f i ® s t m ¤ ñ d @ ¥
PEER-REVIEWED JOURNAL ON THE INTERNET

Digital reading spaces: How expert readers handle books, the Web and electronic paper

by Terje Hillesund

Abstract

This paper focuses on changing reading characteristics and presents a study among a group of expert readers. Considering technological bases of reading and applying corporeal and material perspectives, this study examines manners in which proficient readers handle printed and digital texts, attempting to explain differences in digital and paper–based reading. Based on findings, this paper reflects on how long–form text can be productively transferred into the digital reading space.

Contents

Introduction

Over the last decades, an exceptional growth in audiovisual media and digital text has changed written discourse. Traditional newspapers and printed books are in decline, and so are certain forms of reading. Increasingly, contemporary reading is done in highly interactive digital environments, such as the Web, in which script combines with pictures, videos and music, affording little space for sustained reading of long–form text. In addition, electronic paper seems to offer viable alternatives to many traditional printed formats.

This article focuses on reading in a period of transition. It presents a study among expert readers, represented by a group of academics, enquiring about their digital and paper–based reading. Qualitative interviews confirm that proficient readers use the Web and computers for overview in a manner characterised by browsing and skimming; that is: discontinuous and fragmented reading. Typically, concentrated reading is done on paper, especially reading of long–form text. While reading of novels is usually continuous, from beginning to end, sustained reflective reading — studying — is characterised by discontinuous and often treacherous reading. This study suggests that academics seldom read a scholarly article or book from beginning to end, but rather in parts and certainly out of order, using hands and fingers flicking back and forth, underlining and annotating, often relating the reading to their own writing.

Without underestimating cognitive aspects of reading, such as decoding and comprehension, the study emphasises the relation between reading and materiality. A much ignored basis for reading is the physical handling of reading matter, and this study indicates that ways of reading are partly conditioned by text technologies. By including corporeal and material aspects and minutely examining the manner in which proficient readers handle text, this study seeks to explain the main differences between digital and paper–based reading. The article begins with an overview of reading research, contextualising its perspective. It continues with a presentation of methodology and results, then summarises findings and concludes by reflecting on how long–form text can be productively transferred into the digital reading space.

Research on reading

In Western research, the multiplicity of writing systems (such as Chinese characters and Korean hangul) is often recognised. Nonetheless, reading is usually treated as interpretation of alphabetic text, including pattern recognition, decoding of letters and words, and — against a background of cultural understanding — making of meaning at increasingly higher text levels (Kucer, 2005). However, the act of reading is complex, and the goal of much research is to determine what parts of the brain are involved and how it works when we are reading (Wolf, 2007). The saccadic eye movements have been thoroughly traced (Rayner, 1997), and combined with centuries of

typographical experience this has given a fairly good idea of how to ensure legibility and how to present text in order to support fluent reading (Lonsdale, *et al.*, 2006). In addition to research in psychology and neuroscience, reading has been studied in several separate fields, such as literacy studies, book history, literary criticism, learning theory and pedagogy. In reading research there is therefore a profusion of perspectives and a multitude of models (Kucer, 2005). But despite this diversity, most traditional research has tended to treat reading in a rather abstract way, as if all reading were more or less the same, as an individual, silent and inward act of interpretation. Similar to this view, text is also abstractly assessed and typically presumed to be a long–form written or printed text.

Within this overall paradigm, large amounts of empirical research have been done on digital reading, often comparing onscreen reading to paper reading. Mainstream research has been measuring the legibility and comprehension of texts presented on stationary computer displays (Dillon, 1992; Dyson and Kipping, 1998; Dyson, 2004; Nanavati and Bias, 2005; Lonsdale, *et al.*, 2006), on handhelds (Darroch, *et al.*, 2005) or on electronic paper (Lee, *et al.*, 2007; Clark, *et al.*, 2008), and preferences regarding paper and screen reading (Bearne, *et al.*, 2007; Noyes and Garland, 2008), reading of e–books (Rowlands, *et al.*, 2007), and user behaviour in Web environments (Liu, 2005; Nicholas, *et al.*, 2008a; 2008b).

It is probably fair to say that research on reading (whether paper or screen based) has had a strong focus on visual perception and cognitive aspects of reading, that is, on reading as a mental activity, sometimes with an emphasis on sociocultural bearings on this activity. Until recently, little attention has been drawn to bodily aspects of reading, or to the fact that reading involves physical handling of books, computers and other reading technologies.

This might be surprising, as psychologists have long argued that human intellectual faculties, rather than being the result of brain evolution alone, are reciprocally related to anatomical and behavioural adaptations to environmental and social changes. Within evolutionary theory, researchers have suggested that there is a close connection between bipedal walking, freeing of hands, gestural communication and the evolution of language and human speech. It has been proposed that early features in the primate brain (the neural mirror system) may have supported the use of hands for communication and its evolution towards human language (Rizzolatti and Arbib, 1998; Arbib, 2005). Many researchers believe that the use of symbols and spoken language gradually developed from gestures (Corballis, 2002; Gentilucci and Corballis, 2006; Armstrong and Wilcox, 2007) and that, in adapted forms, neural structures regulating body movements play crucial roles in both expressive and interpretative tasks related to human speech — and to other cognitive processes (Lieberman, 2002; 2007).

The gestural theory on the origin of language is hotly debated and no certain implications can be drawn on reading. It is nevertheless interesting to observe that, in order to support the view that autonomous speech originated from gestures, researchers point to the way people still communicate in everyday speech, using all kinds of significant bodily motions such as hand and finger movements, facial expressions, exclamations, intonation, smiles and laughter (Corballis, 2002). The basis of writing, likewise, is a manipulation of tools and very much the work of the hands and fingers. Furthermore, in the act of reading we use our hands to fetch, hold and keep the text in the focal area and our fingers to turn pages or scroll computer screens, sometimes pointing to the text itself. When reading to study, students and researchers often have a pen or pencil in their hand, taking notes, underlining and physically touching the text.

In the context of this study, it is particularly interesting to observe how users react to new reading technologies, such as e–book reading devices. While physical aspects of paper reading are usually taken for granted — and thus focus on content — new tools inevitably direct attention to the materiality of text and the tactility of reading. In an assessment of electronic paper devices (Sony Reader and Cybook), the initial focus of Norwegian users was clearly on aesthetics, weight, manual navigation and readability [1]. Similarly, in a qualitative assessment of the Amazon Kindle e–book reader in the U.S. by researchers at Texas A&M University, participants of the focus groups responded to the look of the device — its size and weight, how it fitted in the hand, buttons and the use of fingers, (un)easiness of flicking and navigating quality. They commented on screen size, contrast, reflection, adjustability of fonts and applicability of the device in different circumstances, for instance when travelling (Clark, *et al.*, 2008). While this focus on new form factors may be obvious, at some point all reading technologies have been new, and for coming generations it takes years of practice to internalise the use of dominant reading technologies in society, whether they be clay tablets, scrolls, manuscripts, printed books or computers.

By including bodily and material perspectives in reading research, it becomes increasingly clear that reading, in addition to decoding and comprehension, is also physical handling of reading appliances and that the way we read is dependent on technologies, implement design and text composition. In book history and modern text theory, a number of researchers refer to Roger Chartier who has repeatedly accentuated the significance of text materiality and corporeal aspects of reading. In his treatment of text interpretation, Chartier (1995) strongly argues that texts apprehended through different mechanisms of representation are no longer the same.

Development of reading technologies

Chartier (1995) points to several historical developments pivotal for reading practices and experiences. An early and extremely important development was the implementation of the codex in the second and third centuries. Gradually replacing the scroll, which required both hands in a continuous form of reading, codices, with easy accessible pages, gave new and effective ways of organising and navigating text. However, the early reading of heavy codices and densely written parchment pages (with many abbreviations and no word spacing) required the use of the whole body, including the voice (as the text had to read aloud to be comprehensible). Then, during the Middle Ages, the introduction of smaller books and new text features, such as word spacing, punctuation and paragraphs, gradually made books more easily portable and reading physically less demanding (Saenger, 1997). According to Chartier (1995), these medieval developments in text materiality led

to a very consequential shift from oral reading, indispensable for comprehension, to a process of reading that could be visual, silent and fast; the modern way of fluent reading. As a further development, the printing press gave new ways of reproducing text, making books ever more legible — and less expensive, thus accelerating the spread of literacy.

In the historical process, Chartier (1995) emphasises the so–called reading revolution that took place in Germany, Britain and North America in the last decades of the eighteenth century, a change also commented on by Robert Darnton. In his essay "First steps towards a history of reading," Darnton (1990) refers to the book historians Rolf Engelsing and David Hall who independently describe changes in reading habits on either side of the Atlantic. From the Middle Ages until sometime after 1750 people read "intensively", according to Engelsing. Most households kept only a few books; the Bible, an almanac and a prayer book, which members of the family read over and over again, usually aloud and often in groups. But by 1800 many people were reading individually and "extensively," lending and buying all kinds of material, especially novels, periodicals and newspapers, reading it once and then racing on to the next item (Darnton, 1990). According to Ross, *et al.* (2006), Engelsing's account created a binary conceptual opposition that has lasted to this day: between deep reading and shallow reading or between active engagement with text and passive consumption of text.

Robert Darnton (1990), in his theoretical outline of a history of reading, underscores the significance of text materiality for reading practices, and Alberto Manguel's (1996) copious *A history of reading* is very much a description of codices, printed books and other technologies related to reading. In the field of material studies, Mary and Richard Rouse (1991) and Paul Saenger (1997) have exposed how the advancement of the codex to an easily navigable book was a very long process indeed, and one that only accelerated in the thirteenth century when manuscripts were provided with pagination, indices and concordances, features that were transferred into printed books. For Peter Stallybrass (2002), the art of printing was primarily a culmination of this development of the navigable book. In printed books, legibility and accessibility were further improved by standardised fonts and more systematic provision of titles, chapters, tables of contents and page numbering — material features that assisted fingers and eyes in browsing and navigation. In his analysis, Stallybrass demonstrated that printed Bibles in sixteenth century England were designed to support discontinuous reading, with indices and concordance lists supporting Protestant interpretations of the scriptures. Through studies of contemporary book annotations and diaries, Stallybrass documented that the Bible was in fact read discontinuously. That reading at a later stage, in the eighteenth and nineteenth centuries, was to be dominated by silent and continuous reading, especially of novels, can, according to Stallybrass, be seen as a return to an earlier form of reading: "To imagine continuous reading as the norm in reading a book is radically reactionary: it is to read the book as if it was a scroll." [2]

In his analysis of digitisation, Stallybrass (2002) emphasises the continuation and amplification of codex features in the computer and on the Web. In digital environments many typographical features are the same as before, access to pages is simple, bookmarking is easy, and advanced search functions make it possible for readers to follow up on themes in a discontinuous reading process, jumping from page to page and from site to site. However, while Stallybrass accentuates continuity, Chartier (1995; 1997) focuses on the break, claiming that the new "immaterial" materiality of digital text inevitably requires new ways of reading.

_____

Multimodal and digital reading

Among researchers studying current changes in reading, semioticians are particularly preoccupied with the materiality of semiotic resources, along a range of media. Since the 1970s and 1980s, desktop publishing and offset printing have dominated composition and printing, making the use of photo and graphic illustrations far less complicated. As a result, today's newspapers, magazines, textbooks and trade books are often sophisticated publications in which much of the information is given pictorially and by other visual means. Researchers such as Günter Kress (2003) and Theo van Leeuwen (2001; 2006) have described the visual grammar of multimodal texts, suggesting that multimodal reading is not primarily a continuous or discontinuous reading of verbal text, but rather composite reading in which attention jumps back and forth between illustrations and text. Researchers encounter great challenges in trying to explain how meaning is construed in the many kinds of multimodal reading that are emerging, both in print and on screen.

Among hypertext researchers, George Landow (1992; 1997) and Jay Bolter (1991; 2001) are technologically very explicit. They have examined how the computer alters the materiality, physical handling, and ultimately reading of text. Having little of the tactile materiality of printed text, digital text is a volatile virtual image of an electronically stored text. Thus, digital texts are highly editable, extremely moveable and — through the linking system of the Web — globally accessible. The links on the Web and in hypertext literature provide readers with multiple choices. By clicking the mouse, users can choose their own reading paths. Digital reading is thus multilinear and discontinuous. In a Web environment, text boundaries are no longer obvious, and in a sense the entire Web is one enormous, interconnected text.

While hypertext theorists celebrate a new–won freedom for readers (and writers), others claim that the current shaping of the Web induces a new form of constraint — a psychological urge to click; a kind of uneasy wariness of mind and index finger. Asserting that different kinds of materiality influence our reading, Anne Mangen (2008) examines the impact of the intangibility and volatility of digital text on the reading process, which she claims is dominated by shallow forms of reading, such as scanning and skimming. Taking as a basis Merleau-Ponty's phenomenological concept of humans as bodies–in–the–world and Thorngate's psychological theories of attention, Mangen argues the near impossibility of getting immersed in hypertext or online reading in the same way we get lost in a book. Most Web sites provide an abundance of attention–switching possibilities and promise new stimuli in the form of links, pictures and videos. As a rule, then, when we have options to easily rekindle our attention through outside stimuli, we are psychobiologically inclined to resort to these options. It requires less mental energy to click the mouse and rekindle our attention than to try to resist distractions by attempting to keep on structuring consciousness from within, and thus continue reading (Mangen, 2008). Furthermore, in front of the computer screen — and especially online — we

are relentlessly tuned in to change. We have learned to expect something to happen and are thus doubly compelled by an urge to click.

Many studies support Mangen's description of online reader behaviour as dominated by shallow reading. Ziming Liu (2005) has reviewed the research on digital reading and concludes that: "The screen–based reading behaviour is characterized by more time spent on browsing and scanning, keyword spotting, one–time reading, non–linear reading, and reading more selectively, while less time is spent on in–depth reading, and concentrated reading." [3] Liu notes decreased sustained attention, and his results have been confirmed by research at University College London (Rowlands, *et al.*, 2007; Nicholas, *et al.*, 2008a; 2008b). In a series of articles, David Nicholas, Ian Rowlands and associates describe viewing and reading habits among academics visiting digital journal libraries. Even if the picture is varied, most of the library viewing is cursory in nature, described as "bouncing" — a pattern of behaviour whereby a high proportion of users view only a few Web pages from the vast numbers available and then never return to the site. Some click forward from lists and abstracts to full–text viewing of articles, but as the studies show (Nicholas, *et al.*, 2008a), two–thirds of article views lasted less than three minutes and 40 percent were completed in a minute or less. This viewing and bouncing behaviour is called "squirreling" — an energetic search for treasures that are downloaded for later consumption. Scholars seldom read the same text online for a long period of time. From undergraduates to professors the pattern of behaviour in digital libraries is characterised by Nicholas and Rowlands as "power browsing."

These projects do not tell us what scholars eventually do with downloaded papers and articles. Many are no doubt forgotten, but some are obviously read. According to Liu (2005), research confirms the general belief that a majority of users often print out electronic documents for reading, and that the traditional habit of highlighting and annotating text has not migrated to the digital environment. The latter was also a major finding in the studies of Abigail Sellen and Richard Harper (1997; 2002; O'Hara and Sellen, 1997) who in an extensive research project studied paper and computers and their different uses in various organisations.

> **Some of these books and papers are "hot" and spread out within reach for immediate use. Others are "warm" and piled up for later or potential use. At some point, documents become "cold" and are removed from the desk.**

Sellen and Harper are partly influenced by the psychological theories of James J. Gibson (1979) whose concept of affordances points to the way we perceive objects and tools, especially the actions they induce and the specific uses different designs are prone to encourage. Sellen and Harper's (2002) study shows that the computer system is superior in the actual making and remaking of documents, in storing, accessing and retrieving documents, and in facilitating the distribution of documents. Paper, on the other hand, is used in many creative tasks such as editing, commenting and collaboration on text and in tasks that require certain levels of sustained concentration, such as reading, in which annotation, quick navigation and spatial layout of documents allow readers to deepen their understanding and to create a plan for their own writing. Thus, even if the computer is the main tool in writing, paper reading is an important part of most writing processes, resulting in piles of books and printouts surrounding the writer and the computer. Some of these books and papers are "hot" and spread out within reach for immediate use. Others are "warm" and piled up for later or potential use. At some point, documents become "cold" and are removed from the desk.

Mangen underscores the sensor–motor dominance of the tactile in reading and examines the interplay between the body and the materiality of text. Sellen and Harper richly illustrate different ways in which reading actively brings the body into play and how reading is inscribed in space and time. They also clearly demonstrate how deeply embedded most reading is in practice. Reading is an integral and essential part of a multitude of tasks and activities, including — obviously — scholarly study and research.

Methodology

Mangen's and Sellen and Harper's perspectives were precisely the focus of an enquiry I undertook amongst presumed expert readers in Spring 2009. In 14 semi–structured qualitative interviews, 10 participants — all established humanist scholars and social scientists — were asked about their reading: how and where is it done, how they sit when reading and how they use their hands and fingers. The participants were asked about their note–taking and underlining, if their reading was continuous or done in parts, following links or linear, embedded in scholarly practices or parts of ongoing communicative acts. By asking in this way I hoped to shed light on certain research questions: how do we arrange our surroundings when reading? How do we position our bodies, how do we handle the object (the book, printed papers, the computer or the mouse)? What do we look for first — and last? What makes us start reading a text in a linear fashion — and what makes us stop, or continue browsing?

However, the physical aspect of reading does not lend itself easily to interviews. According to Borgman (2007), tacit knowledge is a part of all expert practice. Humanist scholars are often eloquent, eager to discuss narrative and aesthetic qualities of a novel or arguments of a theory, but they seldom reflect on how they go about reading. Like all people, they are prone to a kind of bodily absence or disappearance which occurs in the senses and parts of the body that are engaged in perceiving (Leder, 1990). Most of the time, readers are not actually aware of what they are physically doing when reading. Using concepts from techno–phenomenologist Don Ihde (1990), we

can say that reading is a most familiar activity, solidly packed and sedimented. It is one of those deep and complex phenomena that are so close to the mundane that their basic traits are hard to discover and talk about.

Thus, there are several reasons why I chose semi–structured interviews in the study of reading. With a focus not primarily on interpretation, I wanted to be able to steer clear of discussing subtleties of theory and instead direct attention towards the often unnoticed positioning of the body, the tactility of reading and its temporal and spatial aspects. During interviews, I prompted respondents to go beyond commonly held notions about reading. At the same time, I wanted the respondents to recount and reflect freely on the issues, being cautious not to speak for them.

The selection of participants was done strategically among scholars diverse enough to provide a rich description of proficient, expert reading. The participants were mostly researchers in the humanities and some in sociology: a literary critic, a local historian, a Bourdieu expert, one studying French film and others Middle English, children's literature, journalism, French literature, and research methodology, all members of staff at universities. The participants were aged from 38 to 65 and seven were men and three women. The interviews were carried out in the participants' offices and recorded on a digital voice recorder. The interviews usually lasted from one to two hours and were in some cases resumed, after an interval of a few days, giving up to three hours of discussion. The interviews continued until the discourse was believed to have reached a saturation point [4].

In this study, as in much hermeneutic research, data includes information gathered from participants as well as personal reflections, based on the very important first–person experience (Polkinghorne, 1988; Ihde, 1986). Like most researchers, I have extensive scholarly reading experience and have also studied digital reading and e–book developments for more than 10 years (Hillesund, 2001; 2005; 2007; Hillesund and Noring, 2006). Thus, in addition to being built on findings from interviews, the description of reading is to some extent shaped by my own experience and to a large extent inspired by findings of other researchers, many of which are mentioned above.

Results

Concepts

In order to trace and describe corporeal and material aspects of reading, both data and concepts are needed. The concepts used in this study to analyse reading are not entirely theoretical but have been largely moulded and shaped by empirical findings in an ongoing hermeneutical process. The aim of the study is not to give statistical evidence on academic or expert reading behaviour, but to disclose and analytically describe basic features of this reading. Hopefully, the discussion will clarify some of the many fuzzy concepts characterising the debate on digital reading. What do we actually mean by deep, sustained or discontinuous reading?

The discontinuousness of expert reading

It is a fundamental fact that text is laid out in space and read in time, and that text always deals with some kind of subject matter. Taking these basic characteristics as a starting point, reading can be described by degrees of continuousness, including temporal and spatial continuousness, and thematic connectedness.

Time spent on an act of reading varies dramatically, from very short acts of reading text or e–mail messages to lengthy periods of reading magazines and books, acts of reading which can go on — more or less undisturbed — for hours. There are obviously all kinds of reading spans in between, but usually the uninterrupted reading of a magazine or journal article is considered a long read and an example of continuous reading — in a temporal sense. Reading that is repeatedly interrupted by other engagements is thus discontinuous.

However, the concepts of continuous and discontinuous reading are ambiguous and often used in a spatial rather than temporal meaning. Spatial continuous reading is reading that follows the linear and sequential order in which a text is presented, such as the normal way of reading a novel. Usually it starts at the beginning, and the reading has to cover a certain amount of text (last for a minimum of time) to be labelled continuous. Discontinuous reading is reading out of order, so to speak, in which the reader jumps back and forth in a text, reading parts of a book or an article without following the linear and sequential order of presentation. Reading a succession of very short texts (or snippets of text) is also a form of discontinuous reading, common when browsing the Web or scanning printed newspapers. Discontinuous reading of multiple texts of disconnected subject matter I have chosen to call fragmented reading.

A combined way of reading is extremely frequent when people are flicking and scanning through newspapers or browsing the Web, intermittently slowing down to continuously read an article or two. Combined, as well as discontinuous reading can go on for a long time and, in a temporal sense, be continuous. However, to call the same reading session both discontinuous and continuous is awkward; in the following I will call all lengthy acts of reading sustained reading.

Sustained discontinuous reading seems to be characteristic of scholarly expert reading. One participant in the study, "George", says that when he receives a presumably interesting printed book, he starts by carefully reading the table of contents and part of the introduction to see if the book interests him. If it does, he starts flicking through the pages, scanning for keywords and skimming small bits of text, trying to get a better feeling of the overall structure and style. He then studies the bibliography and, using the index, he finds two or three places that seem particularly promising. If these passages are of interest, he reads the adjacent subchapters or chapters — and usually this is what he reads in a book. Sometimes, however, he expands the reading to more chapters and, in rare cases, he reads the whole book.

"Jane" tells a very similar story, except that when she starts reading at a promising spot she takes notes on a piece of paper. Using sub–titles, she makes a rough outline of the chapter in question, and when reading she takes notes in order to discern the line of argument and the ways of

combining ideas. Both "George" and "Jane" say they are willing to abandon reading at every point in the process. "Jane" says she stops reading if the text is too unfamiliar or difficult, or if it in any way is irrelevant for her present research. However, if she feels compelled to read on, she often intensifies the note–taking, using all kinds of resources in her office to complement the reading; reference books, scholarly works, and online resources.

Stories of article reading are not dissimilar to those of reading books. "Carl" says he usually skips the abstract of an article and makes straight for the introduction, reading some paragraphs to get an idea of the research problem and theoretical standpoints. If the text is interesting, he jumps to the conclusion and then he studies the empirical findings, flicking back and forth. This, he says, gives him enough understanding and usually renders reading the rest of the article unnecessary, at least for the moment. However, some articles he starts re–reading from beginning to end, always underling and making notes. Sometimes he also reads an article or a book several times, and "Susan", during interview, showed a heavily underlined and annotated paper she had read many times (with generations of notes) in order to use theoretical points in her writing. However, the annotations stopped midway in the article, and asking her why, she said that the last part of the paper presented empirical findings which did not interest her. Asking her if she had read it, she said no.

Discontinuous and notoriously treacherous reading thus constitutes a distinctive scholarly reading characteristic. Yet, as indicated, continuous reading of book chapters and articles is not uncommon as part of an overall study of a subject. Purely continuous reading of whole books also occurs, however, often as complementary reading on subjects adjacent to the main focus of interest. "Carl" also speaks of "scholarly reading for pleasure" which is continuous reading of non–fiction books rather similar to continuous reading of novels. In the study, the participants were unanimous in saying that they read novels continuously, if not always to the end.

All reading commented on so far has been reading of printed books and printouts. Most research confirms that reading of scholarly articles and books is still dominated by paper (Liu, 2005; Tenopir, *et al.*, 2009), but some research may indicate that sustained screen reading is increasing (Nicholas, *et al.*, 2008b). Several of the participants in the study reported that they sometimes read articles on–screen and even online, although their on–screen reading is not particularly conscientious and is usually for the sake of overview, typically without note–taking and often terminated before the end. "George" commented that the more relevant the article, the higher its chances of being read on paper.

Among the interviewees in the study, online scholarly reading is definitely discontinuous and often fragmented in character. Participants reported that they frequently browse the Web and scan Web pages in search of information and updating, some re–visiting favourite sites and blogs. Some participants browse news and cultural sections of online newspapers such as *Le Monde* or the *New York Times*. Occasionally, browsing leads to continuous reading of one or two articles, and more or less always to the following of links in a process that, according to one participant, "can go on forever". When following links in a random way, informers often get led astray; but then fortuitous surfing also leads to discoveries of new and interesting sites.

Participants in this study also make use of the Web in search of specific authors or subjects, using search facilities such as Google, Google Scholar and sometimes databases offered by the university, mostly the national library catalogue and international portals, such as Ebsco and FirstSearch. Participants also use online dictionaries and encyclopaedias, such as the *Oxford English Dictionary* and *Wikipedia*. The Web is sometimes used in collecting data from statistic databases, manuscript databases and newspaper collections. Obviously, the way these resources are used varies considerably among the participants. The point here is that all these scholarly uses of the Web are associated with discontinuous reading aimed at finding, scanning and downloading text.

Immersive reading

When analysing the power browsing behaviour of academics in digital libraries, UCL researchers characterise the reading as shallow, presumably in contrast to a more deep involvement with text (Rowlands, *et al.*, 2007; Nicholas, *et al.*, 2008a; 2008b). The shallow–deep contrast, however, is not always a very clarifying dichotomy. The so–called extensive reading in the eighteenth and nineteenth centuries was criticised for being shallow, but as pointed out by Darnton (1990), far from being superficial, the reading of popular authors of the day was sometimes extremely intense, leading to a wave of suicides in the famous case of Goethe's *The Sorrows of Young Werther* (*Die Leiden des jungen Werthers*) [5]. Also online reading is ambiguous. When "Adam" searches for full–text literature in journal portals, he examines many potentially relevant articles, skimming abstracts, looking at keywords, studying reference lists and reading introductory parts of articles. Many articles are discarded as irrelevant. Some are downloaded and stored. Of these, a few are printed out on paper and read, either immediately or at a later stage. "Adam's" way of reading online may seem superficial, but his skimming provides him with a broader picture and is actually the first move in an exhaustive in–depth reading of selected articles.

Even if it is sometimes difficult to determine what acts of reading are shallow or deep, it is nevertheless a common experience that reading does have different levels of involvement, indicated by the many words for reading: to leaf, flick or thumb through, to look over, to browse and skim, to study, scrutinize and peruse, to decipher and interpret. Marie–Laure Ryan (2001) has examined the many metaphors used in describing engaged reading, which is usually associated with movement, saturation or depth, often in combinations. We talk of being carried away or lost in reading, to be deeply involved or to be immersed, deeply absorbed or engrossed in reading. Based on Ryan's analysis and participant stories, it would seem that engaged scholarly reading can be described as comprising two major types — imaginary and reflected reading.

In immersive imaginary reading, readers get involved in a story, conjuring up vivid images of persons and places, living through situations, empathising with characters. In this process, readers are carried away into imagined worlds, anxious to know what is going to happen. Despite being absorbed in a book, "Carl" claims that simultaneously he has an eye and an ear for literary qualities. For him, becoming immersed in reading is emotionally satisfying, and "Adam" said that he consciously uses novel reading as a form of escape. "Silvio", a literary critic, claimed that absorbed literary reading is an ultimate goal he seldom experiences, due to the analytic and evaluative

character of his interpretations. Immersive imaginary reading is often associated with narratives and requires reading to be fairly fluent.

In immersive reflective reading, readers get involved in argumentative texts, eager to understand, interpret and learn, to see connections and consequences, and to widen their understanding. "Carl" compares the satisfaction offered by reflective and imaginary immersion, saying both experiences produce a place where he wants to be: in absorbed reflective reading he is away in a theoretical world, but recognisable insights makes him feel at home. "Jane" says that to be really engaged in a scholarly text, it has to be familiar, yet challenging. As with imaginary immersion, reflective immersion requires reading to be fluent. As indicated by neurologists, fluency has automated basic reading operations in the brain, adding time for inferences, thus facilitating thinking that goes beyond the text (Wolf, 2007).

All readers experience that text involvement is relative; that immersion is a matter of degree. Sometimes readers get tired or hungry and drop out; at other times readers find a text difficult, uninteresting or downright boring. Moreover, the imaginary–reflective distinction is not particularly clear. Rather than inducing imaginary immersion, much fictional literature, both classical and modern, requires a high degree of reflection in order to make sense and arouse interest. Regardless of this, both imaginary and reflective engagement is sometimes called hermeneutic immersion (Mangen, 2008), a term based on Don Ihde's concept of a hermeneutic relation between users and technology, in this case between reader and book. According to Ihde (1990), there are three basic human–technology relations. In embodiment relations, the tool functions as an extension of body and senses, such as an axe or a pair of glasses. In hermeneutic relations, the instrument tells the user of conditions somewhere else, such as a map or a book describing the coming of *Homo sapiens*. In such relations, attention is towards technology as an object of perception. However, through interpretation of signs, the user becomes conscious of circumstances elsewhere, and as this virtual world becomes the primary focus of attention, the technology fades into the background. In alterity relations, the user's focus is very much on technology itself, often as an object of fascination.

A requirement for hermeneutic immersion is that the technology offers minimal disturbances on the part of the user; that it becomes more or less transparent. Over the centuries, typographers have refined the design of books, making the printed book an effective reading technology. In books, facing pages are important composing units, and typographers' knowledge of fonts, lines, white space and margins has been extremely beneficial for readers. Many books and printed publications are very well suited for both continuous and discontinuous reading, and for imaginary as well as reflective immersion.

Dedicated reading software, such as "Mobipocket" (http://www.mobipocket.com/) and "Microsoft Reader" (http://www.microsoft.com/reader/), also utilises time–honoured typographical features to some extent. The ordinary computer screen, however, is far less suited then paper to create optimal reading conditions. This is partly due to technological limitations, such as low resolution, tiring backlight, widescreen formats and the stationary position of the screen, which in sum makes reading tiring. In addition, most reading software is designed with toolbars, side panels and icons, and the applications are often placed within the interface of a Web browser or an operating system, with their own toolbars and icons. Thus, with numerous eye–catching elements, all offering actions to the user, there is considerable potential for fluency disruptions intruding on text immersion. In the study, "George" said he frequently reads e–books using Adobe Reader (http://get.adobe.com/reader/). When asked to expand on this, it boiled down to reading of two classics at home on his laptop, an implement he held to be "quite all right." Without actually being able to explain why, participants in the study generally complained at the laborious experience of sustained on–screen reading, even with specialised software.

Quite different then, is the new generation of devices based on electronic paper, such as the "Amazon Kindle" and "Sony Reader", specifically designed for reading. Even if they introduce new obstacles, such as slow paging, in these devices backlight, resolution and immobility are no longer issues. Weight, format and typography make them well suited for continuous reading of fiction and non–fiction. "Adam", who owns an "Amazon Kindle" and a "Cybook" and reads e–books on a daily basis, claims that electronic paper is very good for reading novels. After a very short time, he claims, the device becomes transparent and the story springs forth. His enthusiasm notwithstanding, "Adam" describes at length the lack of annotation possibilities and poor navigational aids, arguing strongly that e–paper devices, as yet, are not suited for the exhaustive ways of reading in study and research.

In the study, "Adam" was the only participant with e–   xperexperience, but his account is in close accordance with my own experience, and also in line with research. Ergonomic evaluations reveal that, from a technical point of view, in readability, current e–paper displays are good enough to compete with ordinary office paper; they only need slightly greater illumination (Lee, *et al.*, 2007). When the groups in the Texas A&M study had used the Amazon Kindle for a month, around half the participants were still, to various degrees, conscious of the physical device when reading; some were distracted by the clicking of the next page button and the time lag in paging. The other half had become accustomed to the device, saying that it eventually faded into the background. Nevertheless, many participants wished for improved navigation and better bookmarking and annotation features (Clark, *et al.*, 2008).

Among digital formats, Web browsers are probably the least suited for immersive reading. As pointed to above, the Web has its strength in activities related to searching and browsing, and the use of dictionaries, encyclopaedias and databases. The Internet and the Web are unrivalled in disseminating and accessing information and have facilitated a range of new communicative forms such as e–mail, discussion groups, chat, and net communities, all of which entail reading, usually in a rather fragmented form. The Web is also effective in disseminating and sharing music, videos and movies. According to Ryen (2001) and Mangen (2008), computers have their own specific form of immersion: it is exceedingly common to be caught up in front of the computer, deeply engrossed in browsing, chatting, socialising or gaming, as some participants also reported. Nevertheless, online immersion is very different from the hermeneutic immersion of traditional reading. In imaginary and reflective reading, the text is fixed and the signs arbitrary and transparent; meaning and engagement are for the greater part created by internal processes in the user's mind. By contrast, online immersion is the result of external stimuli and the users' response to a flow of pictures, animations, videos, and text snippets. Much of the fascination lies in the ability to affect the outcome of the "game."

Obviously, computer technology has facilitated a wealth of possibilities in the calculation, manipulation and presentation of data, in receiving immediate input and in cyber socialising. However, technological features that are powerful in some domains may be weaknesses in others. As I will examine further, from the point of view of reading it seems that hypertext, multimodality and the multifunctionality of the Web are incompatible with sustained reflective and imaginary reading, and thus with hermeneutic immersion.

Multimodality, **hypertext and the urge to click**

Multimodality is not a new phenomenon. Illuminated manuscripts and illustrated books have a long history, as Kress and van Leeuwen (2001; 2006) point out. The use of graphs, diagrams, maps, models, drawings and photographs often increases the informational and aesthetic value of print publications. In addition, a heavily illustrated magazine or textbook offers the user several choices. The reader can look at pictures and the accompanying captions and titles and form a good idea of what the article is about. Parallel to this, the background information and explanations of the main text can be read to get the full story. Either way, due to the salience of pictures and inclinations in our perception, the eyes will jump back and forth between text and illustrations. Direct visual perceptions will complement or replace the mental images usually produced during reading. In a spatial sense, strictly verbal reading will thus be discontinuous. Multimodal reading, on the other hand, will in a temporal meaning go on uninterrupted; the reader will construe visual–verbal meaning units not reducible to any of the two modalities. However, as the use of illustrations increases, a visual logic will eventually take precedence and dominate, as is the case with many modern magazines and text books. In publications of this kind, verbal text plays an auxiliary or reciprocal role, anchoring and contextualising pictures. For readers, the meaning is derived from self–sufficient visual–verbal entities dominated by images, and the process of reading inevitably changes as the reader starts looking and flicking.

Yet, from the point of view of sustained reading, the hypertext freedom seems to come at a price.

By contrast, non–illustrated printed texts offer no option but to read. Moreover, many text genres imply an intended reading order. In the eyes of hypertext theoreticians, especially Landow (1992; 1997), these features represent limitations and impose constraints on the reader, keeping the author in control. However, with particular reference to reading of scholarly articles and books, the study shows the opposite to be true. In academic genres, the strict structural order of texts seems to offers readers a high degree of freedom in choosing their own reading paths: always indicating where you are, a tight structure allows for jumping, skimming and discontinuous reading, still making good sense of the text. On the other hand, hypertext theoreticians obviously have a point; hypertext literature and the Web do offer the user a wealth of opportunities. Yet, from the point of view of sustained reading, the hypertext freedom seems to come at a price.

As David Miall and Theresa Dobson (2001) report, evidence from empirical studies suggests that certain aspects of hypertext, such as links and image hotspots, may disrupt reading. In a study of readers who read either a simulated literary hypertext or the same text in linear form, they found a range of significant differences suggesting that "hypertext discourages the absorbed and reflective mode that characterizes literary reading." Since its introduction in the early 1990s, the Web has developed from being as system for linking plain text documents, to be an exceedingly multimodal hypertext, including graphics, pictures, sound, video and animations, as well as interactive and communicative features, such as games and chat, and net societies, more or less combining it all. Needless to say, in this highly audiovisual and communicative universe, continued reading of long–form text is on the defensive. On the Web, most users are tuned in to everything but sustained reading.

Even rather straightforward Web pages have moved far away from time–tested typographical principles applied in publications meant for sustained reading. When "Adam" illustrates how he examines online a Web site for a Norwegian research site, at first he claims to be very good at focusing his attention on the content section of the page, turning a blind eye to the surrounding columns with their ads and links. However, when asked why he initially scrolled down a bit, he said it was to get away from the top advertisements and the title head, both being a nuisance. And while he is at it, he says he sometimes scrolls sideways to get away from the vertical ads, and he ends up with a long anti–ad harangue. When referring to one of the ads depicting Charles Darwin in one of the right columns and asking if he had noticed it, he said it been there for weeks and that he had actually clicked on it a couple of times to see what it was.

In the interview, "Adam" continued by browsing one of the quality Norwegian online newspapers. When asked to say what he was looking at, he said he went straight for the titles and text and was less interested in the pictures, which he hardly noticed. However, when changing to the *Guardian*, there was a long silence as he studied the front Web page. "Here it takes more time," he said. "The news area is plain text and I have to start reading to detect what the articles are about. The *Guardian* is different from the Norwegian papers in which the pictures give a pretty good idea of what the stories are all about," he said. When asked if he actually did look at the pictures, he said: "Well, yes, I suppose I do."

As for the urge to click, "Adam's" story indicates that it is psychologically very hard to fight off distractions and alluring links even when reading interesting subject matter. Still on the *Guardian* Web site, he illustrates how he sometimes barely skims the first part of an article and only starts reading seriously when he has scrolled past the links and ads to the page area where text is the sole element. However, at this point in the interview he picks up his iPhone, saying that he actually prefers to read lengthy news articles and comments on that device. Even if the display is rather small, it is clear and when reading, verbal text is the only thing occupying the visual area — there are no distractions. Unsolicited, he enthusiastically starts relating how he can sit at home, feet up, enjoying reading the long, informative articles from the *New York Times* on his iPhone. He also says he reads e–books on the iPhone, and that e–books on iPhone and Amazon Kindle are somehow

synchronised. Related to Mangen's reasoning on text materiality and reading, "Adam's" stories suggest that it is not the intangibility of digital text as such that prevents hermeneutic immersion, but rather the prevalent hypertextual and multimodal manner of its presentation.

"Adam's" story about home reading also drew attention to a very important contextual factor. For academics, the computer is a multifunctional working tool and, as some participants pointed to, extremely demanding. Participants said they often felt obliged to start the day checking for e-mail messages, answering some or responding to others, for instance by starting to prepare for an upcoming meeting. While checking, one might also open the learning management system to see if more students have submitted their obligatory papers and then suddenly remember those unfinished PowerPoint presentations. Several participants had data or texts that needed further analysis — and then there is the writing. All participants were working on at least one unfinished manuscript for a journal article or a book. Thus, with its strategic location, the computer is a constant reminder of things undone. Taken together, all these factors — ergonomics, multimodality, hypertext and multifunctionality — make it extremely hard to maintain an act of digital reading for a substantial period of time.

Reading and body

In this study, the participants were very conscious of the obligations and allurements of the computer and, preferring paper, all had in different ways developed strategies to avoid being distracted or tempted by the screen while reading, usually positioning their body so as not to stare directly into the beckoning display. Some participants simply turned their back on the computer, using another part of the desk. "Carl" had cleared a well-lit corner of his office couch, and "Eric" said he sometimes found a quiet spot in the canteen to get things read. All said they often read at home.

While reading, the participants use their hands very actively to hold the book or printout in the visual focal area, flicking back and forth in a discontinuous way of reading, as previously described. In addition, especially with printouts, the participants hold a pen, pencil or highlighter in their hand. Using rather different systems, they underline, highlight and make carets or exclamation marks, lines or squiggles, notes or comments, in the margins or around the text. "Carl" said he felt uneasy without a pencil in his hand, and "Susan" said she always operated a highlighter, using it like a weapon to help her concentrate and hunt for important passages. Among the participants, several said that the use of hands, fingers and pen or pencil was an indispensable part of their scholarly reading.

In the interviews, participants described in minute detail how they use their fingers and pencils. "Susan" had the highlighter poised a few centimetres above the text, ready to strike, whereas others, while pointing to and following the text, kept the pencil prepared in a hand resting beside or underneath the text (some participants intermittently biting its end). Some of the participants were gradually leading the pencil closer to the text when concentrating or preparing for underlining. In this way, through the pen, the hands and fingers reach out and touch the text. When lines and notes are inserted, the text subtly changes as the reader's own emphasis and connections are made visible to the eye and brain. Thus, at a micro-level, reading involves kinaesthesia and motor control (dexterity) as well as tactile and visual perception.

Annotation and marking tools were mainly used by the participants for two interrelated purposes: to improve comprehension of text and to render visible relevant connections to their own writing. Highlighting and note-taking helps slow down the pace of reading and often leads to re-reading of passages and recording of points. From a cognitive psychology perspective, the annotation habit is probably a way of processing information, giving it time to fit into schemas in long-term memory and provide time and space for reflection and discovery of inferences. In addition to using words describing comprehension, such as understanding, insight and cohesion, participants always ended up saying that they often related the underlining and annotating to their writing. Annotation is accordingly described as an aid to help re-locate important points or citations for use in their own articles and books.

As noted earlier, reading is a bodily and mental process evolving in time. When "Carl" meditates on the pleasures of reading, he recognises glimpses of insight as inherent in the very process of reading, happening while reading, and then quickly fading. To him, underlining and note-taking is a somewhat futile attempt to externalise these insights, making them visible and lasting; an endeavour which is only completed when his own writing is successful. "Carl" also tells an anecdote that lucidly illustrates the relations between body, text materiality and different ways of reading. His use of metaphor is particularly enlightening.

In the story "Carl" tries to uncover why he prefers paper to computer when engaging in an act of reading. Sometimes, he said, when working away from printers at his cottage, he urgently needs to read an article kept on his laptop. At one level on-screen reading is unproblematic; he can read through the text, understanding every sentence and paragraph. At the same time, he often gets a feeling of failing to get fully to grips with the text, that he somehow loses oversight and is unable to fence the article in, which is frustrating. When asked to expand on these utterances, he says that in order to see connections and make inferences when reading, he often needs to have several text passages or ideas present simultaneously. In printed versions, the passages are physically there on the sheets of paper, and he can flick back and forth, stick his finger in between sheets and keep several ideas in his memory at the same time; comparing, relating and thinking. He is unable to do this on the laptop; here, the text and the author's intention somehow slip through his fingers.

In this study, all participants considered digital scholarly reading to be more superficial than paper reading, with more skimming and less annotation. In paper reading, the participants make active use of the tangibility and physical shape of books and printouts. The bundle of sheets, the solidified text and the over-writable paper make it easy to flick back and forth and use a pen in the typical discontinuous and annotating way of concentrated scholarly reading. By contrast, the digital nature of text and the use of the mouse and keyboard make computers very well suited for browsing, searching, accessing, downloading and skimming text, which is how the participants use their computers. The participants' answers and "Carl's" story make a very good case for Mangen's claim that the intangibility and volatility of digital text make it hard to combine with immersive reading, at least with the scholarly form of immersive reflective reading highlighted in this study.

Writing in reading

The briefly mentioned relationship between reading and writing points to another important dimension of reading: the degree to which reading is integrated in more comprehensive tasks. Sometimes, of course, reading is a stand–alone activity, done for its own sake, such as leisurely reading of novels. Often, however, reading is part of a wider activity, such as completing a form, receiving an instruction or performing all kinds of administrative work. For scholars, reading text is an integral part of their work; they read to prepare lessons, to evaluate, give assessments, to review, to correct and to comment, all activities with their own specific way of relating to the text. In research, texts are mainly read for three purposes by the participants: texts are the object of analysis, such as works of philosophy and literature; documents are the source of information and data, as in history and linguistics, and journal articles and monographs present theories and data relevant for the scholar's own writing.

Thus, for the participants in this study, writing and the activity of research are very much ingrained in their scholarly reading: relevance for writing is what they look for when searching for literature, determining what to download and whether the text is actually printed out and studied. Further, their own research questions form the perspective used in interpreting and making meaning of text, and finally, future writing is what guides the hand, fingers and pen in highlighting and annotating while reading. In the end, notes from reading are used when writing.

Reading in writing

In the same way that writing is part of reading, reading is part of writing. In the study, all participants were writing on the computer using keyboard and screen, often producing text from notes and sometimes from handwritten rough drafts. When writing, the participants were all reading, yet in various ways. "Johanna" said she was reading the text as she was writing, more or less simultaneously, correcting errors and usage on screen as she went along. "Silvio", on the other hand, was also simultaneously reading what he was writing, but he could write several paragraphs or subchapters before going back, re–reading and correcting the text.

In the initial phase, while still actively writing, the participants' reading and correcting are done directly on screen, using the keyboard. At some point, however, the text is always printed out on paper. "Silvio" said that he once sent a whole chapter to his publisher without having it printed locally at all. But this was an exception, and "Silvio", who assiduously worked on the computer, frequently used paper when correcting and editing his own text. However, printout frequency varied considerably among the participants, some printing out their text constantly, while others wrote several subchapters before printing. In the subsequent reading and editing process, they make active use of a pen or pencil to correct misspellings, change words and survey the structure of the text. Sometimes this results in major changes, and often it leads to the discovery of shortages in the text, which again, at times, leads to further and very purposeful reading of scholarly literature on the subject.

Paper, pen and computer

Thus, reading is immanent in writing — and in much the same way, printed paper resides within computers. In this study, it has become clear that humanist scholars and social scientists combine different text technologies in their literary activities. At the core of the activity is reading, and when reading in the reflective mode, participants predominantly use printed paper in the form of books and printouts. When writing, they use software designed to facilitate paper text production, such as Microsoft Word, thus writing with paper formats in mind. Outside this core of paper and reading, the computer system is used for the definite production of text, and for storing, disseminating, accessing, skimming and downloading of text. Today, one can safely say that scholars have some fingers in a paper–based text cycle and the rest in a digital text cycle. Indeed, by focusing on physical aspects of reading, this study reveals that three historical systems are in use in scholarly literacy events; the modern computer system, printed paper — and the ancient system of handwriting.

Summary

In *Literacy in the new media age*, Günter Kress (2003) says he is very impressed by the intuitive way his teenage son is playing computer games. Undeniably, many young people are very good at processing and responding to simultaneous stimuli in a highly multimodal and interactive environment, filled with games, videos, music and social media, such as YouTube and Facebook. Young people often treat computers with great familiarity and use *Wikipedia* and Google as a matter of course. According to Kress, the new generation will certainly wire up the brain in new ways, developing skills that are beneficial in the media landscapes to come. Other researchers, however, are concerned that these multitasking skills may come at the expense of valuable abilities related to sustained reading (Wolf, 2007). Becoming a fluent reader — and especially an expert reader — also requires neurological wiring. It takes many years of practice and concentrated reading to develop vocabulary and decoding skills to such a level that time is given for inferences and reflections, that is to form the brain circuitry for proficient reading. Furthermore, reading–related combinations create added neural paths in the brain, positively affecting cognitive capacities (Wolf, 2007). Considering the extreme plasticity of the brain, it is no wonder neuroscientists are anxious to know how new media behaviours will shape the cognitive skills of coming generations.

As indicated by Kress and Wolf, significant cognitive skills are related to the handling and utilisation of text technologies. However, in addition to skills, digital dominance is essentially a matter of culture and symbolic exchange, and Roger Chartier warns that the ongoing transformation of the written culture has both positive and negative sides to it. He claims that "the transfer of a written heritage from one medium to another, from the codex to the screen, would create immeasurable possibilities, but it would also do violence to the texts by separating them from the original physical forms in which they appeared and which helped to constitute their historical significance." [6] Evidently, changes in text cultures have taken place throughout history, and written discourse has never been static. Philologists have repeatedly shown that supposedly stable written texts are by no means fixed entities, neither in the manuscript tradition nor within the print culture. Specific texts change and, as

the history of the book reveals, so do their general material and typographical features. Moreover, literacy studies give convincing evidence of great variations in reading practices over time.

However, since the introduction of the codex, these changes have taken place without altering the fundamental structure of the book, with its bound collection of written sheets of parchment or paper. In contrast to previous modifications, the ongoing digital transformation fundamentally changes the physical form of text. In computers, the written text is no longer physically tied to the surface of a medium that simultaneously stores and represents the text. In the computer system, storing and representation are separated, making digital text extremely malleable, moveable, and — through systems of links and search facilities — extremely accessible and essentially borderless (Hillesund, 2005). According to Chartier (1995), such new material features will inevitably and imperatively require new relationships to the written word, new intellectual techniques and new ways of reading.

In this study, in line with Chartier and others, I have argued that there is a relation between text materiality and ways of reading. The study shows that expert readers use computers and the Web for overview, actively using the mouse and keyboard in a search for information and literature in a manner characterised by skimming, browsing and bouncing — that is, discontinuous and fragmented reading. Sustained reading is typically done on paper, especially reading of long–form text. The study shows that immersive imaginary reading, such as reading of novels, is usually continuous, from beginning to end. Immersive reflective reading, studying, on the other hand, is characterised by discontinuous and often treacherous reading. Experts seldom read a scholarly article or book from beginning to end, but rather in parts, and certainly out of order, actively using hands and fingers in flicking back and forth, underlining and annotating, often connecting their reading to their writing, and usually spreading pieces of paper around their desk.

Conclusion

There are many reasons for trying to bring more sustained reading on to a digital platform. Today, digital text cycles dominate communication in vital parts of society, such as industry and commerce, administration, and news dissemination. It would most certainly be economically and environmentally beneficial to be less dependent on parallel text cycles based on paper. Among young people, sole reliance on screen–based technologies seems to be rapidly increasing, and in the educational sector there is a great demand for digital teaching material. It could have severe consequences if this material did not include easily readable long–form text in which detailed descriptions, long arguments and complex narratives are decisive, providing students with important frames of reference indispensable for deeper understanding. In a cultural perspective, enhanced reading applications might also secure ties to long–lasting written discourses in literature, philosophy and science.

This study suggests there are two major challenges for long–form text transference. The first is to replicate conditions for continuous imaginary reading, and the second to create favourable conditions for sustained reflective reading. Whatever the solutions, digital text will under no circumstances be the same as printed text and, in relation to reading experiences; it will never be more than a question of proximity.

With regard to the first challenge of continuous reading, it seems clear that the stationary displays of PCs and laptops are unfit for immersive imaginary reading. However, as indicated, there seems to be a relatively easy solution to this particular challenge that nevertheless would require a radial change of attitude for many readers. Handheld devices, especially dedicated e–readers, seem to be capable of giving a fairly good approximation of the reading experience provided by printed books, such as novels, and at the moment e–paper devices seem the most promising. Devices of this kind fit snugly into the hand and let users position the body for reading. While the user cannot flick through the pages in the ordinary way, the devices engage the fingers in paging by clicking buttons. They are generally highly readable, easy on the eye, and some devices indicate where the readers are within the overall text. Thus, current e-paper devices create good conditions for transparency and provide an efficient hermeneutic relation between user and technology. In short, e–paper devices make good alternatives for continuous reading.

The second challenge, to create good conditions for reflective reading, or studying, is more demanding and will require considerable intellectual and technical ingenuity. Concentrated studying often combines continuous and discontinuous reading and, as shown in this article, discontinuous ways of reading involve very active use of the hands in flicking, underlining and annotating, all within the physical unity of a printed text. Nor is sole reliance on Web browsers fruitful for this kind of reading. Based on experience from the study, I will tentatively present ways of meeting the challenge.

First of all, Web browsers should be used for what they are good at — presenting overviews and accessing information through links and search functions. For the rest, browsers should be a deliverer of adapted applications in a modular design and a layered sandwich structure. In a layered structure, Web browsers may be the interface for multimodal presentations and a range of analytic, creative and collaborative tools and social networking facilities. However, as soon as long–form texts are presented and sustained reading is required users of the Web should be able to apply dedicated reading software. This software should ensure that distracting elements of browsers and operating systems are eliminated, along with unnecessary links and graphics. Drawing on typographical knowledge, in reading applications the focus should be on reading, preferably based on a two–layer system with one "read–mode" for continuous reading, stripped of everything unnecessary, and one "study–mode" for discontinuous reading, equipped with aids for navigation, highlighting and annotation. Dedicated reading software should enable links to much–used reading resources, such as dictionaries and encyclopaedias, and the "study–mode" should easily combine with creative applications, such as word processors, for effortless transfer of notes, citations and references.

In addition to delivering text to dedicated reading software, it would be beneficial if text–intensive Web sites offered portions of text specially prepared for handheld devices. Considering recent improvements in mobile technologies, such as in e-paper, it is likely that current navigation and annotation issues will soon be resolved, probably accompanied by easy communication with

computers. This would broaden the use of reading devices to include immersive reflective reading. In the meantime, however, Web–delivered versions for printout are still desirable, in some cases even providing for printed books. After all, as this study confirms, in the foreseeable future there will be many literacy tasks that are best solved using paper.

In my view, a modular design will make digital texts accessible in formats fit for their actual use. Some academic projects are engaged in development research along lines resembling those outlined in this discussion (Siemens, *et al.*, 2006; Kopak and Chiang, 2009; Willinsky, 2009), and IT companies — such as Adobe, Microsoft and Google — are working on a variety of digital text solutions for newspapers, magazines and books. As to solutions, I agree with John Bradley (2008), who suggests that tool builders would have greater success if digital tools were more in line with the ways in which literacy events actually take place. By including a corporeal and material perspective in reading research, and by broadening studies to include different age groups and circumstances, a richer description of reading may result and probably a better understanding of how reading and technology interact in real–life situations. Such insight might assist developers and companies in their efforts to create enhanced reading applications and devices. It might even contribute in bringing texts from the cultural heritage into the digital domain in fashions that secure links to the millennia–long tradition of written discourse.

About the author

Terje Hillesund is an Associate Professor at the University of Stavanger, Norway. He has a Master's degree in sociology from the University of Oslo and a Ph.D. in media and communication theory from the University of Bergen. His main research interests have been in printed media — newspapers, journals, and books — and their transformation in the age of computers and the Internet. From 2000 to 2002, Dr. Hillesund led a project for Arts Council Norway in which a research team studied the potential impact of e–books on the Norwegian book industry. The results were presented in three reports in 2002. Dr. Hillesund has published scholarly articles on subjects such as e–books, digital reading, XML, digital text editions, and open access.
E–mail: Terje [dot] Hillesund [at] uis [dot] no

Acknowledgments

This article is a rewritten version of the paper "Digital humanities: Why worry about reading?" presented at 147th Nobel Symposium in Stockholm 23–26 June 2009. The Stockholm paper concentrated on challenges in the digital humanities whereas this paper has a wider and more general outlook and more elaborate descriptions of methods and results.

Notes

1. *NFF–Bulletin (Norwegian Non–fiction Writers And Translators Association's membership magazine)*, volume 23, number 4 (2009), at http://www.nffo.no/, accessed 6 April 2010.

2. Stallybrass, 2002, p. 48.

3. Liu, 2005, p. 700.

4. The research project was registered with the Norwegian Social Science Data Services (NSD, http://www.nsd.uib.no/nsd/english/index.html), the privacy ombudsman for all Norwegian universities and research institutes, and follows the legal and ethical guidelines regulating research. In this paper, all participants have been anonymised.

5. See, for example, http://en.wikipedia.org/wiki/The_Sorrows_of_Young_Werther; and, Barbara T. Gates, 1988. *Victorian suicide: Mad crimes and sad histories*, chapter 2. Princeton, N.J.: Princeton University Press.

6. Chartier, 1995, p. 22.

References

Michael A. Arbib, 2005. "From monkey–like action recognition to human language: An evolutionary framework for neurolinguistics," *Behavioral and Brain Sciences*, volume 28, pp. 105–124.

David F. Armstrong and Sherman E. Wilcox, 2007. *The gestural origin of language*. Oxford: Oxford University Press.

Eve Bearne, Chris Clark, Annette Johnson, Penny Manford, Marilyn Mottram, and Helen Wolstencroft with Rosemary Anderson and Nikki Gamble, 2007. *Reading on screen*. Leicester: United Kingdom Literacy Association.

Jay Bolter, 2001. *Writing space: The computer, hypertext, and the remediation of print*. Second edition. Mahwah, N.J.: Lawrence Erlbaum.

Jay Bolter, 1991. *Writing space: The computer, hypertext, and the history of writing*. Hillsdale, N.J.: Lawrence Erlbaum.

Christine L. Borgman, 2007. *Scholarship in the digital age: Information, infrastructure, and the Internet*. Cambridge, Mass.: MIT Press.

John Bradley, 2008. "Pliny: A model for digital support of scholarship," *Journal of Digital Information*, volume 9, number 26, at http://journals.tdl.org/jodi/article/view/209/198, accessed 26 October 2009.

Roger Chartier, 1997. "The end of the reign of the book" translated by Eric D. Friedman, *SubStance*, volume 26, number 82 (Special issue: Metamorphoses of the book), pp. 9–11.

Roger Chartier, 1995. *Forms and meanings: Texts, performances, and audiences from codex to computer*. Philadelphia: University of Pennsylvania Press.

Dennis T. Clark, Susan P. Goodwin, Todd Samuelson, and Catherine Coker, 2008. "A qualitative assessment of the Kindle e–book reader: Results from initial focus groups," *Performance Measurement and Metrics*, volume 9, number 2, pp. 118–129.

Michael C. Corballis, 2002. *From hand to mouth: The origins of language*. Princeton, N.J.: Princeton University Press.

Robert Darnton, 1990. *The kiss of Lamourette: Reflections in cultural history*. New York: Norton.

Ian Darroch, Joy Goodman, Stephen Brewster, and Phil Gray, 2005. "The effect of age and font size on reading text on handheld computers," In: Maria Francesca Costabile and Fabio Patemò (editors). *Human–computer interaction — INTERACT 2005: Proceedings of the IFIP TC13 International Conference* (Rome, Italy), *Lecture Notes in Computer Science*, number 3585. Berlin: Springer–Verlag, pp. 253–266.

Andrew Dillon, 1992. "Reading from paper versus screens: A critical review of the empirical literature," *Ergonomics*, volume 35, number 10, pp. 1,297–1,326.

Mary C. Dyson, 2004. "How physical text layout affects reading from screen," *Behaviour & Information Technology*, volume 23, number 6, pp. 377–393.

Mary C. Dyson and Gary J. Kipping, 1998. "Exploring the effect of layout on reading from screen," In: Roger D. Hersch, Jacques André, and Heather Brown (editors). *Electronic publishing, artistic imaging, and digital typography: Seventh International Conference on Electronic Publishing: Proceedings*. Berlin: Springer–Verlag, pp. 294–304.

Maurizio Gentilucci and Michael C. Corballis, 2006. "From manual gesture to speech: A gradual transition," *Neuroscience and Biobehavioral Reviews*, volume 30, number 7, pp. 949–960.

James J. Gibson, 1979. *The ecological approach to visual perception*. Boston: Houghton Mifflin.

Terje Hillesund, 2007. "Reading *Books in the Digital Age* subsequent to Amazon, Google and the long tail," *First Monday*, volume 12, number 9, at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2012/1887, accessed 26 October 2009.

Terje Hillesund, 2005. "Digital text cycles: From medieval manuscripts to modern markup," *Journal of Digital Information*, volume 6, number 1, at http://journals.tdl.org/jodi/article/view/62/65, accessed 26 October 2009.

Terje Hillesund, 2001. "Will e–books change the world?" *First Monday*, volume 6, number 10, at http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/891/800, accessed 26 October 2009.

Terje Hillesund and Jon N. Noring, 2006. "Digital libraries and the need for a universal digital publication format," *Journal of Electronic Publishing*, volume 9, number 2, at http://www.journalofelectronicpublishing.org/, accessed 26 October 2009.

Don Ihde, 1990. *Technology and the lifeworld: From garden to Earth*. Bloomingston: Indiana University Press.

Don Ihde, 1986. *Experimental phenomenology: An introduction*. Albany: State University of New York Press.

Rick Kopak and Chia–Ning Chiang, 2009. "An interactive reading environment for online scholarly journals: The Open Journal Systems reading tools," *OCLC Systems and Services*, volume 25, number 2, pp. 114–124.

Günter Kress, 2003. *Literacy in the new media age*. London: Routledge.

Günter Kress and Theo Van Leeuwen, 2006. *Reading images: The grammar of visual design*. Second edition. London: Routledge.

Günter Kress and Theo Van Leeuwen, 2001. *Multimodal discourse: The modes and media of contemporary communication*. London: Arnold.

Stephen B. Kucer, 2005. *Dimensions of literacy: A conceptual base for teaching reading and writing in school settings*. Second edition. Mahwah, N.J.: Lawrence Erlbaum.

George P. Landow, 1997. *Hypertext 2.0*. Revised edition. Baltimore, Md.: Johns Hopkins University Press.

George P. Landow, 1992. *Hypertext: The convergence of contemporary critical theory and technology*. Baltimore, Md.: Johns Hopkins University Press.

Drew Leder, 1990. *The absent body*. Chicago: University of Chicago Press.

Der–Song Lee, Kong–King Shieh, Shie–Chang Jeng, and I–Hsuan Shen, 2007. "Effect of character size and lighting on legibility of electronic papers," *Displays*, volume 29, number 1, pp. 10–17.

Philip Lieberman, 2007. "The evolution of human speech: Its anatomical and neural basis," *Current Anthropology*, volume 48, number 1, pp. 39–66.

Philip Lieberman, 2002. "On the nature and evolution of the neural bases of human language," *Yearbook of Physical Anthropology*, volume 45, pp. 36–62.

Ziming Liu, 2005. "Reading behaviour in the digital environment: Changes in reading behaviour over the past ten years," *Journal of Documentation*, volume 61, number 6, pp. 700–712.

Maria dos Santos Lonsdale, Mary C. Dyson, and Linda Reynolds, 2006. "Reading in examination–type situations: The effects of text layout on performance," *Journal of Research in Reading*, volume 29, number 4, pp. 433–453.

Anne Mangen, 2008. "Hypertext fiction reading: Haptics and immersion," *Journal of Research in Reading*, volume 31, number 4, pp. 404–419.

Alberto Manguel, 1996. *A history of reading*. London: Harper Collins.

David S. Miall and Teresa Dobson, 2001. "Reading hypertext and the experience of literature," *Journal of Digital Information*, volume 2, number 1, at http://journals.tdl.org/jodi/article/viewArticle/35/37, accessed 26 October 2009.

Anuj A. Nanavati and Randolph G. Bias, 2005. "Optimal line length in reading: A literature review," *Visible Language*, volume 39, number 2, pp. 120–145.

David Nicholas, Paul Huntington, Hamid R. Jamali, Ian Rowlands, Tom Dobrowolski, and Carol Tenopir, 2008a. "Viewing and reading behaviour in a virtual environment: The full–text download and what can be read into it," *Aslib Proceedings*, volume 60, number 3, pp. 185–198.

David Nicholas, Ian Rowlands, David Clark, Paul Huntington, Hamid R. Jamali, and Candela Ollé, 2008b. "UK scholarly e–book usage: A landmark survey," *Aslib Proceedings*, volume 60, number 4, pp. 311–334.

Jan M. Noyes and Kate J. Garland, 2008. "Computer– vs. paper–based tasks: Are they equivalent?" *Ergonomics*, volume 51, number 9, pp. 1,352–1,375.

Kenton O'Hara and Abigail J. Sellen, 1997. "A comparison of reading paper and on–line documents," *CHI 97 Electronic Publications: Papers*, at http://www.sigchi.org/chi97/proceedings/paper/koh.htm, accessed 26 October 2009.

Donald E. Polkinghorne, 1988. *Narrative knowing and the human sciences*. Albany: State University of New York Press.

Keith Rayner, 1997. "Understanding eye movements in reading," *Scientific Studies of Reading*, volume 1, number 4, pp. 317–339.

Giacomo Rizzolatti and Michael A. Arbib, 1998. "Language within our grasp," *Trends in Neurosciences*, volume 21, number 5, pp. 188–194.

Catherine Sheldrick Ross, Lynne E.F. McKechnie, and Paulette M. Rothbauer, 2006. *Reading matters: What the research reveals about reading, libraries, and community*. Westport, Conn.: Libraries Unlimited.

Mary A. Rouse and Richard H. Rouse, 1991. *Authentic witnesses: Approaches to medieval texts and manuscripts*. Notre Dame, Ind.: University of Notre Dame Press.

Ian Rowlands, David Nicholas, Hamid R. Jamali, and Paul Huntington, 2007. "What do faculty and students really think about e–books?" *Aslib Proceedings*, volume 59, number 6, pp. 489–511.

Marie–Laure Ryan, 2001. *Narrative as virtual reality: Immersion and interactivity in literature and electronic media*. Baltimore, Md.: John Hopkins University Press.

Paul Saenger, 1997. *Space between words: The origins of silent reading*. Stanford, Calif.: Stanford University Press.

Abigail J. Sellen and Richard H.R. Harper, 2002. *The myth of the paperless office*. Cambridge, Mass.: MIT Press.

Abigail J. Sellen and Richard Harper, 1997. "Paper as an analytic resource for the design of new technologies," *CHI 97 Electronic Publications: Papers*, at http://www.sigchi.org/chi97/proceedings/paper/ajs.htm, accessed 26 October 2009.

Ray Siemens, John Willinsky, and Analisa Blake, 2006. "A study of professional reading tools for computing humanists," Electronic Textual Cultures Laboratory, University of Victoria, at http://etcl-dev.uvic.ca/public/pkp_report/, accessed 20 October 2009.

Peter Stallybrass, 2002. "Books and scrolls: Navigating the Bible," In: Jennifer Andersen and Elizabeth Sauer (editors). *Books and readers in early modern England: Material studies*. Philadelphia: University of Pennsylvania Press, pp. 42–79.

Carol Tenopir, Donald W. King, Sheri Edwards, and Lei Wu, 2009. "Electronic journals and changes in scholarly article seeking and reading patterns," *Aslib Proceedings*, volume 61, number 1, pp. 5–32.

John Willinsky, 2009. "Towards the design of an open monograph press," *Journal of Electronic Publishing*, volume 12, number 1, at http://dx.doi.org/10.3998/3336451.0012.103, accessed 20 October 2009.

Maryanne Wolf, 2007. *Proust and the squid: The story and science of the reading brain*. New York: HarperCollins.

Editorial history