DIFFERENCES IN LITERARY READING FROM PRINT VERSUS COMPUTER SCREEN. AN EMPIRICAL STUDY

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ABSTRACT

This article investigates the influence new technologies might have on ways we read and understand literature in the age of electronic media, specifically in terms of interacting with digital interfaces. As a number of media and communication theorists suggest, electronic media bring about the way we use and understand texts, what in turn has an impact on our thinking.

An experiment was designed in order to test whether electronic interface affects literary processing in terms of attention, interest and understanding. Additionally, readers' performance was compared to their personal preferences for reading on screen or in print. Participants read a short story and were randomly assigned to one of two conditions: reading the story from a computer screen or in print. They were asked to underline striking passages while reading, and to fill out a questionnaire afterwards. Contrary to popular belief, results suggested that reading from screen versus reading in print do not yield significant differences.

SAMENVATTING

Vraagstelling

Iedere nieuwe technologie – of het nu gaat om de uitvinding van het perkament of van de drukpers – zorgt voor nieuwe manieren van lezen en schrijven. Ook digitale media maken dat onze omgang met teksten verandert. Literaire e-boeken hebben andere eigenschappen dan hun gedrukte tegenhangers, omdat het nieuwe medium niet dezelfde karakteristieken bezit als het oude medium.

Over de digitale lezer van verhalen en gedichten doen verschillende assumpties de ronde: deze surft langs teksten, scant ze op hoofdstuk- en paragraaftitels en leest ze diagonaal. In plaats van aandachtig en gestructureerd, gaat hij vluchtig en gefragmenteerd te werk. Maryl vraagt zich af of we op deze manier nog literaire lezers zijn, of eerder ongeduldige tekstgebruikers. Maar: naar verschillen in het gebruik van gedrukte en digitale literatuur is nauwelijks empirisch onderzoek gedaan. Daar moet Maryls experiment verandering in brengen.

Methode

63 studenten aan de Warschau School van Sociale en Geesteswetenschappen, waarvan 32 vrouwen en 31 mannen, lezen een Pools kort verhaal (2077 woorden) van papier of van het computerscherm. Tijdens het lezen onderstrepen ze passages die ze belangwekkend of interessant vinden. Hun leestijden worden gemeten met een digitale stopwatch. Na het lezen en onderstrepen vullen ze een enquête in. Deze

bestaat uit een geheugentest over de belangrijkste gebeurtenissen, het schrijven van een korte samenvatting, en uit algemene vragen over hun mediagebruik en sociaal-demografische achtergrond.

Resultaten

De theoretische aannames van het onderzoek moeten worden verworpen. Er bestaan geen significante verschillen tussen het lezen van papier en het lezen van het scherm. De leestijd is in beide condities vrijwel hetzelfde. Proefpersonen spreken weliswaar een voorkeur uit voor het gedrukte boek, maar daar is in hun leesprestaties niets van te merken: op aandacht, interesse en begrip verschillen hun scores tussen beide media niet significant.

Conclusie

Het verschil tussen het lezen en interpreteren van gedrukte en digitale literaire teksten is dus minder groot dan algemeen wordt aangenomen. Toch kan deze studie een dergelijk verschil niet uitsluiten. Mogelijk treden er een aantal complicerende variabelen op. De proefpersonen hebben de tekst gelezen in een artificiële situatie, wat hun aandacht en concentratie kan hebben verscherpt. Ook kan de conditie impact hebben gehad op het aantal onderstreepte woorden: achter het scherm vergeet je dit sneller te doen dan met de vertrouwde *highlighter* op papier. Verder hadden lezers met een langer verhaal, zoals een roman, achter het scherm waarschijnlijk meer moeite gehad in vergelijking met het gedrukte boek.

Bovendien zijn de proefpersonen, als studenten, jong. Ze switchen daardoor relatief gemakkelijk en natuurlijk heen en weer tussen gedrukte en digitale media. Een laatste verklaring die Maryl opvoert voor het ontbreken van significante verschillen is een culturele: de mediale veranderingen liggen zo diep, dat we nieuwe media strategieën toepassen in het gebruik van de oude media. Met andere woorden: we verwerken een gedrukte literaire tekst anders dan dertig jaar geleden, omdat we nu ook werken met computers en internet. Zo kan het komen dat print- en schermlezen zo dicht bij elkaar liggen. Dit valt volgens Maryl helaas niet te achterhalen met vergelijkbaar onderzoek dat indertijd is uitgevoerd.

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INTRODUCTION

The rising popularity of e-books and new, electronic, forms of literary production show that the electronic access to literature becomes an ordinary reading habit. Hence, it is important to investigate the possible influence of new technologies on ways we read and understand literature in the age of electronic media.

Every fundamental breakthrough in the history of communication – be it invention of writing or print – brought about significant changes on many levels, concerning not only the textual form but also the way people responded to texts. In the analysis of the revolution of writing, Goody (1977) directly linked capacities of human minds to communication technology, claiming that 'the development of concepts and formulations of an increasingly abstract kind (side by side with the more concrete), cannot be understood except in terms of basic changes in the nature of human communications' (p. 150-151). Havelock (1986) proposed his 'general theory of orality', claiming that it was the unique mixture of orality and new technology of writing in ancient Greece that made literature possible (p. 86-87). Ong (1977), in his extensive analyses of all communication breakthroughs, assumed that those changes affect our thinking: 'writing and print and the computer enable the mind to constitute within itself – not just on the inscribed surface or on the computer programs – new ways of thinking, previously inconceivable questions, and new ways of searching for responses' (1977: 46).

Contemporary theorists, evaluating this recent communication shift, seem to share this viewpoint. For instance, Manovich (2001) assumes in his influential book *The Language of New Media* that contemporary changes can even have more grave

consequences than the invention of printing press, which affected 'only one stage of cultural communication – the distribution of media.'

In contrast, computer media revolution affects all stages of communication, including acquisition, manipulating, storage and distribution; it also affects all types of media – text, still images, moving images, sound, and spatial constructions. (p. 43).

Moreover, discussing various distinctive aspects of the 'language of new media', he stressed the mutual influence different media have on each other: 'the history of human-computer interface is that of borrowing and reformulating […] other media, both past and present: the printed page, film, television.' (ibid. 95). This claim corresponds with the influential concept of remediation, proposed by Bolter and Grusin (2000), which entails that remediation is a logic by which new media refashion prior media forms, or, simply, 'a representation of one medium in another' (ibid. 45). This concept has serious consequences for literary reading: digitalization of literary texts is not a 'neutral' representation of text on the screen, but a remediation of print. Therefore, the properties of digitalized texts are different from the original, because the qualities of the older medium are supplemented by the characteristic of the target medium.

This claim is developed further on the field of literary studies by Hayles (2002). She suggested that the reading mediated by electronic interfaces – which she dubs 'writing machines' – is a fundamentally new bodily experience. 'Inscribing consequential fictions,' she argued, 'writing machines reach through the inscriptions they write and that write them to re-define what it means to write, to read and to be human' (p. 131). Hayles stressed that a book is only 'an artifact whose physical properties and historical usage structure our interactions' (ibid.: 22). Hence, the lack of such physical features as, for instance, a printed page as a 'unit of reading', may have a huge impact on the way we handle texts. Similar viewpoint is expressed in Heim (1993), although in a somewhat different, rather pessimistic manner:

> human eyes blink less often when viewing computer texts. The cornea of the eye requires frequent fluid baths, and eyelids normally bathe and massage the eyeballs by blinking every five seconds. But the stress of computer interaction tends to fix vision in a stare.' (p.6)
>
> Heim argues that computers change the way we think, because – as machines – they promote information over significance, and therefore affect the ways we deal with texts, affect our reading strategies: 'infomania erodes our capacity for significance. We collect fragments. We become mentally poorer in overall meaning. We get into the habit of clinging to knowledge bits and lose our feel for the wisdom behind knowledge.' (ibid. 10)

Empirical findings of Mackey (2002) seem to support those claims insofar the reading strategies are at stake. In her exploratory study on youth media use, she described two crucial factors which govern reception processes of present-day media consumers: personal salience and fluency. 'They checked out the story in any medium to see if it held any individual interest for them, and balanced this element against the question of how difficult or how easy it would be to gain access to that world' (p. 16). She described this strategy in terms of a 'trade-off': 'the more salient the story, the more prepared they were to invest time and effort into reading or viewing or playing' (p. 93). This kind of reader, a digital one, is an ideal reader of hypertextual literature: one who plays with texts (for different uses of the word 'play' in this context, see Mackey, 2002) to retrieve information important for one's biography. It is a strategy commonly used online, while surfing the web, browsing and skimming multiple texts in order to access particular information. One can wonder, whether – while adapting such strategies – we are still readers, or rather, to use Ted Nelson's catchphrase, 'impatient users' (see: Huhtamo 1999:107).

As far as literature is concerned, contemporary media theorists' attention is focused on new forms of literary texts, which combine traditional literary structures with new electronic tools, such as hypertext fiction, interactive dramas or digital poetry (see Hayles 2008 for discussion). Yet, as the growth of e-book industry shows, the majority of online readers concentrate on digitalized versions of traditional literary texts, published online in numerous formats. If theoretical assumptions are true, it could mean that although we have access to a growing body of literary texts (including the finest works of word literature), we fail to approach them with a required level of attention, because electronic interfaces promote fragmentary reading and surface understanding of the content. Empirical research into differences in reading between print and computer screen seem to partially support those claims.

In their short review of first experiments conducted in this field, Dillon, McKnight and Richardson (1988) discussed those variables that were commonly explored in empirical research: reading speed, accuracy, fatigue, understanding and preference. They indicated that the largest differences were observed for reading speed and accuracy, although it was always hard to judge whether these variables stemmed from the properties of the carrier as such, or rather from imperfection of early visual displays. Less promising were the results of two pilot studies conducted by Douglas, Kellami, Long, and Hodgetts (2001), which were aimed at comparing reading from paper and computer screen by visually impaired children. Participants were asked to read aloud short excerpts on a computer screen. Although the studies

did not provide any significant results, their exploratory nature should be noted: both experiments were conducted on small samples (5-8 participants).

Yet, the most recent investigations on the field seem to support claims made by media theorists. In her experiment on cross-media proofreading accuracy, Patty Wharton-Michael (2008) asked participants to correct mistakes in two short newspaper texts and found significant differences concerning one article. The lack of differences in proofreading of the second article was attributed to the content bias – the text might have been so salient for readers that they concentrated more, regardless of condition. The claim about differences in text processing between print and screen was also supported from the neurophysiologic perspective by Geske and Bellur (2008). They used electroencephalogram (EEG) to measure brain activity during the reading tasks. Subjects were asked to read simple, newspaper texts, presented directly in front of the subject at eye level. One group read the text presented on a piece of paper, and the other read from a CRT screen. The researchers concluded that artificially produced, pulsed light of CRT screens affects reader's attention. Moreover, reading from a CRT screen required more effort, suggesting according to researchers increased cognitive load rather than simple attention (p. 418).

Earlier research in this field accounted for some differences in text processing between print and computer condition. Yet, the impact of the interface on literary reading has not been tested so far. Empirical literary scholars focused in their explorations rather on the text structure, than on the interface itself (see: Miall 1997, 1998, 2003; Miall and Dobson 2001). The current study measures possible differences in memory, understanding and attention between those conditions.

According to theoretical assumptions concerning reading texts on screen, the prediction can be made that reading literary text on an electronic interface weakens readers' attention to details, yielding faster reading times, and lower scores of content and style recollection.

EXPERIMENT – METHOD

PARTICIPANTS

Sixty-three students from the Warsaw School of Social Sciences and Humanities participated for course credit (32 female, 31 male). All participants had their own computers at home. Participants were randomly assigned to either the print (P) or the computer (S) condition.

MATERIALS

Participants read a Polish short story *Jonasz* [*Jonas*] by Tomasz Małyszek, about a man who, after having a quarrel with his wife, goes to the ocean shore and, eventually, engages in a fight with a shark. The story was short enough (2077 words) to avoid participants' fatigue. Furthermore, it was written in a realist manner, as a third-person narrative with an established course of events, while allowing for different interpretations: it could be perceived as a story about Jack or about the marriage, or as a biblical allegory. Also, the short story was published in a literary journal, and was written by a not very well-known author eliminating the bias of participants' previous experience with the text or the author.

DESIGN

In order to test these hypotheses an between-subjects design was employed, whereby a group of participants read a text in print (P) or on the computer screen (S). Interest, attention, understanding, media use and preference were taken into account. A pilot study with three participants per condition was conducted. Minor ambiguities in questionnaire were spotted and corrected. No problems with the understanding of the tasks or with the reading and underlining procedure were reported.

PROCEDURE

Participants were asked to read the story and underline the passages they found striking or otherwise interesting. Reading times were measured with a digital stopwatch. The text layout remained exactly the same in both conditions: font size, white background, paragraphs, margins (in html version the tables were applied to ensure the fixed length of passages). P-group was given separate sheets with a printed story, whereas S-group read on laptops, in a Firefox browser window. P-group underlined passages with a highlighter, whereas S-group used the mouse cursor. Diigo.com software was applied in order to provide a 'natural' selection tool: participants could highlight the text with one click. They were instructed how to use this tool before they accessed the story online. They could also choose the pointing device: touchpad or external mouse.

After having read the story, participants filled out a questionnaire. To ensure the sameness of experimental conditions, both groups were given a printed questionnaire, which consisted of following sections: socio-demographical data, memory test (content and style recognition), short summary of the story (open question) and a media-use questionnaire (concerning participants' everyday media consumption).

Both memory tests consisted of 20 questions. Content-recognition test concerned the factual information about the story, with 4 possible answers, only one of which was correct. The style-recognition test listed 20 sentences from the story, 10 of which were manipulated in order to sound archaic (5) or colloquial (5). Participants were asked to mark the sentences, which appeared in the story in exactly the same form.

Although initially underlinings were to be coded with accuracy of one verse, the results showed that participants applied different strategies for this task. Some underlined whole sentences (or even paragraphs), while the others marked single words, or three-word phrases. Given such differences, the total amount of underlined *words* was coded (divided into five parts of the story). For each correct answer in content-recognition task participants were awarded 1 point per question. In the style recognition test the points were given for both underlining the correct passages and omitting the false ones (1 point per passage). Alternative coding was applied (with points given only for the right answers), but it showed no significant differences to the first mode. The open question ('What was the story about?') was coded in terms of the perspective adapted for the story – whether participants claimed the story was about Jack or the marriage, or else. The 'Preference for print' variable was computed from 7 questions, in which subject were asked to describe in which condition (print or screen) they read faster, more attentive, with more interest and comfort, and which of them they find less fatiguing or preferable. Each 'print' indication was given one point and counted.

RESULTS AND DISCUSSION

The experimental study did not confirm theoretical assumptions at any level. Moreover, reading times in both groups were almost the same (Screen: $\bar{x}$=13:58, SD=02:54; Print: $\bar{x}$=13:54, SD=02:40), what may suggest that distribution of scores might be affected by other variables than condition. Participants showed extremely high preference for print, which was marked on a 7 point scale (0=preference for screen at all times, 7=preference for print at all times): 79% were ranked between 5 and 7, and 41% showed maximum preference for print. Yet, no significant influence of preference on reading performance was found in both conditions. The fact that no significant differences in reading literary texts from screen in terms of attention, interest, reading times or understanding, may suggest that the differences between conditions, if any, are not so strong as it is often claimed. However, some potential confounding variables should be considered.

Firstly, the participants were reading in an artificial situation – their overall attention could have been sharpened by the experimental condition, since they knew they were going to fill out a questionnaire afterwards.

Secondly, the content-recollection test can be regarded as relatively easy (Mean=Median=16 points out of 20; SD=2,071). Yet, developing a set of 20 questions for a short story is a relatively difficult task, providing the amount of information one has at hand. Perhaps some open questions or longer texts could have been applied.

Thirdly, as it was mentioned earlier, the reading procedure might have had its impact on the amount of words underlined in both conditions. When reading with a highlighter, one is constantly reminded about the necessity of underlining. Yet, when reading from a screen, with a mouse cursor as a booth navigating and high-lighting tool, one can easily forget about the task. Immersion in the story-world might also played a role here. Exploration of the story plot in terms of amount of words underlined showed extreme differences between individuals in parts 3 and 4, where the fight with a shark is described in detail. For instance, average partici-pant underlined 10,9% of words in part 3, yet the standard deviation was as high as 17,32%. We can assume that some participants were so interested in this dramatic part, that they underlined many passages, whereas the others were so immersed in the story, they forgot about the task.

Finally, the lack of significant correlation between readers' preference for print and their performance in reading from screen might have been caused by the length of the story. Perhaps personal preference plays role in the case of longer texts (e.g. novels), which require readers to spend more time in a fixed position and exposes them longer to constant backlight of LCD screens. Yet, given the continuous raise of the average time spent in front of computer screens, we may assume that this pre-diction would not be confirmed.

These results suggest that the differences between reading from print versus reading from screen are not as obvious as suggested in the literature. However, the current study cannot rule out that no differences exist. Perhaps they are less visible due to socialization and deeper changes in our culture. Given the fact that participants were relatively young, exposed to computers from the early childhood, we may assume that the competence they have acquired enables them to switch between conditions and to process texts in a similar manner regardless of interface. The other explanation could be that the changes in our culture, as described by the-orists, are so deep that not only we switch fluently between conditions, but we also adapt new strategies to older (i.e. printed) materials. That means, in short, that we may process printed text differently than, say 30 years ago, because we have devel-

oped strategies to deal with digital interfaces. Yet, in order to test such hypothesis, we would have to replicate a study on literary response from a period when computers were quite rare (1980's, for instance) and compare the results. In that case however, possible differences could be ascribed to many factors such as evolution of culture, changes in literary competence, different forms of education, etc.

To account for the undergoing communication change, further studies may be conducted. The study described in this paper could be replicated with longer literary texts to test for the long-term effects of preference for print. Investigation into factual texts (e.g. textbooks), could bring some significant data for the field of education, testing whether students can master the equal amount of knowledge despite of reading conditions and whether printing out digital copies of textbooks or journal articles is justifiable. Finally, if no significant differences were observed in terms of interface, it would be worthwhile to make a step further and compare a linear story with its interactive or hypertextual edition in terms of reading processes and ascription of meaning. New or, say, digital dimensions of reading practices pose many questions which still remain to be addressed and evaluated empirically.

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