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# Digital replica editions versus printed newspapers: Different reading styles? Different recall?

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## Abstract

This article investigates reading styles and recall of the news from reading digital replicas of printed newspapers on tablets and compares them with the printed version. The study aims to theoretically understand the effects of the medium interface (tablet vs paper) on perceived reading style and recall of information. The experimental study ( $N=90$ ) showed that digital replicas were not perceived to be read in a more fragmented, selective, or elaborate manner than their printed counterparts. On average, readers recalled less from the digital edition than from the printed version, but the differences were small. The study also showed that “digital innovators” recalled the same amount of information from reading the newspaper on tablet as from reading it on paper, unlike less innovative readers: these readers recalled more from reading on paper than from tablet.

## Keywords

Digital editions, digital reading, newspapers, reading style, recall, tablets

Digital developments are transforming media worldwide. As part of this trend, newspapers are increasingly being produced for, published on, and consumed on digital devices such as laptops, tablets, and smart phones. Newspapers are present in a variety of digital

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The authors have contributed equally to the study and are listed in alphabetical order.

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forms, including news sites (e.g. <http://news.google.com>), brand websites (e.g. <http://www.bostonglobe.com>), E-newsletters, E-alerts, social media profiles (e.g. <https://www.facebook.com/bild>) and digital editions (also E-editions, for example, <http://thewashingtonpost.newspaperdirect.com/epaper/viewer.aspx> or <http://guardian.newspaperdirect.com/epaper/viewer.aspx>).

Digital editions<sup>1</sup> of a newspaper are considered particularly attractive to both publishers and consumers for several reasons (Hollander et al., 2011; Van Cauwenberge et al., 2015). Publishers produce digital editions at low cost because hardly any extra production costs are involved, merely the cost of digitizing the existing paper issue. Digital distribution is straightforward and avoids the vulnerability and expense of delivering paper copies (Kanter, 2008) and is considered ecologically friendly. For consumers, digital editions have attractive characteristics as well. They are easy to get and archive and are familiar to readers because they look like the traditional newspapers (Dundar and Akcayir, 2012; Hollander et al., 2011). Digital editions have become increasingly popular. In the United States, for example, the total circulation of the daily digital editions of the Top 25 Newspapers exceeds 3,600,000 copies.<sup>2</sup> In the Netherlands, digital editions (“digital only”) have a share of more than 17% of the circulation of the national newspapers. This number is rising.<sup>3</sup>

Despite the popularity of digital editions, to the best of our knowledge, no research has investigated how reading styles of digital editions on tablets differ from printed newspapers and whether what people recall from reading digital editions is different from printed newspapers. Most earlier studies in the field compared printed newspapers with online news sites instead of digital editions (Adam et al., 2007; D’Haenens et al., 2004; Eveland and Dunwoody, 2001, 2002; Jones et al., 2005; Santana et al., 2013; Sundar et al., 1998; Tewksbury and Althaus, 2000). Differences between the printed newspapers and the online news sites in these studies included various content differences (online versions usually contain less information), lay-out differences (headlines and location of articles were different), modality differences (e.g. movies were added to the text in some studies), and the inclusion of hyperlinks (interactivity) in the online versions. These multiple differences between the versions in earlier studies not only limit the comparison between traditional paper and new digital versions but also hinder theoretical conclusions regarding which aspect contributes to the different outcomes and to what extent.

To tackle these issues, we will study digital replica editions of newspapers on tablets that have the same content, presentation (lay-out), and modality as their printed counterparts. Articles and advertisements are identical, with the same headlines and lay-out, and they are in the same locations. Differences are limited to the “medium interface” (Griffith et al., 2001): the “touch” (plastic vs paper), the size, and the navigation features that include for the digital edition a navigation bar, the option to switch between text or paper view, and the option to zoom in (Garland and Noyes 2004; Mangen et al. 2013).

With an experiment, we will investigate the effects of the medium interface (tablet vs print) on audiences’ self-reported reading behavior and memory of the news. In addition, we will also investigate whether perceived differences in reading style and recall from the news is more prevalent for some groups of readers—people with higher or lower levels of digital innovativeness. The study aims to contribute to theory by providing

insight into how a complete digital edition is read on tablet, something which has never been studied before. By comparing printed versions of newspapers and their exact digital replicas on tablets, we are able to isolate the influence of the medium interface without confounding factors like differences in interactivity, content, and lay-out. We believe this is important; as Mangen et al. (2013) noted, few studies have specifically addressed the potential differences between reading similar texts in print and on screen, not to mention the case of tablets. Methodologically, this study contributes not only by making a fair comparison between print and tablet newspaper editions but also by extending previous research in the field with regard to ecological validity. In view of the lack of empirical studies using actual real life texts “which are longer than one or a few paragraphs” (Graesser et al., 1997; Mangen et al., 2013: 62), the current study employs actual, entire newspapers that were published on the day of the data collection.

## Reading behavior

We will investigate three reading style characteristics that have also been studied in previous online news website research: perceived mode of reading (linear vs fragmented), perceived selective scanning, and perceived elaboration.

The layout of newspapers contains features such as sections and headlines that facilitate a non-linear style of reading (Kress and Van Leeuwen, 1998). These features are also included in the tablet version. Two additional aspects of tablet newspapers may add to a more non-linear mode of reading. First, digital editions on tablets display a navigation bar at the top of the screen that shows all pages of the issue plus an indication of the section (sport, news, culture, etc.) in small format, which facilitates the option to click through to specific pages and articles, making it easier to adopt a non-linear reading style. Second, tablet readers might adjust their reading style of digital editions on tablet to their use of tablets for online websites (Ackerman and Goldsmith, 2011) where a non-linear reading style is the norm (Eveland and Dunwoody, 2002). Empirical research has provided evidence for this expectation: screen-based reading behavior is characterized by more time spent on scanning and browsing and non-linear reading (Liu, 2005). In line with this, we hypothesize

*H1.* Digital editions on tablets stimulate a more perceived fragmented style of reading than print formats of newspapers.

Eveland and Dunwoody (2002) defined selective scanning as “the process of picking and choosing among information based on personal criteria for relevance, importance, and interest” (p. 38). These researchers expected that readers of digital media, having more control over their reading behavior, would actively scan and select news items. Their study confirmed this for online news websites: they found that selective scanning was more prevalent among web readers than among print readers. It is not known whether selective scanning also applies to reading digital editions on tablets. It could be argued that tablet users have less control over their reading behavior than online readers who have hyperlinks and other digital navigation options at their disposal. On the other hand, readers may apply a digital reading style because of the tablet device. As no empirical

studies have been conducted on the occurrence of selective scanning when reading digital editions on tablets, we base our hypothesis on earlier research on reading from computer screens (Eveland and Dunwoody, 2002):

*H2.* Perceived selective scanning will be greater among people reading a digital replica edition on tablet than among people reading a printed newspaper.

Another aspect of reading style is elaboration: “making mental connections between related pieces of information” (Eveland and Dunwoody, 2002: 39). Eveland and Dunwoody found that elaboration was greater among readers of an online news article than among print readers of the same article. They explained this finding by the similarities between hypermedia (hyperlinked, interactive and non-linear) and human cognitive processing (Churcher, 1989; Eveland and Dunwoody, 2002; Nelson and Palumbo, 1992; Tulving, 1985).

Other scholars argue the other way around: people read a digital medium in a less elaborate way. Ackerman and Goldsmith (2011), for example, concluded that people believe that digital media are better suited for fast and shallow reading of short texts, while print media are better suited for effortful learning. Liu (2005) showed that this belief also translates into actual behavior; reading from screens was related to less time spent on in-depth, concentrated reading. As digital editions of newspapers hardly use hyperlinks and cannot be characterized as highly interactive, we formulate our hypothesis based on these studies:

*H3.* Perceived elaboration will be lower among tablet users than print users.

## Recall

In our study, we use a free recall task consistent with other studies on recall from the news in different media (Eveland and Dunwoody, 2002; Eveland et al., 2002; Jones et al., 2005; Magee, 2013; Morineau et al., 2005). These news studies showed poorer recall of the news associated with on screen reading (e.g. Eveland and Dunwoody, 2001, 2002; Tewksbury and Althaus, 2000), but this has not been studied yet for digital editions on tablet.

Several factors may account for the poorer performance of tablet reading. First, the hypothesized differences in reading behavior (linear-fragmented, selective-not selective, elaborate-superficial: see H1 to H3) would also affect recall. Selective scanning means that readers skip the information that they are not interested in, and this could result in their recalling fewer articles and topics. In line with this, earlier research has generally found that “selective scanning is harmful for, as opposed to beneficial to, the learning process, at least in the context of learning public affairs information from the news” (Eveland and Dunwoody, 2002: 39; Eveland and McLeod, 1995; Kosicki et al., 1987; Tewksbury and Althaus, 2000). We can also assume that a fragmented reading style hinders the recall because browsing and reading small bits of information is likely to result in less in-depth processing (Liu, 2005) and a reduced ability to remember the details of a text (Dundar and Akcayir, 2012; Rho and Gedeon, 2000). Furthermore, if elaboration is

lower on tablets, as hypothesized, this could decrease recall; studies have shown that elaboration is important for recall (for an overview, see Eveland and Dunwoody, 2002).

Second, next to the effects of the reading behavior variables, it is also predicted that “perceived disorientation” (“the tendency to lose one’s sense of location” (Ahuja and Webster, 2001: 16)) may cause poorer recall for readers of the tablet version (McDonald and Stevenson, 1998). When reading a text from a computer screen or tablet, it is necessary to scroll through the text and to zoom in to read the articles, as a tablet is significantly smaller than a traditional printed newspaper. Research on e-books has showed that it is very tiresome to navigate pages, and that it is difficult for readers to advance to a desired section (Carlson, 2002).

The small screen size of a tablet could also hinder readers’ mental representation of the text, which in turn could result in reduced recall (Eklundh, 1992; Piolat et al., 1997). Mangan et al. (2013) discussed this in a study that compared reading texts on paper versus on computer screen:

Readers in the paper condition had immediate access to the text in its entirety. This access is, moreover, built on both visual and tactile cues: the reader can see as well as tactilely feel the spatial extension and physical dimensions of the text, as the material substrate of paper provides physical, tactile, spatiotemporally fixed cues to the length of the text. (p. 66)

Readers in the computer condition, by contrast, were restricted to seeing (and sensing) only one page of the text at any given moment. Hence, their overview of the organization, structure, and flow of the text might have been hampered due to limited access to the text in its entirety (Eklundh, 1992; Piolat et al., 1997). Based on these considerations, we predict that the relationship between medium interface (paper vs tablet) and recall is also mediated by perceived disorientation.

These considerations lead us to the following hypotheses:

*H4.* The type of medium interface (paper vs tablet) has an effect on recall from the news: tablet users will remember less news than traditional print users.

*H5.* The relationship between type of medium interface (paper vs tablet) and recall is mediated negatively by (a) perceived fragmented reading, (b) perceived selective scanning, (c) perceived elaboration, and (d) perceived disorientation.

## Digital innovators

In our study, we will also investigate to what extent digital innovators have a different reading style and perform differently when reading a tablet newspaper. Digital innovators, people who show a “predisposition to learn about and adopt new digital products” (Goldsmith and Hofacker, 1991: 219), might have more experience using tablets and reading texts on tablets, since consumers who score high on innovativeness are relatively early to adopt new technologies (Goldsmith and Hofacker, 1991). On the one hand, we would expect that they have adopted a “digital reading style,” making them more likely to read in a more fragmented, selective, and less elaborate manner than readers who have lower levels of digital innovativeness. Based on the hypotheses above, this would imply

that digital innovators would recall less from a digital edition. On the other hand, they are probably more competent and experienced reading on tablet, which would make them less vulnerable to the negative effects of a digital reading style and less disoriented reading the digital edition than readers with lower levels of digital innovativeness.

In view of these contradictory arguments, we will study these relationships with an open question:

*RQ1.* How does a reader's level of digital innovativeness influence (a) perceived reading behavior and (b) recall from reading paper and tablet newspapers?

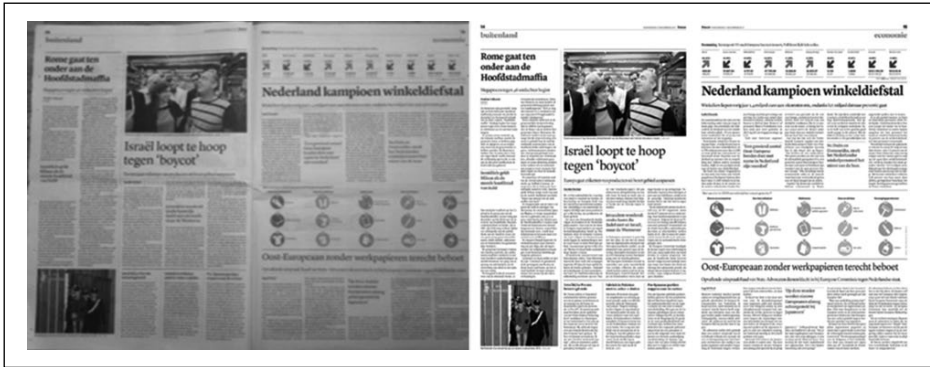
## Method

### *Design and participants*

To test the hypotheses, an experiment was conducted with a one factor (tablet vs paper) between-subjects design. For this experiment, 90 college students (64% female,  $M_{\text{age}} = 23.00$ , *standard deviation*<sub>age</sub> ( $SD$ ) = 4.84) were recruited using flyers and posters in the building of a large university in Northwest Europe. Participants were randomly assigned to one of the conditions. The two experimental groups did not differ with respect to background variables such as age, gender, and day of data collection. The experiment took about 45–60 minutes, and participants received €10 for their participation.

### *Procedure*

The experiment ran for 3 days, and participants could walk in at any moment. The experiment took place at the university in a library-like reading room (not in a classroom). On arrival, participants were asked to read an informed consent in which it was stated that “the study consists of reading a newspaper and filling out a questionnaire. The aim of the research is to study how people read newspapers.” After reading the informed consent, they were asked to read that day's newspaper for about 30 minutes. Each day, the latest version of the newspaper was used in the experiment. After participants had read the newspaper, they could click through to the questionnaire (tablet version) or could fill in a questionnaire on paper (paper version). The assignment of a paper-and-pencil questionnaire or a digital version of the questionnaire eliminated the need to switch media (from tablet to paper or from paper to tablet). Using a tablet questionnaire for tablet users and a paper questionnaire for print readers removed the possibility that the participant perceived a discrepancy between the medium used for reading the newspaper and the medium used to answer questions on their reading behavior and recall of the newspaper content (Mangen et al., 2013). Such a match between the modality of the experimental material and the questionnaire is less likely to influence the results of a study than a mismatch that would have been present if some participants had been asked to fill in the questionnaire on the same medium as they used for reading the newspaper (e.g. a printed newspaper with a printed questionnaire), while other participants had been asked to switch (e.g. from a tablet newspaper to a printed questionnaire) (Costley et al., 1997; Jones et al., 2005).



**Figure 1.** Illustration of the similarity of the experimental material in the paper versus tablet condition.

## Stimuli

In the experiment, we used real issues of the Dutch national newspaper *Trouw*, which is considered a quality newspaper. A total of 46 participants read a paper version, and 44 participants read a tablet version on a Samsung Galaxy S3 10-inch device. The content and presentation format (lay-out) were exactly similar. The tablet version contained features to enlarge texts, choose between “text only” and “paper” (text and lay out) format, and a navigation bar to select specific pages.

Figure 1 shows a screenshot of a newspaper page, for both the paper and the digital version. As can be seen, the text, typeface, and illustrations are exactly the same. The newspaper had a standard lay-out: the most important news on the front page, then national news, foreign news, articles about the economy, sports, an opinion section (“Letters to the Editor”), articles with background information, and services. The Thursday issue, for example, consisted of two sections of 24 pages each. The total number of articles was 82. The length of the articles varied from about 10 sentences to 2 pages.

An academic study of *Trouw* conducted in 1982 found that the newspaper had a good readability (Scholten, 1982). To ensure that this is still the case, we tested the readability of five randomly chosen articles published in the issues that we used in our experiment. The average word length in our sample was 5.70 characters, and the average number of words per sentence was 14.05 which can be considered highly readable (Hacquebord and Lenting-Haan, 2012).

## Measures

All information on the measures included in our study can be found in Table 1.

## Analysis

T-tests were used for the category variables such as “medium interface” (paper vs tablet). For the multivariate (mediation and moderation) analyses, we applied Hayes’ PROCESS



**Table 1.** Measures.

Variable	Operationalization	Source	Reliability	M (SD)
1. Recall	The number of articles that participants could correctly recall.	Magee (2013)	–	8.71 (3.64)
2. Perceived fragmented reading	Two items “I only read sections of the newspaper that looked important or interesting”; and “I skimmed through the newspaper.”	Eveland and Dunwoody (2002)	$r = .340^{**}$	4.59 (1.31)
3. Perceived selective scanning	“I read the newspaper in an unstructured manner”; “I read page by page (reversed item)”; and “I viewed the pages in random order.”	Constardine (2012)	EV = 2.00; R <sup>2</sup> = 66.79; $\alpha = .75$	4.59 (1.31)
4. Perceived elaboration	“I tried to think of the practical applications of what I read”; “I tried to relate the ideas in the story to my own past experiences”; “I thought about how what I read related to other things I know”; “I thought about what actions should be taken by policy-makers based on what I read”; and “I found myself making connections between the story and what I’ve read and heard about elsewhere.” Seven items, e.g. “I felt lost” and “I felt disoriented”	Eveland and Dunwoody (2002)	EV = 2.68; R <sup>2</sup> = 53.54; $\alpha = .77$	4.86 (1.04)
5. Perceived disorientation	Six items, e.g. In general, “I am the last in my circle of friends to buy new technology, such as computers, mobile phones, apps, etc. when it comes to the market.” “Compared to my friends, I own many ICT products,” and “I know about the latest ICT products before other people do”	Ahuja and Webster (2001)	EV = 5.34; R <sup>2</sup> = 76.32; $\alpha = .95$	2.57 (1.35)
6. Digital innovativeness	“A paper version of a newspaper is attractive”; and “I value a paper version of a newspaper.”	Goldsmith and Hofacker (1991)	Forced 1-factor solution: all item loadings >.64; $\alpha = .84$	3.61 (1.28)
7. Attitude printed newspaper	“A tablet version of a newspaper is attractive”; and “I value a tablet version of a newspaper.”	–	$r = .73^{**}$	4.94 (1.59)
8. Attitude tablet newspaper	Three 7-point scales with the following poles “I prefer paper to digital” to “I prefer digital to paper”; “I prefer reading on paper to reading on screen” to “I prefer reading on screen to reading on paper”; and “I enjoy reading on paper over on screen” to “I enjoy reading on screen over on paper”	–	$r = .58^{**}$	3.58 (1.43)
9. Preference for reading from screen	–	–	EV = 2.67; R <sup>2</sup> = 89.02; $\alpha = .94$	2.23 (1.35)

M: mean; SD: standard deviation.  
 Variables 2–8 were all measured on 7-point Likert scales with options ranging from “strongly disagree” to “strongly agree.”  
 \*\* $p < .01$  (two-tailed).

**Table 2.** Reading preference (screen vs paper), attitude towards tablet and printed newspapers and evaluation of their size, divided by experimental condition.

	All resp.	Print condition	Tablet condition	t(88)	p (two- tailed)
	M (SD)	M (SD)	M (SD)		
Preference reading from screen versus paper (scores lower than 4 indicate preference for paper)	2.23 (1.35)	1.88 (0.92)	2.59 (1.63)	-2.53	.01
Attitude printed newspaper	4.94 (1.59)	5.21 (1.39)	4.67 (1.75)	1.61	.11
Attitude tablet newspaper	3.58 (1.43)	3.26 (1.45)	3.92 (1.35)	-2.23	.03

Mean scores; 7-point scales.

macro. We used a significance level of .05 for the t-tests and allowed—given the number of respondents—a significance level of .10 for the multivariate analyses. The zero-order correlations between the variables can be found in Appendix 1.

## Results

### General

Table 2 shows that most readers (83.5%) preferred reading from paper (mean score 2.23 on a 7-point bipolar scale (scores lower than 4 indicate a preference for paper). This preference is reflected in the significant difference,  $t(89)=6.01$ ;  $p<.001$ , in attitudes towards paper versions (mean score 4.94) and tablet versions (mean score 3.58).

The table shows an effect of experimental condition. Compared to respondents who read the printed version of the newspaper, those who read the digital version were more in favor of reading from screen, and more positive about the digital version, although they were still more positive about the printed version. Thus, direct experience with digital editions seems to contribute to a positive evaluation.

### Perceived reading style

To test H1–H3, we conducted three independent sample t-tests with medium interface (paper vs tablet) as grouping variable and the three reading variables as test variables (see Table 3). It shows that, according to the respondents' perceptions, reading the newspaper on tablet did not differ from the paper version: there were no significant differences between the tablet and the paper version with regards to perceived fragmented style of reading, perceived selective scanning, or perceived elaboration. Therefore, H1 to H3 were rejected. In other words, the digital replica on tablet was perceived to be read in the same way as the printed version. Although we did not formulate a formal hypotheses on differences in perceived disorientation between printed and tablet newspapers, a t-test showed that printed and tablet newspapers did not differ in terms of perceived disorientation.

**Table 3.** Differences between paper and tablet newspapers regarding reading style, disorientation, and learning from the news.

Reading style variables	<i>t</i> (88)	<i>p</i> (one-tailed)	Paper <i>M</i> ( <i>SD</i> )	Tablet <i>M</i> ( <i>SD</i> )
Perceived fragmented reading (H1)	0.21	.42	3.11 (1.39)	3.05 (1.58)
Perceived selective scanning (H2)	-0.09	.46	4.58 (1.33)	4.60 (1.31)
Perceived elaboration (H3)	-0.50	.31	4.81 (1.04)	4.91 (1.05)
Perceived disorientation	-0.86	.20	2.45 (1.25)	2.70 (1.45)
Recall (H4)	1.59	.055	9.30	8.09

### Recall

The data also show that—as hypothesized in H4—tablet users recalled fewer news items than print readers. Readers of the printed newspaper recalled on average 9.30 articles, while readers of the tablet version recalled on average 8.09 articles. This indicates that the difference between paper and tablet readers was significant, but small ( $t=1.59$ ,  $p=.06$  one-tailed).

Hypothesis 5 stated that the relationship between type of medium interface (paper vs tablet) and recall is mediated negatively by (a) perceived fragmented reading, (b) perceived selective scanning, (c) perceived elaboration, and (d) perceived disorientation. Although not all bivariate relationships were significant, we conducted a formal mediation analysis to check for possible suppression effects (see MacKinnon et al., 2000). We conducted a mediation analysis using Model 4 of Hayes' (2013) PROCESS macro. The macro produces the Sobel test for the specific indirect effects and generates 90% bias-corrected confidence intervals for the indirect effects using 1000 bootstrap samples (Hayes, 2013). Medium interface (paper vs tablet) was used as independent variable, recall as dependent variable, and all four proposed mediators—perceived fragmented reading, perceived selective scanning, perceived elaboration, and perceived disorientation—were entered as parallel mediators in the model. The results showed that for all reading variables, the indirect effect was not different from zero with a 90% confidence interval (CI) (perceived fragmented reading:  $B=.01$ , standard error [ $SE$ ]=.10,  $p=.47$  one-tailed,  $CI=[-.09, .27]$ ), perceived selective scanning ( $B=-.02$ ,  $SE=.14$ ,  $p=.44$  one-tailed,  $CI=[-.36, .13]$ ), perceived elaboration ( $B=.03$ ,  $SE=.11$ ,  $p=.41$  one-tailed,  $CI=[-.06, .40]$ ). This indicates that the relation between medium interface and recall cannot be explained by the reading variables and also not by perceived disorientation ( $B=-.07$ ,  $SE=.13$ ,  $p=.32$  one-tailed,  $CI=[-.37, .04]$ ).

### Digital innovativeness

To test how a reader's level of digital innovativeness influenced (a) perceived reading behavior and (b) recall from reading paper and tablet newspapers (RQ1), we again used Hayes' (2013) PROCESS macro (model 1). To give insight into the differences in reading behavior, we used device, digital innovativeness and the interaction between type of device and digital innovativeness as predictors, and the reading behavior variables as dependent variables in the analyses.

*Perceived reading behavior and perceived disorientation.* The analyses showed that perceived digital innovativeness did not moderate the relationships between device and the reading behavior variables: perceived fragmented reading ( $B = -.07$ ,  $SE = .25$ ,  $t = -0.30$ ,  $p = .39$  one-tailed,  $CI = [-.57, .42]$ ), perceived selective scanning ( $B = .01$ ,  $SE = .22$ ,  $t = 0.06$ ,  $p = .48$  one-tailed,  $CI = [-.43, .46]$ ), and perceived elaboration ( $B = .20$ ,  $SE = .17$ ,  $t = 1.15$ ,  $p = .13$  one-tailed,  $CI = [-.15, .54]$ ). However, there was a significant interaction effect of medium interface and digital innovativeness on perceived disorientation ( $B = -.48$ ,  $SE = .22$ ,  $t = -2.15$ ,  $p = .02$  one-tailed,  $CI = [-.92, -.04]$ ). To decompose significant interaction effects, we used the Johnson–Neyman technique. In essence, the Johnson–Neyman test reveals the result of a spotlight analysis for every value of the continuous variable and thereby eliminates the arbitrariness of choosing high and low values such as one SD below and above the mean (Spiller et al., 2013: 282). Results showed that when digital innovativeness was below  $-.95$  (mean-centered variable), tablet readers demonstrated a higher level of perceived disorientation than print readers. However, when digital innovativeness was above this value, there was no difference in perceived disorientation between print and tablet readers. In our dataset, 23.33% of the respondents scored below this value and 76.67% of the respondents scored above.

*Recall.* With regards to recall, the results showed a marginally significant effect of medium interface ( $B = -1.22$ ,  $SE = .76$ ,  $t = -1.61$ ,  $p = .06$  one-tailed  $CI = [-2.72, .28]$ ), a non-significant effect of digital innovativeness ( $B = -.08$ ,  $SE = .30$ ,  $t = -0.27$ ,  $p = .40$  one-tailed,  $CI = [-.68, .52]$ ), and a significant interaction effect of medium interface and digital innovativeness ( $B = 1.11$ ,  $SE = .60$ ,  $t = 1.84$ ,  $p = .003$  one-tailed,  $CI = [-.09, 2.29]$ ). The results showed that when digital innovativeness was below  $-.29$  (mean centered: 42.22% of the respondents scored below this value and 57.78% above), print readers demonstrated a higher level of recall than tablet readers. However, when digital innovativeness was above  $-.29$ , there was no difference in recall between printed and tablet readers. So it can be concluded that digital innovators recalled information equally well from reading the newspaper on tablet as from reading it on paper, unlike less innovative readers; these readers recalled more information from reading on paper than from reading on tablet.

*Attitudes toward printed and tablet newspapers.* Finally, we tested whether medium interface and digital innovativeness predicted readers' attitude toward printed and tablet newspapers using Hayes' (2013) PROCESS macro (model 1). The results showed that medium interface and digital innovativeness both predicted attitudes. People scoring higher on digital innovativeness had a more negative attitude toward printed newspapers than people scoring lower ( $B = -.36$ ,  $SE = .13$ ,  $t = -2.85$ ,  $p = .01$  one-tailed,  $CI = [-.62, -.11]$ ). On the other hand, people with a higher level of digital innovativeness had a more positive attitude towards tablet newspapers than people with lower levels ( $B = .31$ ,  $SE = .11$ ,  $t = 2.71$ ,  $p = .01$  one-tailed,  $CI = [.08, .54]$ ). There were no significant interaction effects of medium interface and digital innovativeness ( $ps < .05$ ).

## Discussion

This study shows that reading digital replica editions of newspapers on tablet is comparable to reading traditional printed newspapers. Tablet newspapers were not

perceived to be read in a more fragmented, selective, and elaborate manner than their printed counterparts. On both devices, the average reader claimed to have neither a “fully” non-linear nor a “fully” linear mode of reading and neither a “fully” selective nor a “fully” non-selective reading style. Thus, when comparing paper versions of newspapers and their digital replicas on tablets, without confounding factors like differences in content, lay-out, and interactivity, differences in the perceived reading style were non-existent.

One reason that self-reported reading behavior did not differ between digital and printed versions might be that the digital navigation structure of the tablet version contained fewer interactive navigation possibilities than the online news sites that were used in previous research and on which our hypotheses about reading behavior were based (e.g. Eveland and Dunwoody, 2001; Sundar et al., 1998; Tewksbury and Althaus, 2000). Not only was the content identical, but the lay-out and structure of the printed and digital versions was also the same: the most important news appeared in the front and topics like culture, sports, and economy appeared in the back or in separate supplements. This structure has been common in all newspapers for many years, and since readers are presumably familiar with it, this could contribute to a comparable perceived reading style of tablet and printed versions. It seems that our participants transferred their usual newspaper reading style to the tablet version rather than adopting the online tablet reading style to reading digital editions (Ackerman and Goldsmith, 2011).

Although differences in perceived reading style were non-existent, recall of information from the news was lower for the digital replica edition than for the printed edition, which is in line with our expectations. However, the differences were small. The explanations that we tested for this effect (perceptions of fragmented reading, selective scanning, elaboration, and disorientation) were not confirmed. Interestingly, we found that the reader’s level of digital innovativeness plays an important role, with less digitally innovative readers recalling less from the tablet version than from the paper version; digitally innovative readers recalled just as much from the digital version as from the paper version. Less digitally innovative readers exhibited higher levels of disorientation on tablets than their more innovative counterparts. The findings indicate that their digital competence and experience enable digitally innovative readers to read better on a digital device, in a less disoriented way. Digital innovators were also more positive about reading digital editions than less digital innovative people. As the attitudes toward the digital version of the newspaper are more positive for digital innovators, this could imply that, in practice, digital editions will mostly be read by people for whom there is no difference in recall.<sup>4</sup>

Even though our sample consisted of young college students, often considered to be early adopters of new technology such as smartphones and tablets (Lee, 2014; Pew Research Center, 2011), they preferred to read printed versions, which is in line with research comparing print books and e-books (Kretzschmar et al., 2013). It seems that readers still value the physical contact and scent of paper (Dundar and Akcayir, 2012; Shepperd et al., 2008; Woo, 2005), or perhaps they consider printed newspapers to have an important status as part of our cultural heritage (Kretzschmar et al., 2013). Another reason could be that our respondents – young consumers – felt that the digital editions simply did not match the interactive possibilities of tablet reading (see Note 4).

An interesting question for future research is to what extent extra digital possibilities such as sophisticated hyperlinks, options for click-through to additional content, or options for interaction with other readers (see Chung, 2008) will make the tablet versions more attractive. It would also be interesting to study how these digital possibilities would affect reading style and the effects of the digital device. Our studies on digital magazines with interactive features for sharing, liking, voting, and commenting give some indications of possible effects (Rauwers et al., 2016). For publishers who want to bet on “digital” to compensate for the rapidly declining readership of their printed newspapers, it is crucial to know how to include new digital and interactive possibilities in tablet versions and to what extent.

A strength of our study is its naturalistic character. We used a real newspaper and included three editions, a new one for each day of the experiment. In this way, we were able to compare the effects of paper versus digital for a text longer than the one or two paragraphs most studies have used (Mangen et al., 2013). It could be, however, that respondents in the experiment read the newspaper differently than they would normally do. Please note though that the experimental instruction did not indicate that they had to read the newspaper in a certain way or that we expected them to recall items, and that the instructions for the two versions – tablet and paper – were the same.

A final suggestion for future research concerns how the reading behavior variables fragmented style of reading, selective scanning, and elaboration are measured. In our study, we relied on self-reports for reading behavior (such as perceived elaboration, perceived selective scanning etc.), which run the risk of memory problems and social desirability (e.g. Robinson and Godbey, 1997). Empirical evidence has shown that the validity of self-reports of media exposure depends on the type of measure, the type of content, and the conditions under which the measures are acquired (see also De Vreese and Neijens, 2016; Smit and Neijens, 2011). Research has shown that validity issues are less of an issue for the more general reading style variables applied in this study, particularly when measured immediately after reading the newspaper (Hyönä and Nurminen, 2006). It would be interesting, however, in future studies to map reading behavior by means of passive measurement tools such as eye tracking and (for tablet versions) apps that record usage (Mattlin and Gagen, 2013).

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## Notes

1. We borrow the following terminology from two authoritative audit organizations: the Alliance for Audited Media (AAM, USA/Canada) and the International Federation of Audit Bureaux of Circulations (IFABC, International). A digital *edition* is an edition of the print publication published electronically as a unit. The content cannot change once the issue is made available. With a digital *replica edition*, each issue’s content and design are identical to the original print edition. Layout and editorial content of a digital *non-replica edition* may contain

sections that are unlike the print edition, but the digital edition must maintain the same basic identity and content of the same editorial home as the print version. A digital *publication* is a stand-alone digital product without a companion print edition. Digital editions and digital publications are not websites as they have page-turning characteristics. Sources: <http://auditedmedia.ca/news/blog/2013/march/ask-aam-how-do-the-qualifications-for-digital-replicas-and-nonreplicas-differ/> and <http://www.ifabc.org/site/assets/media/Documents/IFABC-General-Assembly-2014/IFABC-Guideline-for-Digital-Media.pdf>). In this article, we study digital replica editions.

2. Source: Alliance of Audited Media, as cited in the Pew Research Center's The State of the News Media 2013. More recent figures are not publicly available.
3. Source: NOM, the Dutch IFABC member (<http://www.nommedia.nl>; <https://dundas.reports.nl/NOM>). This figure shows the paid "digital only" circulation as a percentage of the total (print + digital) paid circulation of Dutch national newspapers (annual moving average, until first quarter 2016). Taking into account that some subscribers have a combined print and digital subscription, it shows that in total 29% can access the digital edition. Digital non-replicas are not on the market in the Netherlands.
4. We would like to thank an anonymous reviewer for this interesting suggestion.

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### Appendix I. Zero-order Pearson correlations of all variables.

	1	2	3	4	5	6	7	8	9	10
1. Paper (1) or tablet (2)	1									
2. Recall	-.17	1								
3. Perceived fragmented reading	-.02	-.14	1							
4. Perceived selective scanning	.01	-.18	.39**	1						
5. Perceived elaboration	.05	.08	-.06	-.20	1					
6. Perceived disorientation	.09	-.17	.29**	.24*	.09	1				
7. Digital innovativeness	-.04	.01	-.15	.03	-.20	-.02	1			
8. Attitude printed newspaper	-.17	.18	-.15	.02	.32**	-.18	-.28**	1		
9. Attitude tablet newspaper	.23*	.16	-.07	.07	-.02	-.24*	.25*	-.01	1	
10. Preference for reading from screen	.26*	.04	-.10	-.04	-.31**	-.12	.32**	-.51**	.32**	1

\* $p < .05$ , \*\* $p < .01$  (two-tailed).