Expected later information access invites shorter reading time and possible comprehension loss

Tora Bodin
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Abstract

With the increased use of technology in society, there are concerns about how reading is affected by the constant access to an incessantly increasing amount of information. The present study examined how reading strategies and resulting memory and comprehension is affected by the belief that information to be remembered would continue to be available. In a within-participant experiment, twenty-seven participants were instructed to read six texts, and led to believe that they would have access to some of the texts while later answering comprehension questions. The results showed that participants spent significantly longer time reading texts they believed would not be accessible later, compared to those they believed they would have access to ($p = .0007, d = 0.47$). The participants did achieve slightly higher scores on the comprehension questions for the texts they believed they would not have access to, compared to the other condition, but the effect was not significant. The findings have implications for potential changes to reading strategies in response to increased use of technology as an external memory and information storage. I discuss how these strategies could have affected the raise of Fake News, inasmuch as increased information load from the Internet leads to a less meticulous reading style.

Keywords: Reading, reading comprehension, transactive memory, Internet, information overload

Abstrakt

Den ökade teknologianvändningen i samhället medför oro kring hur läsande påverkas av den ständiga tillgången till ständigt växande informationsmängder. Syftet med föreliggande studie var att undersöka hur lässtrategier påverkas av förväntan om senare informationstillgång. I ett experiment med inompersonsdesign blev tjugo-åtta deltagare instruerade att läsa sex texter, och ledda till att tro att de skulle ha tillgång till några av texterna när de i ett senare moment skulle svara på läsförståelsefrågor. Resultaten visade att deltagare spenderade signifikant längre tid på att läsa texter de inte trodde att de skulle ha tillgång till senare, jämfört med de som de trodde skulle finnas tillgängliga ($p = .0007, d = 0.47$). Deltagarna fick även högre poäng på läsförståelsefrågorna som baserades på de texter de trodde skulle försvinna jämfört med den andra betingelsen, men effekten var ej signifikant). Att endast en liten trend i skillnad mellan läsförståelseresultat uppmättes tros bero på ett undermålligt mätinstrument. Resultaten har implikationer för potentiella förändringar i lässtrategier baserat på ökad tillgång till teknologiska minneshjälpmedel och informationslagringssystem. Vidare diskussion reflekterar över hur dessa strategier kan ha påverkat den ökade spridningen av Fake News, ifall ökad informationsbelastning från internet leder till en mindre noggrann lässtil.

Nyckelord: Läsning, läsförståelse, transaktivt minne, internet, informationsbelastning
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The ability to read is not naturally occurring in humans the way spoken language is. While young children learn to speak just by interacting with the people around them, it usually takes years of training to obtain reasonable reading skills (McGuinness, 1997; Pinker, 2015). Working with the written word is a relatively new part of human culture; the earliest written languages we are aware of today are only about 5000 years old (Olson, 2016). It is interesting to reflect on how the ability to read has affected our cognitive strategies. The present study aimed to investigate differences in reading and memory strategies and the resulting text comprehension, based on expected later information access, to offer further understanding of the subject.

Before being able to write and to store written information, knowledge could only be accessed by gaining it oneself or by conversation with someone who had access to it. It could only be kept by remembrance. Records show that speculation about the effect of the written word existed even 2500 years ago. In Plato’s Phaedrus (translation by Waterfield, 2002), he describes the famous philosopher Socrates musings over how writing and reading will change the way we remember things for the worse:

The loyalty you feel to writing, as its originator, has just led you to tell me the opposite of its true effect. It will atrophy people’s memories. Trust in writing will make them remember things by relying on marks made by others, from outside themselves, not on their own inner resources, and so writing will make the things they have learnt disappear from their minds. (Socrates, as quoted by Plato, 428 – 348 BCE.)

The statement may seem conservative today, with literacy being considered a necessary mean to achieve any form of higher education. But the rhetoric used does not differ a lot from how many describe how the onset of technology and online reading today could affect our brains (Cavanaugh, Giapponi & Golden, 2015).

The access we have to textual information has changed a lot over the years. From finely handwritten scrolls only accessible to the rich and educated, to printed books and public libraries, to the wide range of search engines and databases we have today (Johnson, 2015). Nowadays, information is easily accessible to anyone with an Internet connection. If a person knows where to look, all the knowledge of both Wikipedia and countless research databases and news websites is just a few searches away. The way we store and access information is, beyond doubt, continuously changing.

This new way to access information comes with new problems. Information overload has been an issue for a long time. With the relatively new introduction of the Internet, the overload effects have increased (Bawden & Robinson, 2008). The constant connection to different social media can lead to attention deficits (Hembrooke & Gay, 2003) and many researchers report feeling stressed because they do not have the time to keep up with the exponentially increasing amount of publications in their research fields (Landhuis, 2016). In the same way that the written word’s first introduction changed recall strategies by allowing people to write down what they needed to remember, it seems reasonable that the recent changes in information accessibility leads to people developing new information processing strategies.

Many different strategies have developed to deal with textual information overload (Liu, 2005). The use of tables of context and index pages exists for this particular reason (Blair, 2003). Only reading the headlines and abstracts of articles is often enough to determine whether
it is worth dwelling deeper into that particular text (UNSW, 2015). Shallow skim reading helps the reader look for specific facts and information points without needing to thoroughly go through all pages first. Being able to skim through, sort out and prioritize material is essential to manage the endless source of information we are presented to every day.

As with all shortcuts and new methods, there are both benefits and drawbacks. The increased use of this new way of quickly processing information has raised concerns related to the skillset of deeper reading (Cavanaugh, Giapponi & Golden, 2015). Some claim that the process of superficial skim reading leads to readers missing out on more advanced analysis on multiple planes. Partially from reading and understanding single texts, but also from the knowledge that is acquired by reading and gathering information from multiple sources to draw new conclusions. Similar to the ancient philosophers before them, modern researchers (such as Cavanaugh et. al, 2015) are worried that in the long run, this could lead to a decrease in skill and quality of knowledge.

**Transactive memory and external memory storage**

One interesting effect of the increased Internet access is that of our view on information storage. A recent study (Sparrow, Liu & Wegner, 2011) discovered that people who were asked difficult questions had a stronger reaction if later exposed to the word “Google” compared to another brand name such as “Nike”. There was no such effect if the participants were originally presented to less difficult questions. The researchers meant that this was an indication of the participants immediately thinking about finding the answer online when they felt unsure of what to respond. This indicates that our brain can be conditioned to look for unknown information in specific places. This is further supported by the fact that different brain patterns emerge when skilled and novice Internet users search for information online (Small, Moody, Siddarth & Bookheimer, 2009).

Sparrow, Liu and Wegner (2011) also investigated how people remember what they previously read and where they read it. Three different experiments were conducted, showing that people remember where something is stored to a greater degree than exactly what is stored. They also learned that people are better at remembering details about information if they do not expect to have access to it at a later time.

By connecting this to our knowledge about skim reading, new conclusions and hypotheses can be drawn. It seems likely that the processing of information is based both on the ability to sort through and choose relevant parts of texts, and on the ability to determine what needs to be memorised in detail and what can be forgotten. The cognitive offloading studied by Storm and Stone (2014) is a prime example of this. Their study shows that the knowledge of guaranteed later access to information allows a person to put less resources into remembering that particular thing and focus on other tasks instead. This process fits well with the concept of *transactive memory* (Wegner, 1987), a strategy first presented about thirty years ago. Wegner describes it as the process in which a group of people in a work environment, or a group of friends, develop a collective skill base in which they are able to rely on each other for different types of knowledge and expertise. In a so called *Transactive Memory System* (TMS) the knowledge a single person holds is her own, but she is also able to access the knowledge of the group, by her asking colleagues and friends. Instead of remembering everything herself, she is aware of what other people have knowledge about, and is able to use that knowledge. This strategy allows for a lesser personal memory demand while still allowing access to the information with just a little delay, in that of asking the question and gaining the answer. Much as one can save data to an external hard drive to release memory on a computer, a person can rely on external sources to remember what she herself does not.
The transactive memory effect is again presented in the previously mentioned article by Sparrow, Liu and Wegner (2014). They mean that people nowadays form a transactive memory system involving the Internet as a cognitive offload strategy. This means that a person would selectively choose which information to process thoroughly and which to skim through lightly, with an expectation of later access to the latter. Similar effects have been shown when taking pictures (Henkel, 2014); when participants took photos of museum objects, it was later shown that they remembered fewer details about them compared to when no photo was taken. These findings support previous studies of directed forgetting, in which participants showed superior recall for words they were previously told to remember, compared to words they were told to forget (MacLeod, 1989). In the present study, participants will not explicitly be told what to remember and what to forget.

When looking at the Internet in particular, studies have shown that participants who have recently used it to answer questions tend to overestimate their own ability to answer questions (Fisher, Goddu & Keil, 2015). The authors mean that using the Internet to find information increases a person’s belief in her own ability to answer correctly. The access to an external memory source such as the Internet carried over the inflated knowledge estimation. This occurred even when the participants were specifically informed that they were to estimate their ability in a scenario without external aids. Using the Internet to answer questions also increases a person’s desire to use it to answer other questions (Storm, Stone & Benjamin, 2016). At the same time, it has also been shown that access to the Internet can decrease a person’s willingness to volunteer answers without first googling them (Ferguson, Mclean, & Risko, 2015). This indicates that there is still an awareness of the Internet holding more information than we do ourselves.

The aim of the current study was to further investigate the relationship between memorizing and the expected later access to information, specifically focusing on encoding and comprehension. The participants read a few different paragraphs of text and was led to believe that they would have access to some of them while answering questions in a later step. When time came to answer the questions, no texts were available. The participants’ reading speed and their answers to the questions were later examined.

The study by Sparrow, Liu and Wegner (2011) focused on exact recollection of information, including specifically formulated statements and tasks without any recall aid. A more externally valid approach would be to measure comprehension. In this way, it may be possible to see what the participants understood from what they read, not only what they explicitly remember. By measuring the time participants spend encoding different pieces of information it should be possible to determine whether people actively make a choice to spend less time processing information they believe will be accessible later on. By letting the participants answer questions in a later step, it should be possible to determine whether this potential increase in effort to remember while encoding actually produces a significant comprehension difference.

**Reading speed and comprehension**

Strong connections have been found between reading speed and reading comprehension when examining literacy (Dyson & Haselgrove, 2000; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003). Reading speed can be used to predict comprehension rate (Skinner, Williams, Morrow, Hale, Neddenriep & Hawkins, 2009); more skilled readers exhibit a higher reading speed than average readers, as well as a greater comprehension rate for what they have read. Still, an increased reading speed does not always lead to an increase in comprehension; there are many individual differences that also play a part (Wal lot, Obrien, Haussmann, Kloos & Lyby, 2014). There is also the parameter of those studies being based on
participants reading in their “normal” way. Within studies focusing especially on skim reading, the opposite effect has been found (Masson, 1982). When skim reading, a person saves valuable time and effort by reading with a higher speed, with the cost of a reduced comprehension rate for both the gist of a text and for more specific details.

The ability to quickly sort through information is crucial to managing information overload. Because of this, my hypothesis was that someone who expected later access to information would spend less time on encoding and processing compared to someone that did not expect later access. In circumstances when they read multiple texts, the participants would focus on those that they believed would not be accessible later on. I also believed that the differences in processing effort would be visible in the participants’ ability to answer reading comprehension questions. The independent variable was expected later access to information. The dependent variables were reading speed and comprehension score. Based on the arguments above, I predicted that participants (1) chose to spend longer time reading texts when they did not expect to have access to them later, compared to when they did, and (2) achieved higher comprehension scores for texts they did not expect access to, compared to text they believed they could access again.

Method

Participants

In total, 35 participants completed the experiment, eight of which were excluded because of not fulfilling the inclusion criteria. Specifically, one was dyslectic or had other reading deficits, one did not have Swedish as the first language, and six took breaks during the experiment. Breaks were determined by assessing total participation times lasting over 30 minutes, as well as participants who spent unreasonably long time reading single texts (cut-off above 80 seconds/text). Twenty-seven participants were included in the analysis (14 women, 12 men and 1 defining as other, $M_{\text{Age}} = 29.67, \text{SD} = 8.88$). The participants randomly received divided into two groups (Table 1). For each text read they were told if the text would be saved for later or not. One group believed the first, third and fifth (odd numbered) text would be erased and that second, fourth and sixth text (even numbered) would be accessible later on. The second group received opposite conditions, that the first, third and fifth texts would be saved and the remaining three would be erased.

Table 1. Participant demographics and group division

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>27</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Age, $M (SD)$</td>
<td>29.67 (8.88)</td>
<td>25.50 (6.69)</td>
<td>34.15 (8.96)</td>
</tr>
<tr>
<td>Gender, Female/Male/Other</td>
<td>14 / 12 / 1</td>
<td>9 / 4 / 1</td>
<td>5 / 8 / 0</td>
</tr>
<tr>
<td>Texts believed to be erased</td>
<td>—</td>
<td>1, 3, 5</td>
<td>2, 4, 6</td>
</tr>
</tbody>
</table>

Instruments and Materials
The test was constructed as a survey and distributed through social media using Qualtrics Research Core (Qualtrics, 2018). The comprehension material used contained six texts (number of words: $M = 111.8, SD = 20.6$) with four questions to each text (Appendix). It was translated to Swedish from a verbal reasoning test hosted by the University of Kent Careers and Employability Service (n.d.), and was used with permission.

**Procedure**

The participants were presented to the texts as “This text will be saved in the folder DATA (or INFO, FACTS)” or as “This text will NOT be saved”. Every participant read all six texts. The belief of later access was strengthened by a practise text in which the participants got to first read a paragraph and then later answer questions while having access to the “folder” it had been saved in, by opening a link to a PDF-document.

In the experiment proper, the reading phase was followed by a short memory test in which the participants were instructed to memorize a number of words and then, on the next page, indicate which words they had just seen. The purpose of this was to load the working memory and thereby decrease the effect of the order in which the participants read the texts. The participants were then informed that they would not have access to any of the information they had previously read, independent of whether they had previously been told that they would or not. They were instructed to answer the comprehension questions that followed based on what they could remember from what they had read.

Each text had four questions, totalling in 24 questions. All question items were presented in a randomized order and consisted of a statement. The participants were asked if they could determine whether the statement was true or false based on the information in the corresponding text. Every question had three answer choices: “True”, “False” or “Cannot be determined based on the information in the text”. These alternatives were evenly distributed as correct answers.

Before commencing the study, the participants were briefly told that the study would measure reading comprehension skill and memory processes. They were informed of the voluntariness of the study and assured that they would be anonymous. All participants gave informed consent to being part of the experiment. After they had finished, they got a thorough description of the purpose of the study, as well as the opportunity to send an email with further questions. They also got to answer a few questions about the circumstances of their performances: If they had taken breaks during the test, if they were in a noisy distracting environment and whether they had suspected that they would not get later access to any of the texts. They also got the opportunity to write down other comments about their participation.

**Results**

Participants spent shorter time reading texts they did expect to have future access to ($M = 34.32, SD = 15.41$), compared to texts they did not expect access to ($M = 41.71, SD = 16.24$). The 7.3 s difference was significant, according to a dependent samples one-tailed t-test, $t_{crit}(26) = 3.55, p = .0007$, based on the average reading time for a participant between conditions (Table 2). The effect size was 0.47 based on all three text in each condition across all participants ($N = 81$).

The number of correct responses across the four questions was lower for texts that participants had expected later access to the ($M = 2.41, SD = 0.75$) compared to the score for questions where they did not expect later access to what they read ($M = 2.53, SD = 0.64$). This difference was however not significant, $t(26) = -0.72, p = .24$, although the effect size was non-trivial ($d = 0.12, N = 81$).
Differences in performance were found both for the average time spent reading different texts and for the difficulty of the questions (see figures 1 and 2). There was also a difference in accuracy rate based on whether the correct answer to a question was True (60% correct), False (36% correct) or Cannot be determined (53% correct). It was difficult to determine the effect of these variables on the results due to the types of correct answers not being evenly distributed between the texts. The possible effects of these factors were not taken into consideration during statistical analysis, but it is possible that they decreased the possibility of significant differences between comprehension scores.

Table 2. Differences in performance based on expected access condition

<table>
<thead>
<tr>
<th>Measure</th>
<th>Condition</th>
<th>M</th>
<th>SD</th>
<th>N</th>
<th>Diff.</th>
<th>t_{crit}</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>Saved</td>
<td>34.32</td>
<td>11.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>Saved</td>
<td>2.41</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erased</td>
<td>2.53</td>
<td>0.64</td>
<td>27</td>
<td>-0.12</td>
<td>-0.72</td>
<td>26</td>
<td>.24</td>
</tr>
</tbody>
</table>

a - Values are based on participants’ mean reading time for the three texts for each condition.

b - Values are based on participants’ average total comprehension score for all questions based on one text for each condition.

Figure 1. Average time spent reading a text when expecting and not expecting later access
Discussion

The purpose of the study was to examine possible differences in reading speed and comprehension, depending on whether participants believed that what they had read would be saved for later or not. My hypothesis was that the expectancy of later access would lead to a superficial reading style, which would show itself as an increase in speed and a loss in comprehension. The results showed an increase in the time spent reading a text when the participants believed the text would be erased, compared to when they believed it to be saved. The difference was visible within all text items, despite substantial differences in reading time between participants. There was also a small trend for increased comprehension score for the questions based on the texts believed to be unavailable later on visible in four out of six texts, but this was not significantly: The first part of this hypothesis was therefore confirmed, but not the second part.

Nevertheless, the effect size for comprehension was non-trivial at 0.12. It is recommended to replicate the experiment with more participants, because the rather small sample size could be the reason this difference did not reach statistical significance. Future studies may also aim to replicate the main result in more controlled settings, as the present test was distributed online and is therefore open to an element of uncertainty as to the effects of all possible external variables; most participants did not offer any additional information about factors in their test environment that could have affected their performance, although they were given the option to do so.

Reading speed and timing

As theorized by Sparrow, Liu and Wegner (2011), it appears that a person does adapt to rely on an external memory source if possible. The decreased reading time for texts believed to be saved shows that there is a tendency to put less effort into reading material that will be accessible later. By doing this, a person saves both time and cognitive resources that can instead be used to process other materials more thoroughly (Storm & Stone, 2014).
In a more controlled setting, an eye-tracking experiment could be added to the design to further examine the strategies that produced the differences. It is difficult to tell if the time differences are results of a higher overall reading speed when expecting later access, as with skim reading, or if it occurred because participants read the texts they believed would be erased more than once before continuing. Either way, it is clear that expected access led to a reading strategy resulting in a shorter reading time.

The way that time could be measured was not the most appropriate. It did not specifically measure the time participants spent on reading each text, but rather the time the participant spent on the page containing the text. Included in the value was therefore everything from when the page was first loaded to when the participant pressed the “next” – button. Because of this, the time measured was always slightly longer than the actual time spent reading, and the figures measured cannot be transformed to an accurate words/minute value. As the timing intervals measured in the current study are relatively long, the effect of this inflated timing measurements is not so severe in terms of the proportional increase as it would have been for reaction time measurements, for example, on the order of one second or less. There is however also the issue of knowing what the participants actually did while on a specific page; there is no way to tell if they took a five second break to read a text message or not, even if the largest outliers were removed before analysis. Also, there could be variations in the time between encoding the texts and answering questions between participants if they spent longer time on the distraction task or took a short break before continuing to the next part. It is possible that differences here affected the participants’ ability to remember what they read, and therefore their comprehension.

Comprehension scores

Sparrow, Liu and Wegner (2011) found that participants scored higher in memory recollection tests when they did not believe they would have access to the items later. This effect could not be replicated in the present study. Based on previous research (Masson, 1982; Dyson & Haselgrove, 2000), it appears likely that a decreased reading time would lead to comprehension loss; otherwise there would be no need for anyone ever reading slowly or thoroughly. There is more than one way to explain the current results, starting with the fact that Sparrow et al. measured explicit recall and that in their experiment, the participants got to read single sentences, and not entire paragraphs of text. This could have made it easier to decide what part of the sentences needed to be remembered, as they only included one or two distinctive facts. When reading longer texts, the participants had to sort through the information and determine what was important to remember themselves, something that can vary from person to person. This change would have increased the probability of participants remembering the wrong details from the texts, and could have led to their comprehension scores being low even if they did remember the majority of the text.

An alternative to the True/False/Cannot be determined questions used could be to have the participants answer open text questions instead. This type of measuring would be based on recall without recognition and might produce results more similar to those found by Sparrow et al. (2011). Another option is to have the participants write a summary for each text. This could show which parts they remember the best and which, if any, details they are most likely to omit from memory when expecting later access. This method could be combined with the previously mentioned eye tracking measure to gain further insight into how they read, what they focus on remembering, and what they recall based on this, depending on the expected access condition. Evaluating these kinds of measurements is more time consuming, and there is a greater risk of bias and inconsistent assessment across human scorers, but the information gained from this method could be worth these disadvantages.
Because the present study had a within-participants design, variations in question- and text- difficulty should not have affected the comprehension outcome. There is still a possibility that the combination of some of these factors could have resulted in comprehension variations. For example, questions with the answer False based on Text 2 could have been especially difficult to answer in the believed-to-be-saved-condition. Exactly how these different factors affected one another is difficult to determine specifically because the distribution of type of correct answer was uneven between the texts, and hence confounded in the present design.

The differences in response accuracy for types of questions may be connected to the ability to create fake memories (Roediger & Mcdermott, 1995). Participants’ response accuracy was lower when determining if a statement was False compared to True or Cannot be determined. This can be explained by the somewhat uncertain status of the Cannot be determined – answer. Most question statements were created in a way so that they could easily be believed to be true by someone who had not read the texts. The choice to use this type of questions was made with hopes of diminishing the effect of misattributed sources in the comprehension results (Zaragoza & Lane, 1994). Some question items stated things that were definitely true, but could not be derived from the information in the texts. By using these questions, the participants would be forced to focus explicitly on what they had read, instead of on their entire knowledge base. In the specific context of transactive memory systems this distinction would make it clearer whether they actually remembered what they had read and where they read it, or were just making qualified guesses. The brain is often led to believe it remembers something if it appears logical and similar to what was encoded (Roediger & Mcdermott, 1995). The act of determining if something was previously read is rather easy; it is a form of recall based on recognition. When determining whether a comprehension question that appears to hold truth is false, a person needs to systematically review what was just read until she can determine if something in the text actively argues against it. If that is not the case, or she cannot remember enough details to be sure, another answer than False may be chosen instead.

The worries of Socrates in the time of fake news

Socrates worried that literacy would atrophy peoples’ memories and ruin the culture of science and education. It is possible that his first concern holds some truth today; a human does not need to memorise everything she learns if she wants to access it later, and therefore her brain no longer adapts to do so to the same level. The second part of the concern, that the scientific culture would be changed for the worse, is a statement that most people today would not agree with. The written word has allowed scientific studies and theories to spread all over the world and has made science and education available to others than great Greek philosophers and their students. Even if an individual can no longer manage to keep every scientific discovery inside her head and cannot personally make comments on every subject, the large scientific community as a whole can do so, with different people specialising within different fields.

Change brought on by new technology often brings about both advantages and disadvantages. While the advantages should definitely be cherished, it is important to keep track of how these new aids affect us. There is often a way to minimise the drawbacks if we are aware that they exist. In the same way that tables of content and indexes were created in the past to deal with the information overload brought on by printed books, new ways to filter through information emerge with new technology. By using keywords and other search strategies when looking for information online, the amount of information in need of further readings can be filtered down to a more manageable amount. More focus should be put into developing strategies that can further aid in sorting through information.
It is possible that an increased effort for teaching literacy skills, especially reading comprehension, is needed in basic education to counteract the possible effects Internet usage and information overload have on reading strategies. Even if it is crucial to learn to manage the constant flow of information that is the Internet, the preferable way to achieve it is not one with a side effect of loss in detailed reading comprehension. This is especially important in a time where news articles, opinion pieces and advertisements compete for the readers’ attention, and are often presented in a way that makes their purposes difficult to distinguish (Lazauskas, 2016). In a time when Internet users need a simple structure and clear overviews to be able to manage information load, many online publishers offer the complete opposite in the shape of clickbait headlines and similar methods that do not offer any actual information about the article topics and only strive to increase the curiosity of the reader and the likelihood of the article being opened (Kuiken, Schuth, Spitters & Marx, 2017). This method of writing headlines works strictly against the need for an overview and increases information overload in a world in need of the opposite.

If information overload does lead to a decrease in careful reading and critical thinking, as suggested by Cavanaugh, Giapponi and Golden (2015), this may have implications for the rise of the current issue of Fake News, which is believed to have affected the political climate and recent elections (Allcott, & Gentzkow, 2017). Social Media and the concept of Fake News, inaccurate or false articles often intended to influence political views, is a clear example of when critical thinking loses to the effects of cognitive overload. There is a negative association between the amount of information overload someone is exposed to and the average quality of information they share online (Qiu, Oliveira, Shirazi, Flammini & Menczer, 2017). When all information is accessible for a later, more thorough read, and there is a lot of information to read through, there is a greater risk for information being skimmed through and accepted as truth without a critical eye. There are many other factors that play into the spreading of Fake News (Lazer et al., 2018), but the fact that the problem has a partial foundation in the results of the present study is enough to raise concerns.

Humanity survived the invention of the written word, and has survived countless technological advances since then. If society manages to find an overarching structure for online information and publishing that strives to help the reader focus, instead of demanding attention and luring her in, the rise of online information can be survived as well. It is not unlikely that, under the right conditions, this new way to store and access information will simply allow us to adapt in new fascinating ways, and that all the current concerns will be history in a few years.
Reference list


Appendix – Texts, questions and answers

1. So much of the literature of the western world, including a large part of its greatest literature, was either written for actual speaking or in a mode of speech, that we are likely to deform it if we apply our comparatively recent norm of writing for silent reading. It is only that so much of this work is drama or oratory (the latter including the modern forms of sermons, lectures and addresses which as late as the nineteenth century play a most important part). It is also thought that through classical and mediaeval times, and in many cases beyond these, most reading was either aloud or silently articulated as if speaking: a habit we now recognise mainly in the slow. Most classical histories were indeed quite close to oratory and public speech, rather than silent reading of an artefact, was the central condition of linguistic composition.
   a. Until the nineteenth century, most people could only read with difficulty. **Cannot be determined**
   b. In ancient times, literature was intended to be read aloud. **True**
   c. Classical histories were passed on orally and never written down. **False**
   d. Only people with literacy problems now read aloud. **True**

2. Millions of lives around the world could be saved, and the quality of life of hundreds of millions markedly improved - very inexpensively - by eradicating three vitamin and mineral deficiencies in people's diets. The three vitamins and minerals are vitamin A, iodine and iron - so-called micronutrients. More than 2 billion people are at risk from micronutrient deficiencies and more than 1 billion people are actually ill or disabled by them, causing mental retardation, learning disabilities, low work capacity and blindness. It costs little to correct these deficiencies through fortification of food and water supplies. In a country of 50 million people, this would cost about $25 million a year. That $25 million would yield a fortyfold return on investment.
   a. Most illnesses in developing countries are caused by vitamin and mineral deficiencies. **Cannot be determined**
   b. Micronutrients provide inadequate nourishment to maintain a healthy life. **False**
   c. Vitamin A, iodine and iron are the only micronutrients that people need in their diet. **Cannot be determined**
   d. Correcting micronutrient deficiencies would cost about $2 per person per year. **False**

3. The clinical guidelines in asthma therapy have now moved towards anti-inflammatory therapy - and away from regular bronchodilator therapy - for all but the mildest asthmatics. This is now being reflected in prescribing patterns. In the U.S., combined prescription volumes of the major bronchodilators peaked in 1991 (having risen slowly in the preceding years), though they still account for around half of the 65 million asthma prescriptions there. During the same period, prescriptions for inhaled steroids have doubled, but still account for less than 10% of asthma prescriptions in the U.S.
   a. Only mild cases of asthma can be helped by anti-inflammatory therapy. **False**
   b. Use of bronchodilators has been increasing since 1991. **False**
   c. Doctors are reluctant to treat asthma with inhaled steroids for fear of potential side-effects. **Cannot be determined**
   d. Bronchodilators are the single most prescribed treatment for asthma. **True**
4. Buddhism was introduced to Japan from India via China and Korea around the middle of the sixth century. After gaining imperial patronage, Buddhism was propagated by the authorities throughout the country. In the early ninth century, Buddhism in Japan entered a new era in which it catered mainly to the court nobility. In the Kamakura period (1192-1338), an age of great political unrest and social confusion, there emerged many new sects of Buddhism offering hope of salvation to warriors and peasants alike. Buddhism not only flourished as a religion but also did much to enrich the country's arts and learning.

a. Buddhism was adopted by the court nobility at the urging of the emperor. **False**

b. The introduction of Buddhism to Japan led to great political unrest and social confusion. **False**

c. Buddhism replaced the Shinto religion which had previously been followed in Japan. **Cannot be determined**

d. Japanese arts and culture were greatly enriched by the introduction of Buddhism. **True**

5. In Japan, companies generally expect their employees to put in long hours of overtime. But it is difficult for women, who also have household chores to do and children to take care of, to work at the same pace as men, who are not burdened with such responsibilities. Many women inevitably opt for part-time jobs, which enable them to combine work and domestic duties. At present, 23% of all female salaried workers are part-timers and the ratio has been on the rise in recent years. Part-time work places women at a disadvantage. The wages of part-time workers are considerably lower than those of full-time employees, and part-time work tends to involve menial labour. Moreover, because salary and promotion in Japanese companies are often based on seniority, it is extremely difficult for women either re-entering the labour force or switching from part-time to full-time work to climb the ladder.

a. Japanese men do not share household chores and childcare with their wives. **True**

b. A quarter of all part-time workers in Japan are female. **Cannot be determined**

c. Part-time workers hold a low status in Japanese companies. **True**

d. Women in Japan are unwilling to work overtime. **Cannot be determined**

6. Abdominal pain in children may be a symptom of emotional disturbance, especially where it appears in conjunction with phobias or sleep disorders such as nightmares or sleep-walking. It may also be linked to eating habits: a study carried out in the USA found that children with pain tended to be more fussy about what and how much they ate, and to have over-anxious parents who spent a considerable time trying to persuade them to eat. Although abdominal pain had previously been linked to excessive milk-drinking, this research found that children with pain drank rather less milk than those in the control group.

a. There is no clear cause for abdominal pain in children. **True**

b. Abdominal pain in children may be psychosomatic in nature. **True**

c. Drinking milk may help to prevent abdominal pain in children. **Cannot be determined**

d. Children who have problems sleeping are more likely to suffer from abdominal pain. **Cannot be determined**