior long stories	0.52	0.14	0.67		3.62	.001
Screen/preference long texts	-0.37	0.15	-0.45		-2.40	.023
Gender	0.56	0.25	0.29		2.22	.033
<i>Note: F(4, 32) = 7.03, p < .001, R² = .47.</i>						
<i>(b) Regression eudaimonic responses using background variables only: Meaningfulness</i>						
Step 1						
Screen/condition	-0.96	0.28	-0.50		-3.38	.002
Step 2						
Screen/condition	-1.04	0.26	-0.54		-4.01	.001
% of paper reading	0.01	0.00	0.38		2.87	.007
Step 3						
Screen/condition	-0.93	0.25	-0.48		-3.68	.001
% of paper reading	0.01	0.00	0.39		3.06	.004
Gender	0.66	0.31	0.28		2.18	.037
Step 4						
Screen/condition	-0.79	0.24	-0.41		-3.26	.003
% of paper reading	0.02	0.00	0.44		3.60	.001
Gender	0.75	0.29	0.32		2.62	.013
Screen/preference long stories	0.26	0.11	0.30		2.45	.020
<i>Note: F(4, 32) = 9.91, p < .001, R² = .55.</i>						

(continued)

TABLE 5
Study 2 (continued)

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(c) Regression eudaimonic responses using background variables only: Hedonic</i>						
Step 1						
Screen/behavior long news	-0.25	0.07	-0.50		-3.39	.002
Note: $F(1, 35) = 11.53, p < .002, R^2 = .25$.						
<i>(d) Regression eudaimonic responses using background variables only: Moving</i>						
Step 1						
Gender	0.87	0.31	0.43		2.80	.008
Step 2						
Gender	0.89	0.30	0.44		3.01	.005
% of paper reading	0.01	0.00	0.30		2.05	.047
Note: $F(2, 34) = 6.38, p < .008, R^2 = .27$.						

affect eudaimonic responses (Oliver et al., 2017). As can be seen in Table 6, we still see that screen reading habits and preferences are relevant predictors. In three of the four eudaimonic subscales, we see that these background variables show significant correlations. In all four we do see that a part of the variance in eudaimonic responses is explained by attention (i.e., in scales for impressiveness, meaningfulness, and being moved), and transportation seems associated with meaningfulness. All these relations are positive. As to Impressiveness, the behavior of reading short stories on screen shows a negative association; so does the preference for reading short texts in general on screen. As before, the behavior of reading longer stories on screen is a positive predictor. The odd one out is the preference of reading short stories on screen: earlier we saw that short story screen reading was a negative predictor, but here it is positively related to Impressiveness. Meaningfulness is still predicted to some degree by condition (with screen reading having a negative relation with meaningfulness) and percentage of reading on paper (positive). Hedonic responses were positively related to attention but negatively with a preference for reading longer stories on screen, and with the behavior of reading longer news texts on screen. Frequency of reading for work on screen had a positive relation with hedonic responses.

The results of Study 2 largely confirmed both our hypotheses. Reading the story on screen produces lower ratings on reading experience measures as compared to reading the same story on paper. For the third time around, we saw how self-reported behavior of reading on screen is often negatively related to perceived meaningfulness of the

literary text, even if we take the role of other aspects of the reading experience into account.

Discussion

We examined the hypotheses that reading a literary short story on screen is detrimental to readers' meaningful experience (Medium Matters hypothesis), and that habitual exposure to short texts would accumulate in a shallower approach to such a text (Habituation hypothesis). In the three experiments we conducted, we did not find systematic differences between the experience of reading the text on screen or paper, but we did see a correlational pattern emerging that may be considered indicative of a less direct effect of habitually reading short texts on screen. In support of our Habituation hypothesis, readers who report that they frequently read shorter texts on screen (rather than on paper) were less likely to look for meaning in a text. In the third experiment, results did indicate less eudaimonic responses for reading on screen as compared to on paper, which can be seen as partial support for our Medium Matters hypothesis. The overall pattern, however, might be interpreted as support for the Habituation hypothesis that suggests a much slower, accumulative effect: the more people are exposed to short texts on screen, the less they are inclined to muster the cognitive persistence required for reading a somewhat longer and linear literary text, and to speculate what meaning it might have for them personally.

Altogether, these findings are indicative of a number of substantial changes in reading habits currently driven

TABLE 6
Study 2

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(a) Regression eudaimonic responses using background and response variables: Impressiveness</i>						
Step 1						
Attention	0.70	0.09	0.80		8.04	.001
Step 2						
Attention	0.66	0.08	0.76		7.95	.001
Gender	0.43	0.18	0.22		2.35	.025
Step 3						
Attention	0.67	0.08	0.77		8.54	.001
Gender	0.45	0.17	0.23		2.59	.014
Screen/behavior short texts	-0.13	0.06	-0.20		-2.30	.028
Step 4						
Attention	0.69	0.07	0.79		9.98	.001
Gender	0.44	0.15	0.23		2.96	.006
Screen/behavior short texts	-0.23	0.06	-0.37		-4.02	.001
Screen/preference short stories	0.14	0.04	0.31		3.36	.002
Step 5						
Attention	0.72	0.06	0.83		11.16	.001
Gender	0.35	0.14	0.18		2.45	.020
Screen/behavior short texts	-0.22	0.05	-0.35		-4.10	.001
Screen/preference short stories	0.26	0.06	0.56		4.46	.001
Screen/preference short texts	-0.15	0.06	-0.33		-2.61	.014
Step 6						
Attention	0.68	0.06	0.79		11.07	.001
Gender	0.38	0.13	0.20		2.84	.008
Screen/behavior short texts	-0.23	0.05	-0.36		-4.61	.001
Screen/preference short stories	0.22	0.06	0.47		3.76	.001
Screen/preference short texts	-0.16	0.05	-0.34		-2.95	.006
Screen/behavior long stories	0.16	0.06	0.20		2.50	.018

Note: $F(6, 30) = 33.27$, $p < .001$, $R^2 = .87$.

(continued)

TABLE 6
Study 2 (continued)

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
<i>(b) Regression eudaimonic responses using background and response variables: Meaningfulness</i>						
Step 1						
Transportation	0.62	0.14	0.60		4.45	.001
Step 2						
Transportation	0.51	0.14	0.49		3.69	.001
Screen/condition	-0.65	0.26	-0.33		-2.52	.017
Step 3						
Transportation	0.44	0.13	0.43		3.37	.002
Screen/condition	-0.75	0.24	-0.39		-3.10	.004
% of paper reading	0.01	0.00	0.30		2.51	.017
<i>Note: F(3, 33) = 13.34, p < .001, R² = .55.</i>						
<i>(c) Regression eudaimonic responses using background and response variables: Hedonic</i>						
Step 1						
Attention	0.43	0.12	0.51		3.53	.001
Step 2						
Attention	0.48	0.11	0.57		4.24	.001
Screen/preference long stories	-0.26	0.09	-0.38		-2.82	.008
Step 3						
Attention	0.43	0.11	0.50		4.01	.001
Screen/preference long stories	-0.30	0.08	-0.45		-3.59	.001
Reading frequency work	0.09	0.03	0.35		2.74	.010
Step 4						
Attention	0.37	0.10	0.43		3.54	.001
Screen/preference long stories	-0.27	0.08	-0.40		-3.23	.003
Reading frequency work	0.08	0.03	0.29		2.31	.028
Screen/behavior long news	-0.13	0.06	-0.26		-2.11	.043
<i>Note: F(4, 32) = 10.73, p < .001, R² = .57.</i>						
<i>(d) Regression eudaimonic responses using background and response variables: Moving</i>						
Step 1						
Attention	0.65	0.11	0.71		5.92	.001

(continued)

TABLE 6
Study 2 (continued)

Variable	Unstandardized coefficients		Standardized coefficients		<i>t</i>	<i>p</i>
	<i>B</i>	<i>SE B</i>	<i>B</i>			
Step 2						
Attention	0.60	0.10	0.65		5.81	.001
Gender	0.62	0.23	0.30		2.73	.010

Note: $F(2, 34) = 24.45$, $p < .001$, $R^2 = .59$.

by screen-based reading and, in particular, the extensive use of social media. Given the association observed in our study between the reading of short texts on screens and less eudaimonic responses to the Lessing story, it can be conjectured that the transition of reading in general on paper to various screen devices is negatively affecting our ability and/or willingness to engage with somewhat longer, linear, exclusively text-based, and potentially more complex literary texts, and to find them meaningful. When we read on screens, our reading often consists of engaging with relatively short multimedia features (e.g., news; social media). Whereas written text often forms part of such multimedia features, it often appears in short segments, and does not typically display much of the linguistic, stylistic, and/or semantic complexity which is considered a hallmark of literary texts, of whatever length.

One may speculate that the medium primes a shallow mindset, in two ways. First, the more we use digital devices for short social media texts, the more difficulties we may have using these same digital devices for more challenging reading tasks, such as reading somewhat lengthier, linear, and more complex texts. Second, the more we engage with short social media texts on screens, the more difficulties we may experience also when reading more cognitively demanding texts on paper.

An inability or unwillingness to engage with linear, monomodal, and somewhat lengthy texts that may harbor various types and degrees of complexity is unfortunate and may have far-reaching repercussions both in education as well as in our lives. Illustrative of what has been termed “higher level reading” (Schüller-Zwierlein et al., 2022), such engagement with extensive, written text is associated with a host of beneficial outcomes, both cognitively and emotionally. Engaging with longer and potentially more complex texts builds readers’ vocabulary and nurtures the development of a richer linguistic repertoire than does reading shorter and lexically and semantically simpler texts (see e.g., Pfost et al., 2013). Engaging with somewhat lengthy texts that only consist of static and linear text, and no hyperlinks or dynamic modalities such as audiovisuals that capture and guide our attention, is also a way to practice cognitive and attentional focus and endurance, in ways that few other

media can provide. Moreover, engaging in particular with literary texts entails the possibility to enrich one’s prosocial skills such as perspective taking and empathy, in ways that seem more difficult to achieve when reading informational (that is, non-narrative) texts (Dodell-Feder & Tamir, 2018). More complex texts, for instance, in the shape of literature, require higher level reading skills such as more sophisticated inferencing, more diverse vocabulary, and a greater repertoire of prior knowledge. In return, engaging with such texts nurtures and hones a range of skills that are indispensable in today’s increasingly complex environment, such as critical thinking, reflection, analytical skills, creativity, and imagination (see e.g., Greenfield, 2009; Schüller-Zwierlein et al., 2022; Wolf, 2018).

Findings from the most recent PISA (OECD, 2019) showed a stark decline in leisure reading—which typically entails reading of longer texts, in the form of narrative fiction. In 2018, one third of the students participating reported that they rarely or never read books for leisure or pleasure. Moreover, almost 50% agreed or strongly agreed with the statement “I read only if I have to”. This was an increase of approximately 13% points from PISA 2000. National reading surveys corroborate this picture: as much as one quarter of the American population does not read books⁵, and a third of the German population reads in a book less than once per month.⁶

The reading of lengthier and more cognitively demanding textual material also seems to be under threat in education. Baron and Mangen (2021), for instance, found that professors in reading-intensive disciplines in the humanities, such as history and literary studies, have begun to assign shorter and/or less complex texts for their students, or replaced reading of written material with audiovisual, such as TED talks or podcasts. One of the main reasons given for such changes is the sense—expressed by faculty—that today’s students are less prepared to grapple with the types of texts that require “grit”, such as philosophical treatises or abstract theories. As one professor of philosophy expressed it: “Students’ expectations in making complicated stuff more accessible increases. I cannot conceive of a student reading Kant’s *Critique of Pure Reason*.” (p. 273).

Hence, much available evidence, including the results of the present study, strongly suggests that deep reading is under threat. Defined as the ability to attentively read longer and more complex texts so that we can absorb complex information, can take the perspective of the other, connect what we read to our own life, and develop a sensitivity for the relevance of style choices (Wolf, 2018). Deep reading entails a number of these abilities which come together in literary reading. Consequently, the current trends of a decline in the forms of reading promoting such abilities are a call for action for teachers and policymakers. There are many advantages to the implementation and use of digital technologies in schools, but training cognitive patience and stamina when reading linear, static, monomodal (i.e., written) texts is not among these. Currently available empirical evidence clearly indicates that higher level reading is best trained with paper-bound books. Moreover, preparing students of all ages for an increasingly complex information society requires training them in handling written material in a vast variety of genres, formats, lengths, and complexities. Hence, a comprehensive reading instruction educating tomorrow's students should supplement a focus on digital reading/literacy, with due attention to the vital dimensions of reading that are better trained with literary reading—on paper. A more nuanced understanding of the fundamental differences entailed in the cognitive processing of various modalities seems warranted.

Limitations and Future Research

This study is largely exploratory, and some of our observations are difficult to explain. For example, it is not clear why we found an effect for medium only in Study 2, and not in the pilot and Study 1. Moreover, we found a few disparities in the outcomes of the regression analyses of the various studies. For example, in Study 1, we found that the time spent on screens reading for pleasure was a negative predictor of memorability, and sensory imagery was a positive predictor. For the same variable, memorability, Study 2 showed that reading short stories from screens was a negative predictor, and reading long stories was a positive predictor. Our theoretical framework did help us to predict the directions of the relation between all these variables, but not in such different combinations. In sum, when we look at the tables, we do see patterns emerging, but these would probably need to be substantiated with experiments run with other samples and other stories. Or maybe we need to accept a degree of unpredictability in such relations.

Another potential shortcoming in the present study pertains to the operationalization of the two medium conditions. In order to assess the role of medium on the reading experience, participants were asked to simply print out the text (the paper condition) or to read it on a screen (the digital condition). Given that they were reading a *literary*

short story, one could claim that neither of these two medium conditions are authentic or appropriate: we do not typically read literary stories printed on sheets of paper stapled in the corner, nor on a laptop. A related concern is that we do not know which digital device participants used in the digital reading condition, so we can only assume that most participants read the story on a laptop. Either way, the fact that the digital version was simply a pdf and not the authentic e-book version of the story also renders the digital version somewhat inauthentic. Studies have shown that the authenticity of the medium, beyond a simple paper versus screen dichotomy, plays a role for cognitive as well as affective aspects of reading (Mangen & Kuiken, 2014; Salmerón et al., 2018). Future research on the impact of medium on cognitive and emotional aspects of reading need to apply more fine-grained operationalizations of both print and digital media, with due attention to the differences between various types of screens (mobile phones, e-readers, tablets, laptops) as well as various types of print media (printouts versus the authentic book). For this endeavor, recent qualitative research exploring motivations and rationale driving avid Kindle readers' choice of medium for various types of literary texts are especially informative (e.g., Kosch et al., 2021; Schwabe et al., 2023; Spjeldnæs & Karlsen, 2022).

It also merits mention that the text used as stimulus in the studies is a short story, not only in the sense of being a short literary text as opposed to, for example, a novel, but also in terms of its length. Hence, it may seem a bit far-fetched to discuss our findings in light of claimed associations between eudaimonic aspects of reading, preference for and habit of reading longer texts on paper/screen. While we readily acknowledge these shortcomings, we would nevertheless argue that a text of this length (1900 words) is sufficiently different from the texts typically read on screens, whether on social media or online news channels (e.g., apps, posts, newsfeeds). Moreover, being linear, monomodal (i.e., consisting of written text only), and spanning three to four pages in print, and six to seven pages on screen, Lessing's short story does represent a type of higher level reading that, if not long-form, invites a mode of reading which differs substantially from that of typical screen media engagement (see Schüller-Zwierlein et al., 2022 for a more fleshed-out description of what such differences entail).

In this study, we assessed a limited number of subject variables; in the analyses we only controlled for age and gender. It is conceivable that other factors play a role as well (e.g., socioeconomic background and mother language; see e.g., Berkowitz et al., 2017; Sirin, 2005). We hope that the influence of these was partially neutralized by randomization. Also, more practically, including these in our analyses would have required more participants than were available for our studies. Nevertheless, it seems recommendable that future investigations increase the level of control and explore the interplay between such

background variables, reading habits, and reading experience. In addition, reading habits and experience obviously entail more than what is accounted for by the measures used in the present study. For instance, some readers may profit from digital affordances such as embedded links to multimedia content to support the reading. In order to obtain a more comprehensive and nuanced picture of how digital affordances impact reading habits and experience in various contexts and across types of texts and purposes of reading, longitudinal, in-depth studies of individual readers are warranted. Recent examples inspired by cognitive video-ethnography (e.g., Trasmundi & Cowley, 2020) may be particularly relevant for this purpose, and would help substantiate the theories described in the introduction.

A final limitation concerns the type of data in our study: conclusions based on self-report data need to be cautious. It is not inconceivable that participants were imprecise about their reading behavior. Just think of how weekly reports of screen time on our smartphones can surprise us. In general, information based on direct questions about reading habits is notoriously unreliable (West et al., 1993; see Schmidt & Retelsdorf, 2016 for a more recent discussion of some of the methodological and psychometric challenges). Furthermore, our assessment of eudaimonic responses may have been susceptible to social desirability; especially in Studies 1 and 2, the students of literature participating in the experiments might have wanted to present themselves as attentive and deep readers, notwithstanding our guarantees of anonymity. It should be noted, however, that no significant differences were found on self-reported reading time for pleasure and work/school, suggesting that participants in the three studies may not have differed in the degree to which they were susceptible to socially desirable responses. Future research should include more reliable measures, for instance, by assessing observable, naturally occurring reading behaviors and using indirect proxies to meaningful reading experiences (e.g., thought-listing task, cf. Bartsch et al., 2014).

The latter point is related to another potential shortcoming, which is illustrative of a more overarching concern in empirical research on literary reading, namely, the insufficiency of any measure to capture the multifariousness of readers' pursuit of different types of texts. Readers' motivations and goals when engaging with literary texts of any genre and type vary greatly and one could question whether and to what extent the pursuit of eudaimonic versus hedonic responses form part of students' repertoire of deliberate pursuits when reading literature. Moreover, the reading situation and the context of the task—reading a short story at home, as part of an assignment—plausibly influence the results in ways that are beyond our control. The best way to remedy such limitations in future research would be to design multi-method studies combining self-report data with behavioral and implicit measures, such as eye tracking, video observation, and physiological data (e.g., heart rate variability; galvanic skin response).

Most of our results are correlational, and therefore do not allow for claims about causality. The patterns might be interpreted as support for our habituation hypothesis. But for all we know it may also be that those participants who did not have the skills or the desire for deep reading to begin with were therefore more inclined to read shorter texts. However, the fact that this pattern occurred in three different studies does make it more likely we will find it again in other populations. Nevertheless, further investigations should include (quasi-)experimental designs (e.g., comparing schools with contrasting emphasis on the use of digital devices in education) and longitudinal assessments.

If we are to suspect that frequent exposure to brief snippets of interactive, dynamic, and primarily audiovisual multimedia texts on screens does reduce young people's propensity for eudaimonic response, our data will not reveal to us what underlying causes are: Is it a lack of ability, or training because too little time is spent on higher level reading, engaging with lengthier, and more challenging texts? It may also be a lack of interest, as reflected in, for example, studies with younger students increasingly reporting that reading books is boring (Baron, 2021); and/or it is indicative of a lack of cognitive patience (Wolf, 2018). Designs of app notifications and built-in unpredictability of positive feedback in media algorithms are assumed to stimulate the same reward circuits that are dysregulated in addiction to substances and gambling (Monaco, 2022) and potentially lead to habitual behavior by strengthening neural connections involved in action selection (Hodge, 2020). It seems therefore likely that the two-dimensional text in a book is considered a test on readers' patience, especially when the story is not so much focused on a thrilling series of events but on deepening insights in experience.

Concluding Remarks

Research on reading is extensively multidisciplinary, and with the emergence of digital technologies comes an exponential increase in the complexity and variety of modes of reading to be addressed. By implication, the continuing digitization of information and texts of all kinds requires consideration of new factors in the study of reading, pertaining to text, reader, context, and task (Barzillai et al., 2018; Bråten et al., 2020; Coiro, 2021). One perhaps unintended consequence of such increased diversification of texts and reading modes has been a heightened scholarly interest in research on the reading of multiple texts at the expense of a focus on single-text reading. Moreover, given that digitization allows the seamless integration of static and dynamic information, and multiple modalities (text, audio, images, film) integrated in the same user interface, it is perhaps natural that the reading of multimodal texts has taken on center stage in many areas of reading research. However, given that the reading of single, linear, and often longer texts—such as novels or short

stories—is of paramount importance for the development of reading skills, critical thinking, and reflection, as well as socio-emotional aspects, we will argue that empirical research on single-text reading, and the associations with medium, is only becoming more important with increasing digitization. Reading, and especially reading of somewhat lengthy texts, is arguably the most central and powerful tool for thinking. Being able to read longer and more complex texts is a prerequisite for full participation in civic society, and literary reading uniquely facilitates the exchange of complex human judgments and emotions, with the side effect of exercising discipline and sustained attention.

The habit of frequently reading short texts on screens may be undermining readers' ability to, or interest in finding meaning in literature. With the immense increase of this particular kind of reading behavior in all layers of society, among every age group, and across the globe, it seems unimaginable this will not have consequences for literary culture. *How* we read may affect *what* we read, and hence even changes what is written, as Wolf's (2018) digital chain hypothesis proposes. It is the sheer extent of this potential impact, in combination with the limitations of the present study that necessitate further scrutiny of the relation between digital culture and literary reading.

Moreover, we would argue that it is prudent not to wait for unshakable evidence, only to discover then that the transformations are irreversible. Instead, we should anticipate that there is such a causal relation and take preemptive actions in contexts like literary education and the promotion of reading.

Conflict of Interest

The authors have no conflict of interest.

Ethics Statement

The studies reported in this manuscript have been conducted in compliance with the national ethics requirements in the NL and with GDPR.

NOTES

¹ Progress in International Reading Literacy Study: a large-scale international assessment of reading literacy sampling 4th and 5th graders.

² OECD's Programme for International Student Assessment.

³ In mode effect studies of this kind, experiments often use texts which differ along various textual and stylistic parameters. One common combination is to use one informational text and one narrative text. The former is characterized by being expository, descriptive, or informative, whereas the latter is characterized by telling a story that involves characters (people) interacting in a social environment, and typically pursuing some more or less explicit goal. Whether or to what extent the narrative text is literary is a different question and not one that is typically addressed in such studies.

⁴ The book followed an article by Carr titled "Is Google Making Us Stupid" (published in *The Atlantic* magazine in 2008) that received massive attention in the media.

⁵ <https://www.pewresearch.org/facttank/2021/09/21/who-doesnt-read-books-in-america/>.

⁶ <https://de.statista.com/statistik/daten/studie/171231/umfrage/haeufigkeit-des-lesens-von-einem-buch/>.

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