STUDIES IN WRITTEN LANGUAGE AND LITERACY 17

Learning to Read in a Digital World

EDITED BY

Mirit Barzillai,
Jenny Thomson,
Sascha Schroeder
and Paul van den Broek

John Benjamins Publishing Company

Learning to Read in a Digital World

Edited by

Mirit Barzillai
University of Haifa

Jenny Thomson
University of Sheffield

Sascha Schroeder
Max Planck Institute for Human Development, Berlin

Paul van den Broek
Leiden University

John Benjamins Publishing Company
Amsterdam / Philadelphia

This publication was made possible through the financial support of COST and through a grant from the GO Foundation.

DOI 10.1075/swll.17

Cataloging-in-Publication Data available from Library of Congress:

LCCN 2018015637 (PRINT) / 2018021446 (E-BOOK)

ISBN 978 90 272 0122 5 (HB)
ISBN 978 90 272 6371 1 (E-BOOK)

John Benjamins Publishing Company · https://benjamins.com

Table of contents

Introduction

With digital texts ubiquitous in both homes and classrooms, understanding their influence on the way children read is of the utmost importance for researchers, educators, media designers, policy makers, and parents. The aim of this edited volume is to examine how advances in technology are influencing children's reading skills and development across a variety of environments and populations.

Investigations into children's interactions with texts in digital contexts vary along many dimensions, including how reading in digital environments is defined, whether reading processes are considered fundamentally different across digital and print media, and conceptualizations of how reader skills develop in digital environments. These in turn influence which aspects of reader and text-specific factors are studied. Thus, it is worthwhile to consider some of these dimensions before embarking on a survey of the results.

1. What is reading in digital environments?

One central dimension along which researchers differ concerns the definitions of 'reading in digital environments'. For some researchers, reading in a digital environment refers to the reading of single texts – one might say, 'traditional' texts – on a digital display, as opposed to in paper format. The main questions these researchers focus on concerns how the physical and perceptual features of the display and the affordances allowed by the device influence the processing of the presented information and the experience of the reader. Other researchers consider reading in a digital environment as the processing of written language, in any form (long/short, formal/informal, etc.), in the highly interactive environment provided by the internet. In such an environment, knowledge is processed and constructed in interaction with the information sources by the reader, and often even co-constructed with others. Studies stemming from this view often consider how various elements of digital texts interact with reader skill to influence performance. These different conceptualizations of reading in digital environments can be thought of as endpoints on a spectrum. Between these endpoints are conceptualizations of reading in digital environments such as the reading of multiple texts in traditional formats, non-interactive activities as reading for entertainment or for information-gathering on the internet, and so on.

2. How do reading processes in digital environments compare to those in traditional paper environments?

A second dimension along which researchers vary concerns the relation between reading processes in traditional print contexts and those involved in reading in a digital environment. The central issue underlying this dimension is whether one considers the cognitive processes involved in reading essentially the same in these two contexts (and all intermediate contexts as outlined under the preceding point) or considers the reading processes to be fundamentally different across these situations. The former view emphasizes *continuity* in the processes: reading draws on a set of processes that are involved in all reading situations, although the relative weight of particular processes may differ across reading situations. The latter view emphasizes the *discontinuity* of reading processes in the different reading environments: reading in a digital context draws (in part) on unique processes that are not required when reading printed or written text. The question here is whether research on reading in digital environments requires a paradigm shift in theoretical models of reading and experimental measures or whether the same models and methods used in the study of reading in traditional environments can be adapted for and extended to reading in digital settings. Two observations are important in this context. First, the position of a particular study or researcher on the first dimension (what is reading in digital environments?) is likely to influence the position on the dimension of continuity/discontinuity. In the context of single text reading in a digital environment, the view of continuity in cognitive processes is more likely than in the context of interactive, co-constructive internet explorations, which are more likely to conjure up views of discontinuity. Second, the distinction between continuity and discontinuity of processing may depend on the granularity of description of the processing. When considered at a global level, processes may be more similar than when considered at a level of detail in which particulars of the source of information are included. For example, inference making is likely to be essential for creating an understanding of text in any context, but the specifics of the component processes of such inference making – and the relative weight of these component processes – may vary depending on whether one investigates reading of a written text, perusal of information on the internet, consultation of Wikipedia, and so on.

3. How does one conceptualize 'development' in the context of reading in digital environments?

Investigations into the development of reading skills in digital environments vary in their definition of what exactly it is that develops or what aspects are open to influence from education and practice. With regard to development, one may focus

on the complexity of processing of information in digital environments and, hence, emphasize the need for mature levels of information processing (e.g., executive functions, working memory) that are typically associated with age-related, maturational factors. Conversely, one may focus on the impact of familiarity with digital environments and successful integration of information and, hence, emphasize the need for experience with these environments. Analogously, educational practices may focus on either practicing the fundamental processes in increasing complexity regardless of whether the environment is analog or digital, or on specific exposure to and practice with the unique requirements of digital environments. Of course, most researchers and educators adhere to a mixture of both views of development and both views of the role of education and experience but, even so, they are likely to differ considerably in the relative weight given to each side of these dimensions.

Thus, how researchers conceptualize digital environments and reading development in these environments will determine which aspects of the reader (e.g. skills, emotions, goals) and the text are studied. Throughout the volume, individual chapters differ in their positions on these dimensions and the foci of their research. Yet, the dimensional framework points at areas of potential investigation that have thus far not received much research attention. This is amplified by the fact mentioned above that the position of researchers and studies on the dimensions tend to be correlated.

The book is divided into three themes that cover aspects of learning to read in a digital age, on both a theoretical and practical level. The chapters draw on the expertise of scientists and researchers across countries and disciplines, and review what is currently known about the influence of technology on reading, about how it is studied, and about new insights and research directions based on recent work.

Theme I: Foundations

The book opens with two chapters that address basic questions related to the use of digital texts in various contexts (family, school, etc.). The first (Deszcz-Tryhubczak & Huysmans, Chapter 1) includes a summary of children's and adolescents' multimedia use for different purposes (studying, socializing, etc.) across different EU countries. In the second chapter (Walker et al., Chapter 2) important design properties of digital texts are identified and differences between these and traditional, paper-based texts are discussed.

Theme II: Cognitive and emotional aspects of digital reading across development

Cognitive processes crucial for traditional print reading are well known and extensively studied. Technology and the internet, however, change the balance of cognitive processes needed for efficient digital reading. The chapters in this section

review and outline the cognitive processes and emotional/motivational aspects related to the specific demands of the digital media across different age groups and populations. The cognitive processes discussed in the third chapter (Wylie et al., Chapter 3) include executive control, attention, and memory. In Chapter 4, Salmeron and colleagues focuses on the new sets of skills critical for successfully reading digital texts such as search and navigation skills, integration of multiple pieces of information, and critical evaluation of information. In Chapter 5, Ben Yehuda and colleagues discuss individual differences in digital reading with respect to populations of children with learning difficulties. The role of emotions in digital reading is examined in Chapter 6 in which Kaakinen and colleagues address how text design may induce emotional reactions and explore how factors such as readers' attitudes and motivations influence the way they approach and construct meaning from digital texts.

Theme III: Education, instruction, and assessment

The final section of the book focuses on the impact of digital technology on education, primarily – but not exclusively – during formal schooling in childhood/young adulthood. Our understanding of how digital technology may alter existing models of learning to read remains underspecified. Teachers of reading are increasingly incorporating digital technologies and multimodal practices in their classrooms and must face the challenge of reaching their print-based literacy goals while integrating new literacy skills related to digital technologies. In Chapter 7, Mifsud and Petrova examine the influence of digital technologies on early literacy education by exploring how digital technologies generate both unique challenges and opportunities. As children take on more agency in their own reading, digital technology poses new affordances and challenges in terms of text comprehension and reading strategies. This is the focus of Chapter 8, in which Baturay and colleagues discuss current multimodal conceptualizations of reading comprehension in mid-childhood and beyond. Finally, taking an international perspective, Støle, Mangen, Frønes and Thomson (Chapter 9) focus on the transition of formal assessments to a digital platform and the dilemmas this process poses.

In the final chapter we discuss the implications of digital reading for educators, parents, and practitioners and suggest further research directions. We hope that this volume provides a valuable resource for the host of parents and professionals devoted to understanding children's reading and promoting their optimal development in digital and print environments. We wish to gratefully acknowledge the networking support by the COST Action IS1404 E-READ as well as the publication support of the GO Foundation.

The editors
Mirit Barzillai, Jenny Thomson, Sascha Schroeder and Paul van den Broek

CHAPTER 1

Reading and digital media

European perspectives

Justyna Deszcz-Tryhubczak & Frank Huysmans
University of Wroclaw / University of Amsterdam

The on-going discussion between parents, educators, politicians and academics on the consequences of screen reading as compared to reading from paper is filled with controversy. This chapter aims at providing a factual context for these debates. We first focus on early studies concerning children's use of media. We then summarise available data on children's digital media use and media preferences based on national and cross-national surveys conducted in Europe since 2010, including reading in a family context. We also look at evidence related to digital reading in public and school libraries. We conclude by discussing limitations in the available methodologies and possible new approaches to be taken to enhance our understanding of the ways in which reading is changing.

1. Reading and digital media: Utopian and dystopian perspectives

Discussions on the presence of new media in our lives have usually developed within a field of tension between utopian enthusiasm and elevated hopes about the potential of new technologies and the dystopian rhetoric of fear about the moral and intellectual degradation of society in general, and children and youth in particular. The debate is not new; similar dichotomous approaches accompanied, for example, the widespread introduction of TV into family life. In *The Disappearance of Childhood*, Neil Postman (1982) argued that TV was likely to erode the distinction between childhood and adulthood as the use of the new medium required neither special prior knowledge nor fostered the development of new skills. Andrew Keen (2007), in *The Cult of the Amateur*, deplored the degrading effects of a Web 2.0, favouring user-generated content over "our most valued cultural institutions" like newspapers and the music business, leading to the "destr[uction] of our economy, our culture, and our values". Without restrictive measures, Keen

DOI 10.1075/swll.17.01des

writes, children will be continuously tempted to spend more time online at the expense of more valuable and important activities. While Keen is right about new media's power of attraction, he paints a very black-and-white picture when he states that "parents must man the front lines in the battle to protect children from the evils lurking on the Web 2.0" (Keen, 2007, p. 202).

These variations on technological determinism – the conviction that technologies and media have a determining influence on society and affect our lives and culture in uniform ways (Itō, Horst, Bittanti, Boyd, Herr-Stephenson, Lange, Pascoe & Robinson, 2009; Boyd, 2014) – have also emerged in public debates about the effects of the increasingly pronounced use of electronic media and digital devices on the processes and habits of reading. At one extreme, the statistics indicating the decline of literary culture seem to be the most frequently publicised results of studies and surveys concerned with assessing reading in the electronic age. The emphasis on falling literacy standards – such as shorter attention spans or lower reading speed and comprehension level (Greenfield, 2015; Goleman, 2013) – understandably causes anxiety about the digital natives' academic achievement, job performance, professional competitiveness and general prospects for the future (Sorbring, 2014). On the other hand, while young media users have become "produsers" (producers + users) and "prosumers" (producers and consumers) (Lemish, 2015), the overly optimistic depictions of "technologically empowered 'cyberkids'" (Itō et al., 2009, p. 14) capable of critically interpreting media contents, are equally misleading. The general public in fact often remains uninformed about the complex and uneven impact of screen reading on, for example, reducing the gender and socioeconomic gaps among young people (Livingstone et al., 2005). Both approaches also fail to acknowledge convergent media environments and diverse sociocultural contexts of media appropriation (Hasebrink, Jensen, Van den Bulck, Hölig, & Maeseele, 2015). The haziness of popular perceptions of reading in a digital reality is exacerbated by often too hasty policy decisions concerning the introduction of information and communications technology (ICTs) into schools in some countries and a dearth of sustained systematic efforts to teach new media literacies or "21st century skills" in others (Batorski & Jasiewicz, 2013). Simultaneously, there has been an ongoing debate about which parties involved – parents, educational institutions, the media industry, government agencies – should be responsible for children's media education and behaviour (Lemish, 2015; Valkenburg, 2014).

This chapter aims at supplying a balanced and empirically grounded factual context for current debates about reading in general, and reading from digital devices in particular. We begin with a discussion of early theory and research on media use and reading. We then go on to an overview of what is known about reading in the context of media use and media preferences as based on cross-national

surveys and studies conducted in Europe since 2010. In our overview, we pay attention both to non-reading forms of media use and to reading in multimedia and non-multimedia settings across country populations and specific age groups. We also focus on everyday media use and reading in a family context, including patterns of use, parental guidance and family interactions around new media. As parents have the most crucial influence on their children's present and future reading habits, we explore in detail the available findings on parents' involvement in their children's socialisation into reading. Finally, we are interested in the role of public and school libraries. We base our discussion on examples of national surveys and case studies, which provide culturally contextualised evidence about the use of digital devices for reading in households and educational settings across Europe. We conclude by indicating lacunae in the field of reading research in the context of wider media use as a means of gaining a comprehensive, constructive, and productive perspective on cultural and educational challenges that we face as individuals and societies engaging with digital media. We believe that these gaps can be reduced by research aligning experimental approaches with more traditional methodologies developed for example in literary studies or publishing studies. Finally, we also point out the need for the development of ethnographic approaches and fieldwork investigating children's and young people's every day reading practices in print and on screen.

2. Reading in the lives of European children and young adults

Public perceptions of and scientific debates about digital reading, i.e. reading from the screens of electronic digital devices, are unwittingly affected by earlier discussions about the alleged detrimental effect of electronic media for the language development and reading skills of the young generation. In this paragraph, we give a concise overview of scientific perspectives on the validity of this claim. First, we outline the main assumptions and results of early research on media use, particularly TV viewing, in relation to reading. Next, we present the debate about the relationship between new media (digital, off- and online devices and applications) and reading. We base our discussion on the multi-year, cross-national EU Kids Online project and national studies from several European countries.

2.1 Early theory and research on media use and reading

Paraphrasing Seth Lerer's (2008) contention that ever since there were young audiences, stories have been told and written for children, one could also say that ever since children became readers, their parents, as well as educators, librarians,

politicians and other adults preoccupied with the appropriate management of childhood (Foucault & Gordon, 1980) have expressed concerns as to how and what youthful audiences read influences their psyche and body in the context of their family life, schooling and peer interactions. Texts addressed to children still constitute one of the most effective mechanisms for propagating and consolidating dominant ideologies. When books became a mass medium in the first half of the 20th century and when children's literature became a business of its own in the second half of the 20th century, ongoing censoring interventions into school reading lists or library resources and circulation reflect the belief in the exceptional status of reading as a socially and culturally formative activity. *Harry Potter* wars (Jenkins, 2006) concerning the impact of J. K. Rowling's fantasy series on children's imagination, literacy skills, civic engagement and morale, offer especially vivid proof that literature remains a powerful mass medium in the 21st century.

The emergence of TV as a widely accessible mass medium in the 1960s and 1970s caused serious concerns that it would impede children's reading, despite early evidence about the informal learning effects from television (Schramm, Lyle, & Parker, 1961). As Keith Roe (2007) summarises the growing academic effort in the US and Europe to assess "the TV effect", the belief in the negative correlation between TV viewing and children's reading acquisition and reading achievement, as well as the displacement hypothesis, which assumes that because of watching TV children spend less time performing activities fostering their development, including reading and doing homework, soon became the dominant theoretical perspectives shaping the scientific exploration of the social and cultural consequences of (increased) TV use. Hence, television viewing became associated with entertainment, impoverished cognitive stimulation, low concentration and non-creativity. Nevertheless, until the 1980s, there was a lack of solid evidence supporting the existence of any relationship between TV viewing and children's reading. Assessments of the mechanics, intensity, and possible directions of the TV influence were also ambiguous. This was the case because most research designs failed to take into account the now obvious mediating variables of age, gender, individual differences, or socioeconomic status. Roe (2007) points out that although large-scale longitudinal studies were undertaken to make sense of the dispersed and very often conflicting data gathered earlier, no satisfying consensus had been reached as to the actual complexity of the TV effect on reading. In an extensive review of research in the field, Susan Neuman (1991) concluded that the critical factor shaping the influence of TV exposure on children's academic achievement is not the medium itself but the context of family as a learning environment. On the other hand, Koolstra and van der Voort (1996) argued on the basis of their panel study of Dutch children that despite the ambiguous evidence, the inimical influence of TV viewing on children's early reading achievement should be seen as the

most reasonable working hypothesis. They also proposed the reading depreciation hypothesis, according to which television negatively affected older children's attitudes to reading as a less pleasurable and less satisfying form of entertainment than TV. However, research has also revealed that reading print and TV viewing involve mental processes that are to some extent similar (Mackey & Robinson, 2003) and that comprehending film narratives can develop children's reading skills and motivate them to read printed texts (Marsh & Millard, 2000; Kendeou, Bohn-Kettler, White, & van den Broek, 2008). Nevertheless, as Evans Schmidt and Anderson (2007) conclude, whereas research has not yet fully accounted for the relationships between reading and TV viewing, it is plausible that in younger children, too much time spent watching TV inhibits reading acquisition as it may discourage the development of the mental capacities necessary to master new academic skills such as visual imagination and attention span. They also propose another approach to investigating the TV effect: television as a medium is neutral; it is the content that determines its effects. As Lemish (2015) reports, studies indicate that in all age levels the number of viewing hours affects reading competence, that reading in home environments fosters children's engagements with books, and that the presence of a TV set in a child's bedroom has a negative influence on reading levels. Nonetheless, in a more general take on the relationship between watching television and reading books, Lemish stresses that although undoubtedly some children read more than their peers, these trends have nothing to do with television. As she argues, the blockbusting popularity of the Harry Potter and the Twilight Saga series, as well as the burgeoning market of products resulting from adapting children's literature to new media, indicates that screen culture, which includes not only TV but also other audio-visual media and devices, has not usurped the unique status of reading as a leisure activity.

The question of researching what was happening to children's and young people's reading abilities and interests became even more complicated in view of the rise of new media, the development of digital devices, and the increasing dominance of visual culture. It soon became clear that television was now only one, and not necessarily the most significant, reason why children might neglect reading. It was argued that access to computers reduced the time children spent on other activities, including reading (Subrahmanyam, Greenfield, Kraut & Gross, 2001; Rosén & Gustafsson, 2014). Rosén and Gustafsson (2014) stipulate that one of the most negative effects of children's home computer use on reading is the reduction of time spent on practising reading and hence improving one's ability to comprehend complex continuous texts. Proponents of distraction theory state that the very variety of interactions, contents and formats enabled by the computer inevitably draws user attention away from learning activities including out-of-school reading (Rosén & Gustafsson, 2016). More positive approaches – the activation

and content theories – predicted that the influence of computer use may be beneficial for intellectual development as long as the user is cognitively stimulated by appropriate materials and adequate doses of interactivity (Rosén & Gustafsson, 2016). Yet such assumptions do find some reflection in real computer use only when it is motivated by learning tasks and goals (Rosén & Gustafsson, 2016). As Rosén and Gustafsson (2016) suggest, despite a number of empirical studies into computer use, the four theories (the distraction theory, the substitution theory, the activation and content theories) have not been tested systematically enough in relation to one another to warrant definitive conclusions.

An example of European research addressing this challenge is the study conducted by van der Voort, Beentjes, Bovill, Gaskell, Koolstra, Livingstone & Marseille (1998), which tested the differences in how and why children in the Netherlands and in the UK use 'old' media forms (books, comics, magazines and newspapers, television, video) and new forms of interactive media (electronic games and the personal computer). Significantly, the study classified TV as an 'old' medium, although it should be noted that the very division between old and new media is rather unproductive and artificial as the same contents can spread across all kinds of media, and not necessarily only from old to new ones. Moreover, users often engage in multitasking activities, for example surfing the Internet while watching TV, or alternating these activities. Such processes form the basis of transmedia entertainment and convergence culture (Jenkins, 2006). The participants' use of various media in van der Voort et al.'s (1998) study was investigated not only with regard to the variables of age, gender, and socioeconomic status, but also in the context of the availability of these media in young users' rooms. While the study revealed some significant national differences, for example in the percentages and age of children who did read, it showed first and foremost that in both countries, the amount of time spent reading to relieve boredom, for excitement, for relaxation or for learning decreased with age, while the amount of time spent on engaging with visual culture as mediated by computers increased. Simultaneously, the study indicated that an effective, and very simple, method of counteracting this trend could be providing children with direct access to reading materials in the form of book shelves in their bedrooms, which have become spaces for children's individual use of media and "centers for entertainment and technology" (Thiel, 2007, p. 114). Finally, the study indicated SES-related differences in access to information and new technology as an emerging type of social inequality. A similar relationship was established in the *UK Children Go Online* study (Livingstone & Bober, 2005).

An example of a more recent national study of children's use of television is the investigation of the long-term effects of intergenerational transmission of television tastes and viewing behaviours in the Netherlands, conducted by Notten,

Kraaykamp, & Konig (2012). The study revealed that, whereas one's own cultural background and educational level outweigh the influence of parental influence, children's imitation of parental practices constitutes the main element of parental media socialisation, which in turn is also affected by parents' socioeconomic background and cultural capital. Other significant, albeit less direct, transmission processes constituting the cultural inheritance model are parents' active media guidance behaviours (predominantly of restrictive and protective nature) and their influence on their children's cognitive competencies (Notten et al., 2012). Parents' socioeconomic status and educational background were shown as substantially relevant to the formation of individual television tastes, and especially to the preference for either highbrow or lowbrow content in later life. Finally, although parental influence plays the key role in the development of children's cultural competence, the study indicated the need for further research into the importance of the influence of other socialisation agents (peers, teachers, librarians).

2.2 Research on new media and reading

As the Internet, online technologies and mobile devices became widespread in the past 25 years, research geared specifically at exploring the domestication and home ecologies (Lemish, 2015) of new media turned out to be of paramount importance. A major concern that needed to be addressed in this new field was children's quick acquiescence of online competences, yet often without awareness of the risks accompanying these new opportunities. The earliest cross-national studies in this field are the Children and Their Changing Media Environment study (1987–8); SAFT (Safety Awareness Facts and Tools), conducted in the years 2003–4 and 2006; Eurobarometer (2003, 2004, 2005–6 and 2008); Educaunet (2005); Mediappro (2005–6) and the World Internet Project (WIP) (2007 until now) (Livingstone & Haddon, 2009). Consistent research into children's media use, including reading in digital environments, has been systematically conducted in Germany since 1999 (the KIM series of studies (kids + media, computer internet)) and in the UK since 2005 (National Literacy Trust studies). An important example of such studies is also "Digital beginnings: Young children's use of popular culture, media and new technologies" (Marsh, Brooks, Hughes, Ritchie, Roberts, & Wright, 2005), which explored young children's (aged 0–6) interactions with popular culture, media and new technologies in the home through a survey of 1,852 parents and early-years practitioners. One of the key findings of this study was that young children witness and develop a wide range of practices, skills, and knowledge related to the use of popular culture, media, and new technologies from birth. Children's use of media was also found to be usually active and conducive to playing, speaking and listening, and reading. This process of gaining new skills was supported

and facilitated by their parents and family members, who had concerns about the perceived amount of time children spent with new media and technologies. Nevertheless, they also that felt their offspring benefited a lot from those activities and that media education should be a substantial element of school curriculum. Importantly, engagement with new media and technologies was found to be a social activity shared with other family members, as has been found for television viewing in the 1980s (Lull, 1980; Morley, 1986; Morley & Silverstone, 1990). Practitioners reported that the introduction of the use of ICTs into curricula had increased children's motivation and engagement in learning. Commenting on the implications of their study for further research, Marsh et al. (2005) stressed the need for longitudinal and observational studies of children's media use in family contexts and early-years settings, and especially of its influence on communication practices of young children and on their progress in speaking and listening, reading and writing. As the children studied in this research are now between 16 and 26, it would certainly be extremely revealing to explore how their media use has changed as they have grown. There could also be a correlation between these foundations and this cohort's cognitive skills needed to cope with a transnational, networked and increasingly competitive information society based on immaterial labour and immaterial products, such as knowledge and communication (Hardt & Negri, 2004).

2.3 The EU Kids Online project

A breakthrough in the European academic effort to address children's use of the Internet was the first EU Kids Online project (2006–9), an international network aimed at setting up, assessing and maintaining a publicly available and searchable database of empirical research on children's Internet and online activities. Bringing together multidisciplinary researchers from 21 European countries,[1] the project catalogued ca. 400 studies and mapped out key thematic and methodological trends and gaps in the evidence they provided. These findings in turn served as a basis for policy recommendations on, among others, the provision of safe Internet use for children. One of the most significant outcomes of the project for the purpose of this chapter was the recognition of the considerable overlap of offline and online spheres, and of the resulting embeddedness of the ICT in children's everyday lives (Livingstone & Haddon, 2009). EU Kids Online also established that there was an urgent need for research on children's critical interpretation

1. Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Iceland, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden and the United Kingdom.

and evaluation of online content. Typically, quantitative methods were unable to investigate the immediate, and often elusive, contexts of children's everyday online activities, including reading, and their own perceptions of these experiences, which could be achieved by more child-centred, multimethod, contextual, naturalistic, and longitudinal approaches (Livingstone & Haddon, 2009). It should also be pointed out that in examining converging media environments, it is no longer sufficient to focus on only one medium (Hasebrink et al., 2015).

The database created by the EU Kids Online network was further expanded in the EU Kids Online II project. The search for European studies on media use conducted in 2012 yielded more than 800 additional studies, with the total number of research projects exceeding 1,200. The work on the database continued in new searches for studies in 2013. In 2010 the EU Kids Online network conducted a large-scale survey of Internet use among about 25,000 children aged between 9 and 16 and their parents in 25 countries (Livingstone, Haddon, Görzing, & Ólafsson, 2011). A new series of European surveys is being conducted in 2017–2018 as a response to the rapid changes in mobile appliances and the lack of continuity typically characterizing findings in this field. It will also be an attempt at multidisciplinary, multi-method, contextual, longitudinal and comparative research into the complexity of children's everyday use of online technologies (Hasebrink, 2014). Significantly, the 2017–2018 surveys will concern children and parents whose media socialisation has been more intense and diverse than that of the cohorts participating in the 2010 survey, when fewer devices (notably smartphones and tablets) and applications were available.

An important result of this continued effort to track changes in children's Internet experiences, relevant also to the study of reading in the digital age, is the identification of four groups of countries based on two indicators for the state of Internet diffusion these countries had reached in 2010 (Hasebrink, 2014). Countries in Group I (Denmark, Finland, the Netherlands, Norway, Sweden and the UK) are characterised by more than 75 per cent of their population being Internet users in 2009. In contrast, in countries constituting Group IV (Bulgaria, Greece, Romania, and Turkey), only 30–40 per cent of their population used the Internet in 2009. In countries from Group II (Belgium, France, Germany, Estonia, Ireland, Slovenia, Austria), Internet diffusion was between 58% and 71%, while in Group III (Hungary, Lithuania, Poland, the Czech Republic, Cyprus, Spain, Portugal, Italy), it was between 42% and 57%. The differences between the four groups show the unevenness of Internet diffusion across Europe in 2009, which in turn obviously affected the frequency and nature of children's interactions with online technologies. Yet more importantly, country classification indicates that phenomena and trends observable in Groups I and II could reoccur later in countries from Groups III and IV, being at the same time inflected by more recent

changes in technological innovation and cultural practices concerning new media. In another grouping, based on measures of children's experiences of online opportunities, risks and parental mediation (Helsper et al., 2013), European countries were grouped into the following clusters: countries characterised by 'unprotected networkers' (Austria, Hungary, Lithuania and Slovenia); countries in which users are 'protected by restrictions' (Belgium, France, Germany, Greece, Ireland, Italy, Portugal, Spain, Turkey and the UK); countries with 'semi-supported risky gamers' (Bulgaria, Cyprus, the Czech Republic, Estonia, Poland and Romania); and countries with 'supported risky explorers' (Denmark, Finland, the Netherlands, Norway and Sweden). As reading is one of the many activities in which children engage in digital environments, its contents and intensity depend also on users' opportunities and risks management.

2.4 Insights from national studies

Apart from the multinational comparative EU Kids Online project, a substantial number of studies in Europe have been conducted on the national level, of which only very few highlights can be covered here. What connects these otherwise divergent studies is that they relate reading activity of children and youth to their computer use, mostly (but not exclusively) suggesting a trade-off between the two. In essence, these studies are mimicking research from the pre-Web era exploring the trade-off between watching television and reading time. In general, these studies concluded that as long as television viewing did not exceed moderate levels (up to 4 hours per day), it did not affect reading time and comprehension. Only when parents were allowing their children to spend an unlimited amount of time (over 4 hours per day) in front of the screen, which in fact often reflected their own viewing behaviour as well as the low expectations of their offspring's educational attainment, did reading comprehension deteriorate (Neuman, 1988).

Corresponding conclusions are drawn in research on the displacement effects of computer and Web use in relation to reading in college students (Cai, 2005; Mokhtari, Reichard, & Gardner, 2009) and the general population (e.g., Netherlands: Huysmans, de Haan, & van den Broek, 2004; US: Robinson & Kestnbaum, 1999). Time spent reading for academic and recreational purposes and Internet time appear to correlate positively. The evidence suggests that reading and using Web sources are not functionally equivalent as they appear to serve additional rather than competing functions. However, studies exploring this relationship in children and teens are in short supply. A Dutch national study among 7–15 year olds showed that, with increasing age, children were turning to digital (including social) media more often and reading books less frequently, thus suggesting

evidence for the time displacement hypothesis. However, it also showed that among the 15 year olds, the higher use of TV and digital media did not correlate with a lower level of book reading, which could be expected if time displacement was indeed the case. In sum, the study demonstrated that time displacement as such can be conceived in at least these two different ways, which in turn lead to different conclusions (Huysmans, 2013).

The 2014 Polish comparative study of students in their final year of primary school (12–13 year-olds) and students in their final year of junior high school (15–16 year-olds) revealed some significant aspects of children's reading as one of many forms of their engagement with new media. More than 70% of the respondents from the younger groups were found to use the computer systematically to visit social networks sites, listen to music, watch films, find news and information related to their interests, read texts created by their peers (blogs and fanzines) or communicate with others. 62% of the respondents in this age group also use it to do their homework. Significantly, 37% of these young users actively contribute content by creating their own websites or by blogging. As the study showed, the size of the group of creative young Internet users does not increase with age (Zasacka, 2015). As to reading literature as a leisure activity, very few respondents in both groups (9% of the twelve-year olds and 13% of the fifteen-year-olds) reported this activity. In both cases, girls did so slightly less frequently than boys. Texts read online most frequently are comic books – mostly because they are more easily available on the Internet. It was also established that in both age groups the frequency of turning to e-books is negatively correlated with parents' educational background and the size of the home library. The results obtained through questionnaires were confirmed by interviews conducted with the participants. Students, including those who use the computer every day, declared that, regardless of their family background, they see reading printed books as more convenient, relaxing and healthier. They also like the tactile qualities of printed books (Zasacka, 2015). Hence, students rarely consciously use the resources of electronic libraries which are available for free. Nevertheless, the study also revealed that the Internet had become an environment that fosters interactions *around* reading: it is a source of information about books and a means of sharing this information with others. This is the case especially in the older age group, while young readers still tend to rely on their parents' recommendations (Zasacka, 2015).

These results correspond to some extent to the findings of the German KIM study from 2014. While playing computer games or using the Internet has become a substantial element of children's daily life, they continue to perceive reading paper books as an important activity. According to the study, every second child reads books regularly, with girls being more regular readers (61%) than boys

(41%). Yet children's preference for traditional reading formats and materials has diminished considerably in the UK. As the study "The Reading Lives of 8 to 11-year-olds" 2005–2013 reveals, while in 2010 children aged 8 to 11 usually read books (fiction, non-fiction and poetry) outside class, by 2013 text messages and other technology-based materials had become typical reading material of this age group (Clark, 2014). An interesting finding of the study was that although more boys than girls recognised the connection between reading and future employment prospects, fewer boys than girls saw reading as cool. Moreover, children from higher socioeconomic backgrounds predictably read a greater variety of technology-based materials than their peers from families with fewer cultural and economic resources. Yet, as Clark (2014) points out, this difference is not necessarily a result of better access to technology, as there is no considerable gap in this respect between both groups. Moreover, as the study revealed, while fewer children from the low SES group enjoyed reading outside class, they nevertheless read a greater number of books outside class per month than their peers from the high SES group. According to the author, this may be the case because children from low socioeconomic backgrounds are more likely to associate reading with good future job prospects even if they perceive reading as an "image problem" and feel that their families do not support their reading (Clark, 2014).

The most recent National Literacy Trust's annual survey "Children's and Young People's Reading in 2015" revealed that in that year, children and young people on average spent more minutes reading materials online than they spent reading books (Clark, 2016), with the levels of daily reading increasing only slightly in comparison to 2014 and more substantially in comparison to 2013. According to the study, only 1 child in 7 rarely or never read outside class. Interestingly, significantly more girls than boys said they own an e-reader (38.1% vs. 28.2%.). They also had more books at home than boys. These two factors may explain why girls are more likely to read diverse technology-based materials as well as books. Moreover, girls estimated that they were significantly more likely than boys to spend more time reading both something online and in a book, which is in turn reflected in more positive attitudes to reading on the part of girls. Finally, the study shows that the most conspicuous difference between boys and girls concerns the choice of TV over reading, with more boys than girls preferring TV (82.3% vs. 69.8%) (Clark, 2016). Children's attitudes and motivation to reading were explored in another recent UK study (Picton & Clark, 2015), which focused on the impact of e-books on students' reading skills and motivation over the academic year 2014/15. The study was based on a school-based e-books project involving children's use of an e-book platform. The research revealed that the implementation of the e-book format in school practice resulted in an increase in reading performance and significant changes in children's perceptions of reading from negative to positive, which, as Picton and Clark

argue, also signalled their growing confidence in their own reading abilities. As the authors conclude, the combination of high level of support and encouragement at school with opportunities to read onscreen, for example in the form of a digital library, may significantly support literacy and learning (Picton & Clark, 2015).

The results of the empirical studies mentioned above indicate that despite concerns about the effects of the growing importance of digital media in children's lives on their reading activities, we need to acknowledge the complexity of this interaction. Using digital devices and content involves textual decoding. Moreover, the time displacement hypothesis, according to which the time hitherto devoted to 'serious' reading is now being spent on more ephemeral content, is supported by the evidence only to a limited extent. Additionally, reading on digital devices such as e-readers and tablets might make reading appear more natural to young readers, thereby enhancing literacy development and learning processes. In short, we should bear in mind the limited validity of the popular criticism too easily equating traditional ways of reading as 'good' and digital reading as potentially damaging individual development and social and cultural well-being.

3. Home literacy: Reading and media socialisation in the family

The importance of the family context for acquiring language and reading skills can hardly be overestimated. A plethora of studies have demonstrated the crucial importance of a supportive environment for acquiring such skills. Factors shown to affect reading skills, motivation and behaviour include parents' reading picture books and reading aloud in early literacy, talking with their children about books and giving a good example by reading themselves. Siblings and peers are – to a lesser extent – also shown to influence children's reading. In this section, we provide an overview of what is known about how parental mediation influences media use, reading in general and digital reading in particular. In broader terms, as Lemish (2015) points out, the emergence of family leisure time and the growing significance of the home as the centre of indoor life is closely connected to the increasing presence of importance of media in family life. Finally, we also examine what is known about the role school and public libraries play in reading practices of the young generation.

3.1 Parental guidance

Studies in many countries have shown that a favourable home environment is a strong predictor of reading achievement and learning outcomes later in life. Furthermore, the earlier in life parents actively engage in language- and reading-promoting

behaviour, the more persistent these positive effects turn out to be (see e.g. Schoon, Parsons, Rush, & Law, 2010). Cultural reproduction theory accounts for differences in educational success between social groups by differences in parental cultural capital. According to this theory, parents raise their children within a specific cultural *habitus*. This set of preferences and competencies acquired during childhood influences educational performance and persists into adult life. Research shows that the quality and quantity of intentional and unintentional parental media socialisation is likely to depend on parents' socioeconomic status, and in particular on their educational and occupational background, and on family size and composition (Notten & Kraaykamp, 2009a). Notten and Kraaykamp (2009a) also point out that parents' investing in home media resources (books, TV, digital technologies) is a significant aspect of family socialisation activities. Many studies confirm that parental media resources and intergenerational transmission of cultural and media behaviour determine an individual's educational achievement and cultural literacy, including both the attainment of reading skills and future adult literary tastes (Bus, IJzendoorn & Pellegrini, 1995; Leseman & de Jong, 1998; Van Peer, 1991; Notten & Kraaykamp, 2009). Notten and Kraaykamp (2009a) in their cross-national study of 53 countries also established that the "old" medium of books is most effective in improving children's academic performance.

The latest edition of the multinational PIRLS study (2011) provides evidence for this finding (Araújo & Costa, 2015). In their analyses, Araújo and Costa (2015) divide the respondents, 4th graders, in groups according to the extent to which they are read to by their parents (low vs. high level) and parental educational level (where the split is between secondary and tertiary education as highest attained level). Consistently, reading scores are higher for children who experience a more favourable reading climate at home, as measured by the level of book reading with their parents. Moreover, the parents' educational level (either the mother's or the father's, whichever was highest) plays an important role. In all countries, children with at least one highly educated parent score higher on reading ability than kids from low-educated families.

In light of the above, one of the remaining gaps in research concerning children's use of new media, which happens far more intensely in the family home rather than at school or in other cultural institutions, is the exact significance and forms of parental guidance as a means of stimulating cultural competence, including reading preferences. An early study into parental media socialisation conducted in the Netherlands by Notten and Kraaykamp (2009b) revealed that parents from higher social strata both consume highbrow media content and value leisure reading as a socially desirable activity, thereby encouraging their children to develop the same tastes. Moreover, older mothers engage in more highbrow and less lowbrow media consumption, which also affects the formation of children's

preferences and competencies. Children growing up in large families, in which parents' attention is divided among siblings, experience less parental instruction with regard to media use and content. Finally, children living with divorced parents also participate in fewer parent-child interactions over media, do not receive much guidance concerning reading skills, and are less effectively protected from exposure to harmful media content (Notten & Kraaykamp, 2009b). Importantly, the study indicated the necessity of investigating the significance of parents' gender in their media guidance activities, of research into parents' own perceptions of their own role as educators, and of the extension of related research into other European countries. It is also worth considering whether the highbrow/lowbrow categorisation of culture has not become obsolete in light of the emergence of the 'nobrow' trend and 'artetainment', which rely on the fusion of high aesthetics and massive commercial appeal (Swirski, 2005). Finally, while the study provided useful insights into factors affecting the intergenerational transmission of cultural and media behaviour in the family context as well as its long-term effects, it was based, as the authors indicate, on retrospective data coming from adult media users, which may have resulted in over- or underestimation of certain factors (Notten & Kraaykamp, 2009b).

While the above-mentioned studies reveal general mechanisms and characteristics of parental mediation, they do not delve in detail into parents' attitudes and the particular approaches they adopt to manage children's media use. Nor do they ask whether any new strategies are needed especially for the mediation of digital environments, for example because of the personalised and portable nature of new devices (Haddon & Vincent, 2014; Mascheroni & Ólafsson, 2014; Livingstone et al., 2015). The EU Kids Online network has discovered the following types of parental mediation with reference to older children (9–16 years old): *active mediation* (sharing and discussing online activities), *safety mediation* (advising and guiding on managing risks), *restrictions* (rules and bans), *technical mediation* (use of filters, parental controls) and *monitoring* (checking the computer/social media/phones after use) (Livingstone & Helsper, 2008; Dürager & Sonck, 2014; Livingstone et al., 2015). On the one hand, these types of parental mediation reflect general parenting styles, e.g. authoritative, permissive or uninvolved (Baumrind, 1991; Livingstone et al., 2015); on the other, they are influenced by parents' own digital literacy. Parents who believe that their children are more expert media users than themselves are likely to be less confident of mediating their children's interactions with new media and thus less engaged in them and less aware of both risks and opportunities (Livingstone et al., 2015). Measuring parental guidance reliably poses difficulties, as both parents and children may overestimate or underestimate their attitudes and behaviours. Moreover, parental management of media use is often aimed not only at ensuring that the child benefits from certain activities, but also at meeting

parents' needs, the most common being gaining enough time to deal with housework (Livingstone et al., 2015). The character of parental mediation depends on culture and country, with parents from Central and Southern European countries, Ireland and the UK adopting restrictive mediation; parents from Northern European countries preferring active mediation, and parents from Eastern European countries resorting to all types of parental mediation or being passive (Livingstone et al., 2015). The EU Kids Online survey (Livingstone, Haddon, Görzig, & Ólafsson, 2011; Livingstone, Hasebrink & Görzig, 2012) also revealed that parents with higher income are more likely to favour active mediation of Internet use, while restrictive parental strategies were used equally frequently by parents of different socioeconomic backgrounds. Finally, young parents of today belong to the new generation of 'digital parents', who were themselves socialised into the use of digital media and are now engaging in culturally socializing practices in relation to their own children. Therefore, productive complementary research addressing the fast-paced technological development of digital media and their influence on young generations must employ methods enabling immediate access to concrete parent-child interactions over media use and their socializing effects.

3.2 Parents' views on reading in digital environments

The importance of family for the preservation of a reading culture with the aid of new technologies has also surfaced in the German study from 2012 "Digitale Angebote – neue Anreize für das Vorlesen" (Stiftung Lesen, 2012), in which 500 parents of children between 2 and 8 years old were asked about the use of picture books and children's books apps as sources of reading materials. The study found that digital media had become accepted as a welcome expansion, and not a replacement, of traditional printed picture books. The choice between print and screen depends on particular circumstances in which the reading activity is to take place: print is seen as more suitable for bedtime reading, while screen is perceived of as more convenient when traveling. The study also showed that although fathers still read less to their children than mothers, they tended to choose electronic formats, which may be a way to encourage more fatherly engagement in family reading. If parents refrained from using apps, it was because of their lack of experience with new formats, which in turn signals the need to promote new forms of reading materials and advise on how to use them (Stiftung Lesen, 2012).

Parents' views on possible uses of new technologies in activities aimed at supporting their children's language and literacy development, as well as their attitudes to books and touch-screen devices, were also researched in a UK study by Formby (2014). The study found that nearly all children from birth to five years old had access to books in the home and 73% of children had access to a touch-screen

device at home. 26% of all children used a touchscreen at home to look at or read stories in a typical week, while nearly all children looked at or read print based stories in a typical week (95%). It was also established that the more children looked at or read print based stories at home, the better communication and language skills they had developed at age five. Parents were found to engage in diverse activities to support their children, such as visiting the library once a month or having an average of 89 children's books at home. Predictably, the size of the home library, as well as the frequency of parents' own reading activities, could also be linked with children's better communication and language skills at age five. Interestingly, parents were found to project their own enjoyment of reading onto their children. The majority of parents also strongly agreed that their child should learn to use technology from an early age to do better at school. Last but not least, children of lower socioeconomic status who had access to tablets were found to be twice as likely to look at or read stories on a touchscreen daily, which clearly indicates that there are benefits to looking at or sharing stories using a touchscreen device, particularly for children of lower socioeconomic status, especially when they lack support from their parents (Formby, 2014). As Formby concludes, technology may enable disadvantaged three- to five-year-old children to read more and enjoy it. She also stresses the need for further research into parents' communication with children when they are sharing a story in print or on a touchscreen.

A cross-national qualitative project "Young children (0–8) and Digital technology – a qualitative exploratory study" (Chaudron, 2015) applied such methods to address, among other topics, parents' involvement in media socialisation processes. It aimed at examining young children's (0–8 years old) and their families' experiences with digital technologies, such as smartphones, tablets, computers, and games. By means of interviews and observations in the home context with ten families from each participating country (Belgium, the Czech Republic, Finland, Germany, Italy, UK, and Russia), the project generated data on how children between 0 to 8 years use (online) technologies, how parents guide media use, and how to determine potential benefits and risks connected with children's engagement with new technologies. Parents and children provided very insightful information about their use of the technologies. One of the key findings was that although children's reading and writing skills determine the scope of children's media interactions, they acquire digital literacy even before they learn to read and write. They do so by mastering how to identify visual cues, which in turn to a large extent enables them to use the Internet, Skype or social networks without adult intervention. The study also revealed that young media users learn from observing not only their parents but also other family members, i.e. older siblings and grandparents, with adults often remaining unaware of how children imitate their behaviour. Finally, thanks to ensuring direct access to parents, the project yielded

information on parents' own perceptions of their role as educators and mediators. Although parents see digital technologies as challenging, especially in the context of children's media use, they have a sense of control over media devices and their uses, often turning to their offspring as support in their household and parental duties. Nevertheless, parents recognise a number of risks related to their children's interactions with digital technologies: economic consequences, incidental inappropriate content, and health or social impacts. The most frequently used restrictive strategies include establishing a set of rules concerning time and content. Most children participating in the study appeared to understand and follow the rules quite easily. On the other hand, the potential benefits parents acknowledge include the development of creativity, social skills, hand-eye coordination, and better educational prospects (Chaudron, 2015). A rather worrying outcome of the study is the conclusion that parents seem to be little aware of the actual digital activities of their children, and that they do not realise that their offspring are often capable of bypassing the safeguards they have set up. These findings indicate the need for policies aimed at encouraging more active parental involvement in shaping young users' digital literacy (Chaudron, 2015).

An overview of parents' views and activities more specifically in relation to children's leisure reading of print and digital books can be found in the UK Book Trust study "The digital reading habits of children" (Kucirkova & Littleton, 2016). The survey of 1,115 British parents of 0–8 year old children revealed that most parents worry about such negative effects related to children's reading interactive e-books as the increase in screen time (45%), loss of interest in print books (35%), exposure to dangerous content or advertising (31%), reduction of the attention span (26%), decrease in parents' ability to monitor both children's reading and their purchasing behaviours (21%), inhibition of educational attainment (14%), and harm to a child's brain (10%) (Kucirkova & Littleton, 2016). Moreover, 76% of the parents participating in the survey indicated that they prefer print books for reading for pleasure over interactive e-books. Parents typically reported that they read print books with their child more than e-books, with 56% of parents indicating that they read print books with their child (almost) every day. Only 6% of parents reported that they read e-books with their children every day or almost every day. These proportions are reflected to some extent in the parents' own reading practices: 29% of the parents reported that they read print books every day or almost daily themselves, while a mere 11% read e-books. Half of the parents said that they enjoy reading for pleasure very much, whilst 16% reported that they do not like reading very much or at all. Yet almost half of the respondents mentioned that they would welcome advice concerning interactive e-books. Interestingly, the study showed that even in highly digitised households print books are the preferred choice for children's reading. Finally, the survey revealed

the significance of the age factor in parents' decisions about children's readings as well as children's own preferences as reported by parents. Parents indicated that the best time to start reading with their child is at age 0–1 year for print books; 2 years for interactive e-books, and 3 years for simple e-books (Kucirkova & Littleton, 2016). As the authors point out, the survey findings indicate that parents' concerns and doubts around their children's access to and use of digital books need to be addressed through adequate policies, especially given that young readers exploring digital material with their parents are likely to become critical readers capable of assessing and rejecting inappropriate or poor quality content (Kucirkova & Littleton, 2016).[2]

The above-mentioned evidence indicates that parental guidance and media socialisation efforts shape children's (digital) reading to a considerable extent. These efforts are likely to be guided more by their beliefs about what is beneficial to children's development than actual knowledge of factors exerting positive and negative effects. What is more, parental influence derives not only from conscious guidance efforts, but also from children's observations of their parents' reading and (wider) media behaviour. Finally, the cultural habitus connected to the family's socio-economic status is reproduced through media socialisation, resulting in more intensive reading behaviour of children coming from higher SES families.

4. Libraries

An institution not to be ignored in parental efforts to 'properly' socialise their offspring is the library. The provision of public cultural and educational resources has the potential of offering a route into reading for disadvantaged groups and populations (Kleijnen, 2016; Kleijnen, Huysmans, & Elbers 2015; Nielen & Bus, 2015). According to the public resources substitution theory, high quality and appropriate quantity of public resources is likely to reduce the divide caused by SES-related differences in media use practices (Caro & Lenkeit, 2012; Araújo & Costa, 2015). On the basis of 1998 data from a family survey in the Netherlands, Kraaykamp (2003) studied the long-term effects of reading promotion of three stimulating

2. The abovementioned studies by Chaudron and by Kucirkova and Littleton are contributions to DigiLitEY (The digital literacy and multimodal practices of young children), an international network of scholars conducting interdisciplinary collaborative research on young children's diverse aspects of the presence of new media in the lives of children aged from 0–8 both in home and school settings across Europe. The aim of the network is to also generate knowledge on the implications for policies and practice concerning the provision and use of digital technologies in education and the regulation of children's engagement with them.

factors: a supportive home environment with parents encouraging their children to read; prolonged library membership during childhood; and cultural education (e.g. classes on history and theory of literature) in secondary school curricula. Persons who as a child were stimulated to read literature by their parents turned out to be more avid readers of literary books and, to a lesser extent, of suspense novels. Moreover, their general reading level was higher in later life. Persons who preferred romantic fiction appeared to have copied this preference from their parents as well. Second, persons who were members of the library for a longer period had a stronger preference for literature and suspense novels. Third, cultural instruction in secondary school turned out to be quite effective in stimulating reading of literary novels in later life.

Many EU countries have developed reading promotion policies and initiatives based on combining e-reading with traditional formats and practices. Public libraries and school libraries in particular have the potential to raise awareness of the importance of reading for societies and to effectively contribute to the provision of equal access to literature and information. Most of the research into the influence of school libraries on children's academic achievement has been carried out outside Europe, mainly in the United States and Australia, where school libraries are staffed by teacher-librarians schooled as both librarians and educational specialists. In such an environment, positive effects of school libraries on academic achievement, reading literacy, and learning in a broader sense have been amply demonstrated (cf. Lance & Hofschire, 2012; Lonsdale, 2003; Todd, 2014). Not much is known to date, however, about the use of e-books (enhanced or not) in schools through school and public libraries.

As indicated in *Promoting Reading in the Digital Environment*, a 2016 report of a group of EU member states' experts, libraries should focus, among other things, on developing e-lending of e-books and digital audiobooks, on using digital channels for public information, and on creating virtual and interactive network services offering educational and cultural contents (European Commission, 2016). While these goals should be realised by public libraries, school libraries also play a crucial role in reaching children, their parents, and educators. Irene Picton and Christina Clark (2015) point out that the benefits of including e-books in the school library, for example, include not only the expansion of the (print) library without the need for more shelf space, but also the creation of a more attractive collection: "An e-book library may reflect children's popular requests and usage levels, as pupils can identify and ask for the titles that they most want to read, and conversely less popular titles identified by usage records simply need not be rented again" (p. 36). Moreover, and perhaps most importantly, offering young readers more agency in their reading choices is one of the most powerful and effective ways to get them to read (Picton & Clark, 2015).

Other studies into the use of e-books by primary school students confirm that the in-built enhancements of e-books (stills as well as short videos) may help students to comprehend texts, stimulate reading fluency, enhance vocabularies and boost reading motivation (Verhallen & Bus, 2010; Smeets & Bus, 2012). Nevertheless, some studies reveal negative effects of enhanced e-books on reading skills and comprehension, as well as a more passive reading attitude. This is so because interacting with digital reading devices requires young readers to adapt to hard- and software and develop new reading strategies and even literacies. Moving from print to electronic text implies coping with changes to the text itself, to the graphics, to the reader's role, and to the reading process (Felvégi & Matthew, 2012).

Finally, recent trends in e-book purchasing and e-lending in various countries show expectations about e-books supplanting printed books to have been overly optimistic. In the United States and the United Kingdom the market share of e-books published by the largest publishing houses has shrunk, whereas in countries like Germany and the Netherlands it has stabilised on a rather low level (around 6% of the turnover) (Author Earnings, 2016; Börsenverein, 2016; KVB, 2016; Tivnan, 2016). Therefore, it remains to be seen whether the digital revolution in book publishing will indeed turn out to be revolutionary. However, a recent judgement of the Court of Justice of the European Union (CJEU) has put e-lending (i.e. the lending out of e-books by public libraries) on an equal footing with the lending out of physical books. The Public Lending Right (PLR) may be expanded to include e-books as well as e-audiobooks, meaning that their authors can be financially compensated for the loans. Potentially at least, this might give digital reading through libraries a positive impulse.

5. Outlook

In this chapter, we have reviewed representative examples of European research into children's use of new media and reading aimed at investigating various connections between growing up in a technology-saturated world and complex engagements with texts of various contents and formats either for educational purposes or for pleasure. We started out with a return to early theory and research on media (particularly television) use and reading. Subsequently, we examined cross-national surveys and studies conducted in Europe since 2010 to establish what is known about non-reading forms of media use and reading in multimedia and non-multimedia settings across country populations and specific age groups. We focused in particular on everyday media use and reading in a family context and parents' perceptions of reading in digital environments and their awareness of their own role in fostering their children's interest

in reading. Finally, we looked at the role of libraries in shaping children's reading experiences in digital environments. Our overview is of necessity fragmentary, as a book chapter cannot do justice to all the studies done in national and cross-national contexts. Nevertheless, the evidence we have discussed reveals the crucial influence of diverse family composition and education systems on the emergence of distinctive informal home literacies that coexist with learning within formal educational settings (Carrington, 2001). It is also clear that reading is now part of the evolving screen culture, thereby exemplifying both the challenges and the promises it brings.

In our discussion of the studies on reading we also tried to indicate cases that either reveal certain methodological limitations or exemplify exceptionally effective approaches that could be replicated elsewhere in Europe. In general, research efforts undertaken to study media use and reading can be roughly divided into large-scale international studies like PIRLS and PISA, in which reading is treated as a measurable activity only rather than as an often fragmented and irregular process (Maybin, 2013; Cremin, Mottram, Collins, Power & Safford, 2014), and narrower and in-depth explorations of children's reading experiences with relation to their cognitive development and social relations. While the former studies record shifts in trends, e.g. in reading comprehension over time, the latter recognise children's attitudes and everyday behaviours related to reading. Both rely on such methodologies as surveys, formal tests, focus groups, experiments, observations, interviews, and creative methods, and both provide vital data to be used in recommendations for reading policy and advocacy intended to ensure that, as Cremin et al. put it (2014, p. 5), children "develop as readers who not only can, but do choose to read, for pleasure and for life."

Nevertheless, we feel that existing approaches and methodologies should be complemented by more thoroughgoing and in-depth research, yet unprecedented in Europe on a larger scale. The scholarly endeavour undertaken within E-READ and combined with research conducted in DigiLitEY will undoubtedly significantly broaden our understanding of the effects of digitisation on reading (Mangen & van der Weel, 2016). The gradually more and more frequent combination of experiment-based research (e.g. eye-tracking or neuroimaging) with methodologies developed within pedagogy, publishing studies, literary studies or media studies, may facilitate gauging the significance of such factors as text length and layout, haptic affordances, sensori-motoric and ergonomic aspects, perceptual processing, memory, emotional aspects, audio-visual affordances, spatiotemporal circumstances of reading or the development of the e-book market. Such interdisciplinary approaches may reveal a lot about the yet uncovered aspects of digital text reading and guide policies and recommendations related both to paper and screen reading.

Finally, future research will also have to face the challenge of reading as a transmedia phenomenon (Jenkins, 2006) experienced across various platforms and in multifarious contexts beyond schools or children's homes. It also has to take into account new forms of using media as well as old and new inequalities related to media use, stemming not so much from gaps in access to technology, but from gaps in users' awareness about the educational and cultural potential they offer. We agree with Barbovschi, Green & Vandoninck (2013) and Lemish (2015) that researchers should try to go beyond the traditional medicalisation frame of scholarly inquiry that sees children as having no views or opinions because children do not yet know what is best for them and do not behave responsibly. Lemish mentions the media diet frame, which proposes that there are good and bad mental 'foods' and that adults should socialise children to prefer and choose the former. She further argues that such an approach limits and oversimplifies discussions about children's complex relationships with media, as these interactions should be treated as resulting from the nexus of a child's unique individuality, the particular context of media experience and the social and cultural contexts in which this experience occurs, as 'media use as social action' approaches have demonstrated (Renckstorf, McQuail, & Jankowski, 1996). Hence, as Lemish contends, to account for the multidimensionality of media experiences, scholars cannot generalise about "effects", but need to focus on "roles", "consequences", or "influences" with regard to "'some kinds' of communication, 'some kinds' of content, 'some kinds' of children, [and] 'some' kinds of conditions" (Lemish, 2015, p. 239). Simultaneously, Lemish proposes that this sensitivity to context and cultural situatedness should be combined with methods reconciling traditional research with child-centred methods. Such methods enable children's expression of their views on media-related debates framed by adults' discourses. They guarantee that these worldviews will be recognised as valid sources of knowledge about children as active and well-informed creators and consumers of culture, including reading materials they access in various settings. An example of a pioneering study acknowledging both the cultural situatedness of digital practices and the voices of concrete young users as they engage in the digital world in their everyday lives is Sonia Livingstone and Julian Sefton-Green's *The Class: Living and Learning in the Digital Age* (2016), based on the authors' fieldwork at a school in London. Furthermore, combining traditional ethnography with digital ethnography (Murthy, 2008) into 'multimodal ethnography' (Dicks, Soyinka & Coffey, 2006) may be a useful comprehensive response to the challenge of investigating reading as an increasingly technologically mediated everyday activity in new media environments. Using online questionnaires, e-mail interviews, digital video, social networking websites and blogs not only increases participation in research but also provides access to the often elusive and easily forgettable practices of respondents in natural settings. As a result, these methods

achieve greater collection of more personal and intimate qualitative data than face-to-face interviews and standardised questionnaires (Murthy, 2008). Murthy also argues that while digital ethnography may replicate physical ethnography, it nevertheless enables privileging the voice of respondents, which in turn may be especially useful in research on and with children, as it is likely to shed a new light on adult researchers' conclusions about why some children are reluctant to read while others read avidly both on paper and on screen, for example. Through combining theories and methodologies from various disciplines – notably cognitive and educational psychology, pedagogical and educational science, cultural sociology, and information and communication science – a pluralistic picture of the constantly changing forms and practices of reading might emerge. Such a picture might be just what is needed to better inform public policy and public discourse about the benefits and risks involved in the digitalisation of children's and adults reading.

References

Araújo, L., & Costa, P. (2015). Home book reading and reading achievement in EU countries: The Progress in International Reading Literacy Study 2011 (PIRLS). *Educational Research and Evaluation*, 21(5–6), 422–438. doi:10.1080/13803611.2015.1111803

Author Earnings. (2016). *October 2016 Author earnings report: A turning of the tide…?* Retrieved from http://authorearnings.com/report/october-2016/.

Barbovschi, M., Green, L., & Vandoninck, S. (Eds). (2013). *Innovative approaches for investigating how children understand risk in new media*. Dealing with methodological and ethical challenges. London: EU Kids Online, London School of Economics and Political Science.

Batorski, D., & Jasiewicz, J. (2013). *Nowe media w polskiej szkole*. Retrieved from http://www.regionalneobserwatoriumkultury.pl/tl_files/olek/Nowe%20media%20w%20polskiej%20szkole%20-%20wyniki%20bada.pdf

Baumrind, D. (1991). The influence of parenting style on adolescent competence and substance use. *Journal of Early Adolescence*, 11(1), 56–95. doi:10.1177/0272431691111004

Börsenverein. (2016). *Buch und Buchhandel in Zahlen 2016. Zahlen, Fakten und Analysen zur wirtschaftlichen Entwicklung* [*Book and book trade statistics 2016: Statistics, facts and analyses of economic development.*] Frankfurt am Main: Börsenverein des Deutschen Buchhandels.

Boyd, D. (2014). *It's complicated: The social lives of networked teens*. New Haven, CT: Yale University Press.

Bus. A. G., van IJzendoorn, M. G., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65(1), 1–21. doi:10.3102/00346543065001001

Cai, X. (2005). An experimental examination of the computer's time displacement effects. *New Media & Society*, 7(1), 8–21. doi:10.1177/1461444805049139

Caro, D. H., & Lenkeit, J. (2012). An analytical approach to study educational inequalities: 10 hypothesis tests in PIRLS 2006. *International Journal of Research & Method in Education*, 35(1), 3–30. doi:10.1080/1743727X.2012.666718

Carrington, V. M. (2001). Emergent home literacies: A challenge for educators. *Australian Journal of Language and Literacy*, 24(2), 88–100.

Chaudron, S. (2015). *Young children (0–8) and digital technology: A qualitative exploratory study across seven countries*. Retrieved from http://publications.jrc.ec.europa.eu/repository/handle/JRC93239. doi:10.2788/00749

Clark, C. (2014). *The reading lives of 8 to 11-year-olds 2005–2013: Evidence paper for the Read On. Get On coalition*. London: National Literacy Trust. Retrieved from ERIC database. (ED560666)

Clark, C. (2016). *Children's and young people's reading in 2015. Findings from the National Literacy Trust's annual survey 2015*. London: National Literacy Trust.

Cremin, T., Mottram, M., Collins, F. M., Powell, S., & Safford, K. (2014). *Building communities of engaged readers for pleasure*. Abingdon: Routledge.

Dicks, B., Soyinka, B., & Coffey, A. (2006). Multimodal ethnography. *Qualitative Research*, 6(1), 77–96. doi:10.1177/1468794106058876

Dürager, A., & Sonck, N. (2014). *Testing the reliability of scales on parental internet mediation*. London: LSE/EU Kids Online.

European Commission (DG EAC). (2016). *Promoting reading in the digital environment*. Retrieved from http://bookshop.europa.eu/en/promoting-reading-in-the-digital-environment-pbNC0116151/. doi:10.2766/984241

Evans Schmidt, M., & Anderson D. R. (2007). The impact of television on cognitive development and educational achievement. In N. O. Pecora, J. P. Murray, & E. A. Wartella (Eds.), *Children and television: Fifty years of research* (pp. 65–84). Mahwah, NJ/London: Lawrence Erlbaum.

Felvégi, E., & Matthew, K. I. (2012). eBooks and literacy in K-12 schools. *Computers in the Schools*, 29(1–2), 40–52. doi:10.1080/07380569.2012.651421

Formby, S. (2014). *Parents' perspectives: Children's use of technology in the early years*. London: National Literacy Trust. Retrieved from https://www.literacytrust.org.uk/assets/0002/1140/Early_years_parent_report.pdf.

Foucault, M., & Gordon, C. (1980). *Power/knowledge: Selected interviews and other writings, 1972–1977*. New York: Pantheon Books.

Goleman, D. (2013). *Focus: The hidden driver of excellence*. London: HarperCollins.

Greenfield, S. (2015). *Mind change: How digital technologies are leaving their mark on our brains*. New York: Random House.

Haddon, L., & Vincent, J. (2014). *European children and their carers' understanding of use, risks and safety issues relating to convergent mobile media*. Milano: Educatt.

Hardt, M., & Negri, A. (2004). *Multitude: War and democracy in the age of Empire*. New York: The Penguin Press.

Hasebrink, U. (2014). *Children's changing online experiences in a longitudinal perspective*. London: EU Kids Online. Retrieved from http://eprints.lse.ac.uk/60083/.

Hasebrink, U., Jensen, K. B., Van den Bulck, H., Hölig, S., & Maeseele, P. (2015). Changing patterns of media use across cultures: A challenge for longitudinal research. *International Journal of Communication*, 9, 435–457.

Helsper, E. J., Kalmus, V., Hasebrink, U., Sagvari, B., & de Haan, J. (2013). *Country classification: Opportunities, risks, harm and parental mediation*. London: EU Kids Online, LSE. Retrieved from http://eprints.lse.ac.uk/52023/.

Huysmans, F. (2013). *Van woordjes naar wereldliteratuur. De leeswereld van kinderen van 7–15 jaar* [*From words to world literature. The reading world of children aged 7–15 years*]. Retrieved from http://www.lezen.nl/publicaties/van-woordjes-tot-wereldliteratuur.

Huysmans, F., de Haan, J., & van den Broek, A. (2004). *Achter de schermen. Een kwart eeuw lezen, luisteren, kijken en internetten* [*Behind the scenes/screens. A quarter century of reading, listening, viewing and using the Internet*]. The Hague: Netherlands Institute for Social research (SCP). Retrieved from https://www.scp.nl/Publicaties/Alle_publicaties/Publicaties_2004/Achter_de_schermen.

Itō, M., Horst, H., Bittanti, M., Boyd, D., Herr-Stephenson, B., Lange, P. G., Pascoe, C. G., & Robinson, L. (2009). *Living and learning with new media: Summary of findings from the digital youth project*. Cambridge, Mass: MIT Press.

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: New York University Press.

Keen, A. (2007). *The cult of the amateur: How today's internet is killing our culture*. New York: Doubleday/Currency.

Kendeou, P., Bohn-Gettler, C., White, M. J., & van den Broek, P. (2008). Children's inference generation across different media. *Journal of Research in Reading*, 31(3), 259–272. doi:10.1111/j.1467-9817.2008.00370.x

Kleijnen, E. (2016). Route to reading. Promoting reading through a school library: Effects for non-western migrant students (Ph.D. dissertation). University of Amsterdam, Amsterdam. Retrieved from http://hdl.handle.net/11245/1.547483.

Kleijnen, E., Huysmans, F., & Elbers, E. (2015). The role of school libraries in reducing learning disadvantages in migrant children: A literature review. *SAGE Open*, April–June 2015, 1–16. doi:10.1177/2158244015580369

Koolstra, C. M., & van der Voort, T. W. A. (1996). Longitudinal effects of television on children's leisure-time reading: A test of three explanatory models. *Human Communication Research*, 23(1), 4–35. doi:10.1111/j.1468-2958.1996.tb00385.x

Kraaykamp, G. (2003). Literary socialization and reading preferences. Effects of parents, the library, and the school. *Poetics*, 31, 235–257. doi:10.1016/S0304-422X(03)00033-0

Kucirkova, K., & Littleton, K. (2016). *The digital reading habits of children: A national survey of parents' perceptions and practices in relation to children's reading for pleasure with print and digital books*. The Open University: BookTrust.

Lance, K. C., & Hofschire, L. (2012). *Change in school librarian staffing linked with change in CSAP reading performance, 2005 to 2011*. Retrieved from https://www.lrs.org/documents/closer_look/CO4_2012_Closer_Look_Report.pdf.

Lemish, D. (2015). *Children and media: A global perspective*. Chichester: John Wiley & Sons.

Lerer, S. (2008). *Children's literature: A reader's history, from Aesop to Harry Potter*. Chicago: University of Chicago Press. doi:10.7208/chicago/9780226473024.001.0001

Leseman P. P. M., & de Jong P. F. (1998). Home literacy: Opportunity, instruction, cooperation and social emotional quality predicting early reading achievement. *Reading Research Quarterly*, 33, 294–318. doi:10.1598/RRQ.33.3.3

Livingstone, S., & Bober, M. (2005). *UK Children Go Online: Final report of key project findings*. London, UK: London School of Economics and Political Science.

Livingstone, S., & Haddon, L. (2009). *EU Kids Online: Final report*. London: LSE/EU Kids Online.

Livingstone, S., Haddon, L., Görzig, A., & Ólafsson, K. (2011). *Risks and safety on the internet: The perspective of European children. Full findings*. London: LSE/EU Kids Online.

Livingstone, S., Hasebrink, U., & Görzig, A. (2012). Towards a general model of determinants of risks and safety. In S. Livingstone, L. Haddon, & A. Görzig (Eds.), *Children, risk and safety on the internet* (pp. 323–339). Bristol: Policy Press. doi:10.1332/policypress/9781847428837.003.0025

Livingstone, S., & Helsper, E. J. (2008). Parental mediation of children's internet use. *Journal of Broadcasting & Electronic Media*, 52(4), 581–599. doi:10.1080/08838150802437396

Livingstone, S., Mascheroni, G., Dreier, M., Chaudron, S., & Lagae, K. (2015). *How parents of young children manage digital devices at home: The role of income, education and parental style*. London: EU Kids Online, LSE.

Livingstone, S., Mascheroni, G., & Staksrud, E. (2015). *Developing a framework for researching children's online risks and opportunities in Europe*. Retrieved from http://eprints.lse.ac.uk/64470/.

Livingstone, S. M., & Sefton-Green, J. (2016). *The class: Living and learning in the digital age*. New York: New York University Press. Accessed on http://connectedyouth.nyupress.org/book/9781479824243/. doi:10.18574/nyu/9781479884575.001.0001

Lonsdale, M. (2003). *Impact of school libraries on student achievement: A review of the research*. Camberwell, Victoria: Australian Council for Educational Research. Retrieved from ERIC database. (ED482253)

Lull, J. (1980). The social uses of television. *Human Communication Research*, 6(3), 197–209. doi:10.1111/j.1468-2958.1980.tb00140.x

Mackey, M., & Robinson, M. (2003). Film and television. In N. Hall, J. Larson, & J. Marsh (Eds.), *Handbook of early childhood literacy* (pp. 126–142). London [et al.]: Sage. doi:10.4135/9781848608207.n11

Mangen, A., & van der Weel, A. (2016). The evolution of reading in the age of digitization: An integrative framework for reading research. *Literacy*, 50(3), 116–124. doi:10.1111/lit.12086

Marsh, J., Brooks, G., Hughes, J., Ritchie, L., Roberts, S., & Wright, K. (2005). *Digital beginnings: Young children's use of popular culture, media and new technologies*. Sheffield: Literacy Research Center, University of Sheffield.

Marsh, J., & Millard, E. (2000). *Literacy and popular culture: Using children's culture in the classroom*. London: Paul Chapman.

Mascheroni, G., & Ólafsson, K. (2014). *Net children go mobile: Risks and opportunities* (2nd ed.). Milano: Educatt.

Maybin, J. (2013). What counts as reading? PIRLS, EastEnders and The Man on the Flying Trapeze. *Literacy*, 47 (2), 59–66. doi:10.1111/lit.12005

Mokhtari, K., Reichard, C. A., & Gardner, A. (2009). The impact of internet and television use on the reading habits and practices of college students. *Journal of Adolescent & Adult Literacy*, 52(7), 609–619. doi:10.1598/JAAL.52.7.6

Morley, D. (1986). *Family television: Cultural power and domestic leisure*. London: Comedia Pub. Group.

Morley, D., & Silverstone, R. (1990). Domestic communication – technologies and meanings. *Media, Culture and Society*, 12, 31–55. doi:10.1177/016344390012001003

Murthy, D. (2008). Digital ethnography: An examination of the use of new technologies for social research. *Sociology*, 42 (5), 837–855. doi:10.1177/0038038508094565

Neuman, S. B. (1991). *Literacy in the television age*. Norwood, NJ: Ablex.

Nielen, T. M. J., & Bus, A. G. (2015). Enriched school libraries: A boost to academic achievement. *AERA Open*, 17 December 2015. Retrieved from http://journals.sagepub.com/doi/abs/10.1177/2332858415619417.

Notten, N., & Kraaykamp, G. (2009a). Home media and science performance: A cross-national study. *Educational Research and Evaluation*, 15(4), 367–384. doi:10.1080/13803610903087045

CHAPTER 2

Designing digital texts for beginner readers

Performance, practice and process

Sue Walker[1], Alison Black[1], Ann Bessemans[2], Kevin Bormans[2], Maarten Renckens[2] & Mark Barratt[3]
[1]University of Reading / [2]Hasselt University / [3]Text Matters

This chapter summarises issues that designers consider when they are producing reading materials for beginning and emerging readers, including the constraints imposed by technology. We suggest ways of engaging with users of e-books so that their needs can be considered. We conclude by summarising the typographic parameters that are likely to benefit children's reading.

1. Introduction

This chapter identifies the role of research in typography, and in graphic information design, that is relevant to the design and use of materials for children's reading. By 'design' we mean the visual organisation of type and pictures on paper or screen), and by 'process' the ways in which design is developed to meet the needs of its intended reader group).

Much of what we know about the impact of design on reading comes from the field of legibility research. 'Legibility' in this context is the speed and accuracy with which text on a page can be read (after Pyke, 1926; Zachrisson, 1965; and dos Santos Lonsdale, 2014). In this chapter we present findings from legibility research within a broader framework of considerations that designers use when they organise text and pictures on page or screen. These findings will highlight the multi-variate nature of design decision-making, which makes it resistant to strong rule-bound recommendations. The substrate – screen or paper, for example – on which reading materials are displayed is one of the variables that designers must take into account. Most of the research we refer to is concerned with reading on paper, rather than reading on screen. Therefore we consider how much of this

DOI 10.1075/swll.17.02wal

research is transferable directly to children's digital reading and suggest that, in the absence of guidelines that can be applied universally, an information design approach may be a helpful alternative. Such an approach emphasises the importance of understanding the needs of and eliciting feedback from beginner and emerging readers (and indeed those who read with them) to find out which typographic attributes enhance the reading experience.

We have organised this paper by first summarising the issues that designers consider when they produce material for beginner and emerging readers. This is followed by a discussion about typography and the use of space, and a short section about the interrelation of text and illustrations. This is then set in the technological context of e-reading and the impact that such technology has on design decisions. Finally, we look at ways of engaging with the users of e-books for beginner and emerging readers to suggest approaches to designing with their needs in mind.

We recognise that use of digital resources for beginning and emerging readers in schools is expanding and use of tablet devices at home is widespread. Actual penetration in both spheres is hard to track because of rapid change: in 2014 in the UK it was estimated that tablet devices were used in 60% of primary schools (TechKnowledge, 2014). Many e-books for beginner and emerging readers are multi-modal, incorporating sound and animation as well as pictures and text. There is considerable literature on what Bateman refers to as "modalities of information presentation", covering the dynamic of text and image and how both can be used to convey meaning (see Bateman, 2014; Kress & van Leeuwen, 1996). Almost all e-book platforms allow the reader to interact with texts, for example by making notes which can be private or shared with other readers, to look up the definitions of words in the text and, often, to listen to the text being read aloud. There are a number of 'learning to read' apps that provide work-alone classroom e-learning for beginning readers. The app 'Hooked on phonics', for example, claims 5m users (2016). Multimodality presents many interesting design challenges but is beyond the scope of this chapter.

2. Considerations that affect designers' decisions

Book and information designers are concerned with structuring a text so that its meaning is clear to readers. They help readers find their way around a text, by using headings, contents pages and indexes, and consider whether to organise the content as continuous text or, for example, as a list or a table. They think about where to position illustrations in relation to the text, as well as about the position of both illustrations and text within the format of a display substrate (in a book, a page or double-page spread). They choose typeface and type size for different elements of a text and use space to make the text easy to read. Design decisions

about each of these are constrained by the technology that is used to produce and disseminate the text. Richard Southall (1984, p. 83) used the term "graphic capability" to refer to the potential of typesetting technologies to articulate document structure, describing it as constrained by "the number of characters, typefaces, and type sizes and the facilities for defining amounts of horizontal and vertical space, that the system offers."

Constraints imposed by technology affect the design of devices used for e-reading. After Waller (2012) we use the term fixed layout when the positions of text and pictures on the substrate are fixed in relation to each other and to the boundaries of the substrate (as with PDFs, which may be scaled). A flowed layout is where the position of text and pictures may change according to the size and proportions of the substrate (e.g. on a Kindle) depending on the size of the device and its software capabilities as well as design parameters applied by both designer and reader. For fixed page layouts designers have considerable control over the typographic variables, and print conventions remain relevant; for flowed page layouts there may be much less designer control, dependent upon the e-reading format. In flowed texts control may require considerable technical understanding to implement, together with significant resources for testing that the designed text auto-adapts successfully on a wide range of device formats and sizes.

In thinking about the reading needs of specific user groups as beginner readers, design decisions may be influenced by particular constraints. For example, in reading material for beginners illustrations play a key role, so designers are concerned with ensuring that the text and related illustration(s) appear on the same page or double-page spread. This cannot be relied upon in e-books with flowed texts presented on a range of possible devices. Designers consider how the physical and material attributes of books may affect the child's reading experience. Some reading books, for example, are small enough to be easily manipulated by children's hands; 'big books' are designed to be read aloud, often with large groups of children.

In summary, the design of a specific book encompasses the visual experience of reading – navigation, page layout, illustration, typeface and typography as well as aspects of the physical experience: what it is made of, its size, texture, weight in relation to the reader and the circumstances of use. The design of a specific e-book can manage only the visual experience of reading, and then only within the constraints of the physical device. Other aspects of the reading experience are constrained by the design of the software (e.g. Kindle or iBooks), operating system (e.g. Android, Windows or Apple iOS), and hardware (tablet, laptop, phone). Even e-books that display facsimiles of printed pages require different modes of interaction and engagement to navigate the text, for example (Mangen, 2017). The next section presents a more detailed account of typefaces, type size and the use of space, in relation to children's reading.

3. Typefaces, typography and the use of space

To describe the variables that affect text typography, Twyman (1982) introduced the terms 'intrinsic' and 'extrinsic'. Intrinsic features refer to properties of the characters themselves: typeface or style of letterform; character set (the characters that are available for use); variants of a typeface (italic, bold). Extrinsic features refer to what can be done to the characters by changing the space between or around particular characters, or their colours. In print, intrinsic and extrinsic features of text affect whether or not text is comfortable and easy to read. In e-books, typographic choices extend to how links and interactive elements are signalled. Manipulating a single variable may lead to automatic changes in other variables. For example, if type size is increased, fewer words may appear on a line, possibly extending the content over more pages than in the original size; conversely, vertical line spacing may be reduced to accommodate the same content on a page, creating a denser appearing text; or, if line spacing increases automatically to accommodate the increased size, content may be extended further over more pages. Changes in overall page format will be even more marked when examining factors such as the impact of illustration or other non-textual materials on pages. Although the impact of extending texts over multiple pages in e-books for children has not been studied, there are indications of a cognitive 'cost' of needing to make mouse clicks while reading prose in studies of adult readers using computers (Wright, Lickorish, & Milroy, 1994). This may be relevant to beginner readers having to read content across multiple pages, particularly those experiencing difficulties in reading.

The visual attributes of books for beginners stem from tacit knowledge based on typographic tradition, publishers' expertise and teacher opinion (e.g., Raban, 1984; Woods et al., 2005). Typography in books for beginner readers has also attracted the attention of psychologists interested in legibility research. For typographers, legibility research is a controversial field because the validity of some of the research is difficult to ascertain: test material is often not shown in research reports, and testing is undertaken in laboratory conditions rather than 'real life' settings (see Lund, 1999; Bessemans, 2012; Beier & Dyson, 2014). There is, however, increasing recognition that the gap between experimental results and design experience needs to be bridged (Dyson & Suen, 2016), a notion eloquently expressed by Dillon (2004; 2017) in relation to designing usable electronic texts.

The integration of knowledge arising from research and from practice in defining the visual appearance of books for children's reading has considerable historical precedent. Walker (2013) provides a 100-year historical overview of books for young readers in the UK from the end of the nineteenth century, drawing attention to the various factors that have influenced their design (teachers' opinions; typesetting technology and available typefaces; economic constraints faced by publishers,

type, space between the lines and letters, and the length of the line. These issues are discussed in the next section.

3.1 Typefaces

An issue that has interested both typographers and those engaged in legibility research is whether reading is better supported through distinctive word shapes (assuming word recognition is paramount), or easily distinguishable letter shapes (because readers build up words by recognising individual letters). Historically, a distinctive word shape has been promoted by designers as being key to reading, though with recognition that the features of individual letterforms (i.e., internal shapes, contrast between thick and thin strokes) also contribute to word recognition (see, for example, Spencer, 1969). In the 1990s theories began to emerge suggesting that words may be recognised from a set of critical features, the majority of which were related to the distinctive features of individual letters and their position in a word (see Smith, 1994, pp. 119–131). Recent evidence has elucidated further the roles of letter by letter and whole word reading, and the aspects of letter design that contribute to their identification; this has been usefully summarised by Beier (2012, pp. 22–30) with reference to related research. Pelli and Tillman (2007) examined the contribution of different processes underlying word reading and found that the three processes of letter by letter identification, whole word identification and use of context to predict words operate together in fluent readers, with letter by letter reading contributing more than the other two strategies. Other research suggests that word shape is not critical to word recognition (Larson, 2004; Dyson, 2013) and that words cannot be read if their individual letters are not individually identifiable (Pelli, Farell & Moore, 2003). Letters are identified by detecting independent features (around 7 features per letter) (Pelli et al., 2006). Fiset et al. (2008) suggest that, in Latin script, the terminations (areas where strokes begin or end) carry the most significant cues to letter identification, with intersections, curves and direction of features also important. Cues to letter identification, of course, vary across scripts.

Type designers traditionally strive to create evenness and harmony in the appearance of the characters of a typeface. Improving legibility through modifying letters to increase their distinctiveness has been proposed (Fiset et al., 2008) and explored (e.g. Kolers, 1969; Beier & Larson, 2010). Studies aimed at less fluent readers focus on heterogeneity/irregularity among the characters as a means of improving reading. Wilkins et al. (2007) introduced distortions to Times New Roman to create uneven strokes and distances between strokes. The reading rate of fluent adult readers was not affected, but children with literacy difficulties read the

distorted words faster and with fewer errors. Wilkins has posited that this effect is due to disruption of the stripe patterns of lines of type on a page created by standard typefaces. Bessemans (2012) has found that a more irregular rhythm (and possibly form) facilitates reading for visually impaired children. Other studies suggest that consistency in letter appearance improves reading efficiency. Known as the font-regularity effect (Sanocki, 1987) or 'font tuning', the benefit of consistency is considered to be the result of the perceptual system developing a set of recognition parameters over time, which it can apply throughout a text (see Sanocki & Dyson, 2012).

Clear distinction between letters is important for children's reading. A question often raised in relation to typefaces for children's reading is whether serif or sanserif typefaces are more appropriate (a serif type has small lines attached to the end of a stroke, a sanserif type does not). For example, many teachers favour the use of sanserif typefaces because they relate to letterforms that children are learning to write; but there has been no research that concludes that sanserif type is actually easier for children to read. Walker and Reynolds (2002/3) found that children read text set in serif (Century Schoolbook) and sanserif (Gill Sans) equally well. Bessemans (2012; 2016) found that the children (aged 5 to 10) made fewer mistakes when reading text set in a serifed typeface (DTL Documenta) than when reading text set in Frutiger. Ripoll (2015) found that beginners could read cursive, serif and sanserif equally well (though they preferred the cursive one they were familiar with).

To further simulate handwritten forms, and at the request of teachers, many typefaces used in children's books are designed with alternative character shapes for some letters, typically those for a, g, l and t and capital I and Figure 1 (Figure 2). Known as 'infant' or 'schoolbook' characters, they are similar in form to those that children learn to write. In some typefaces such practice means that there are similarities in letter shapes; for example, in very round-looking typefaces with short ascending and descending strokes, lower-case o, a and g look very similar (Figure 3) and can cause confusion at the word level. A study by Walker and Reynolds

Figure 2. 'Infant', 'schoolbook', 'single storey' are all terms used to describe alternative forms of some letterforms that are thought to be helpful for beginner readers. Sometimes letters are redrawn to look like handwritten forms; sometimes they are drawn to be clearly distinguished from similar-looking letters. The most widely-used infant characters are 'a' and 'g', and letters that might be confused such as capital I, lower-case 'el' and figure one.

Figure 3. In some typefaces, such as Avant Garde Gothic, shown here, there is very little differentiation between the letter shapes, and this is likely to confuse beginner readers.

(2002/3) found no difference when children read text set with infant and non-infant characters, although some children recognised that single-storey a and g were for writing, and double-storey ones for reading. Bessemans (2012; 2016) also found that children (aged 5 to 10) had no problems concerning the use of non-infant characters in type.

Some typefaces have been designed especially for children's reading. In the 1980s, for example, Rosemary Sassoon produced Sassoon Primary. Designed in consultation with children, this typeface has characteristics of handwritten letterforms, notably a slight slant and 'exit strokes' to lead from one letter to the next (Sassoon, 1993). Another approach has been to consider the characteristics that typefaces might have and whether these are likely to help with letter and word recognition, for example, long ascending and descending strokes. Fabula was designed as a screen font in the late 1990s to support bilingual story books for children. It aimed to make a distinction between characters that could be easily confused and to have a friendly and informal feel (see Figure 4). Twinkl, launched in 2016, shares many of Fabula's attributes, and is available in a series of weights (Figure 5).

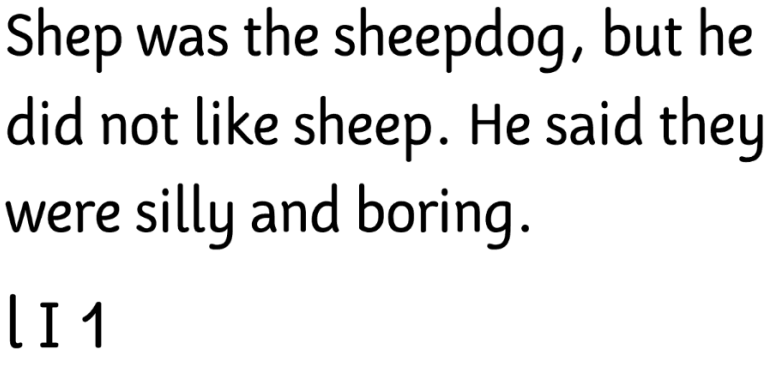

Figure 4. The typeface Fabula was designed to have generous ascenders and descenders, differentiation between a and o, and rounded stroke ends to give a friendly and informal feel. There is a clear distinction between characters that might be confused.

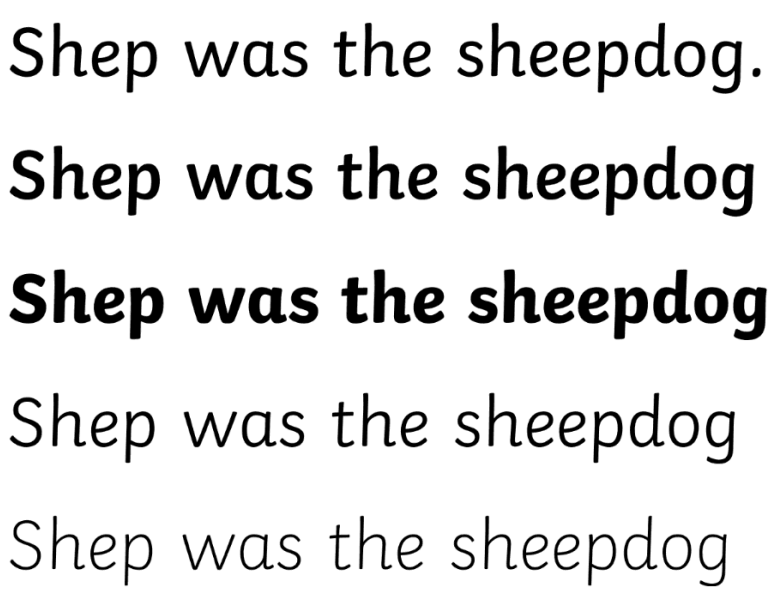

Figure 5. The typeface Twinkl shares many of the characteristics of Fabula. It is available in a range of weights [thanks to Twinkl educational publishers and to Type Together].

3.2 Type size, vertical and horizontal space

In printed materials for adults it is generally accepted that, for type sizes for reading at normal distances, legibility is increased by adequate vertical separation of lines of type. In typographic terminology, this means the addition of two or three extra points of space. It is argued that the additional space makes it easier to follow each line and facilitates an accurate, even sweep of the eyes from the beginning of each successive line (see Tinker, 1968, p. 320). Generous space between lines may also help with word recognition, as there will be less visual interference or 'contour interaction' from lines above and below the line that is being read (Hughes & Wilkins, 2002). The optimum amount of additional space depends on several factors, including the size of the type and whether it is sanserif or serif, and the length of the line. Precise metrics for spacing are therefore difficult to specify and are a further example of a decision designers make, based on experience. There has been very little experimental work on line spacing in books for children, and the results have generally been inconclusive (Tinker, 1968). Sassoon (1993) reported on a study with 8–13 year-old children of different abilities who were shown examples of differently space text, concluding that it is difficult to define a generally applicable practice as children at different levels of reading have different requirements and preference. This view was supported in qualitative studies

undertaken by Reynolds and Walker (2006) who found that most of the children in their sample preferred a reasonably generous space between lines, with perceptions of a text that was very widely or very closely spaced, respectively, as 'did not look like a real book', or was 'too difficult'.

The optimum line length for reading printed texts, for adult readers, is between 50 and 70 characters, or 8–12 words (Spencer, 1969; Hochuli, 2008; Bringhurst, 1992). Tinker (1968) conducted studies of line spacing with Grade 1 children (six- and seven-year-olds). He recommended that with 18- or 24-point type, lines should be relatively short, with 6 to 8 points of additional space. In practice though different 24-point typefaces have different appearing sizes (see, for example, Legge & Bigelow, 2011); and the visual appearance is also affected by the space between the lines (see Figure 6). Taking a different perspective, Raban (1982) found that for beginning readers, breaking lines after 'and' and between phrases caused less disruption of reading than breaking according to line length. Following this phrase-based breaking practice resulted in lines of text of considerable variation in length, and a very ragged right-hand edge (see Figure 7).

Historically, horizontal space – between letters and words – has not been thought by legibility researchers to be as important as type size, line length and space between the lines (see Huey, 1908; BAAS, 1913). This may be due to the prevalence of justified setting, which effectively varies word spacing from line to line in order to maintain straight borders on both the left and right side of the page (Figure 8).

Justified setting was used in reading books until around the mid-1940s, though in the 1920s some were set unjustified with even word spaces. Hartley (1987) concluded that unjustified text was more suitable for screen reading. In the latter part of the twentieth century it was fashionable in typography for adults for words to be very tightly spaced, a practice criticised by Yule (1988) and Sassoon (1993) with regard to children's books. Although in Raban's (1984) study, teachers thought that spacing was less important than typeface or type size in choosing books for children, they thought that for beginner readers (5- and 6-year-olds) word spacing was more important than line or letter spacing. In terms of whether more or less space between words helps beginner readers, Reynolds and Walker (2004) found that, with realistic reading materials discussed in a classroom setting, children were very tolerant in relation to variation in the use of horizontal space. As in Hughes and Wilkins's (2002) study, they found that horizontal space more or less affected perceptions of ease of reading: that tight spacing looked 'difficult', or that wide spacing made type look 'bigger and thinner'. The relation between word spacing and line spacing is also important. Typographers are concerned with ensuring that the space between the lines of type is greater than that between the words. If not, and especially if the text is justified so that the word spacing varies

that pictures were a distraction from word learning, though the validity of some of this work is questionable because the quality of the illustrations and test materials was poor and the results complicated or inconclusive. Kozma (1991) cited research by Winn (1989) which suggested that for knowledgeable readers, pictures should be placed early in the text if they are used at all, and that less knowledgeable readership would benefit from interspersed pictures, juxtaposed with the corresponding text. Horton (1990) concluded that related text and graphic should be placed next to each other and that this was more important than balancing text and pictures for aesthetic reasons. Goldsmith (1984), however, commented that if an illustration was positioned near the top of a page, readers are more likely to pay attention to the text that follows. She also commented on the converse – that a particularly attractive illustration placed at the bottom of a page may distract the reader from reading / being aware of the text above it (e.g., Peeck, 1987; Filippatou & Pumfrey, 1996). In practice there is considerable variation: Walker (2013) identified typical text/picture positional relationships evident in print reading books from the end of the nineteenth century until the beginning of the twenty-first.

What these analyses have in common is the recommendation that a picture should be in the same field of view as the text that relates to it. In e-reading, the ability of the designer to control the spatial relationship of picture to text may be limited. In fixed modes picture positions can be controlled precisely within a 'page' but in flowed modes much less so, and with more effort from the designer/developer. Custom applications offer the most control but in return for a large investment in design and development effort.

5. E-reading formats and the control offered to the designer

The design of pages for reading extends beyond the typography and use of illustrations discussed above. Designers must work within the constraints of the technology available to present text in a way that responds to the needs and expectations of readers, and to how and where they read. The introduction of new technologies, from typewriters at the end of the nineteenth century, to desktop publishing in the 1980s influences how text is presented (Walker, 2001). At each stage of technological transition there is a tendency for producers of text to replicate the conventions of the old technology that readers are familiar with, and then, as new technologies become familiar, for new conventions to become established. Design for reading, at least on paper, is bound by conventions that affirm readers' expectations of visual presentation or graphic genres (Waller, 1991; Kostelnick & Hassett, 2003; Moys, 2017). Conventions and reader expectations are not yet affirmed for e-reading, though research on the location of web objects (that is, any content

contained in a web page) may provide useful pointers; see Bernard (2000, 2001); Shaikh & Lenz (2006); Roth et al., (2010).

The visual experience that can be offered to beginning readers depends on:

- The physical size, colour gamut and pixel resolution of the hardware device on which the visual experience is rendered (see Sorkin, 2016). These will affect the appearance of the text: for example, how crisp, black or grey letter images appear. There are (in 2017) a large number of variants in both the physical size and the pixel resolution of tablet devices used in classrooms, which makes it likely that different readers of the 'same' e-book will have different reading experiences.
- The format repertoire of the page description language, markup/browser combination or programming language used to render the reading experience to the display – that is, the graphic capabilities of the software. Software varies in its capability to draw shapes accurately, place items precisely on the display, select and render typefaces, place pictures etc. The combination of hardware device and software are the publishing 'platform'. There are many publishing platforms on the market and even the dominant one (Kindle) contains many significant variations caused by the different software versions and hardware platforms on which it is used.
- The locus of control over the graphic capabilities of the software; that is, *who* gets to choose how the software capabilities are rendered to the display surface for a particular device and *when* that control is exercised. For example, the reader of an e-book may be allowed to change the size of the type which they are reading to suit their preferences. The 'designer' may be able to specify a type size when formatting a particular e-book for publication. And the publishing platform may have limits on the range of sizes which can be selected for e-books published on that platform, together with restrictions on how much the designer and the reader is able to change sizes within the system's limits.

All of the above vary in the e-reading experiences of beginner readers today. In an ideal world, teachers, publishers, designers, reading researchers and authors would select the publishing platform that best meets the child's needs and the nature of the e-reading material. In practice, factors such as market share of platforms, the need to use particular Digital Rights Management (DRM) systems to protect sales, compatibility with school-wide asset management systems, etc. are likely to be the main factors in choosing platforms. There are over 20 fairly widely-used technical standards that cover e-book formats, each supported by one or more e-book software applications. As technology develops, new standards are introduced and old ones sometimes superseded. A reasonably full listing of standards is available

in Wikipedia.[1] These standards vary widely but fall into main categories plus a few 'exceptions'. The next two short sections summarise the technical constraints imposed by flowed and fixed page layouts.

5.1 Markup-based e-books: Flowed page layout

Most e-reading file standards are based on 'semantic markup' of the text and pictures in a book. The markup is then combined with 'stylesheets' to control how those elements appear on the e-reader screen (see Goldfarb & Rubinsky, 1990, for the principles of separating the semantics and appearance of documents). This is essentially the same process that is used to create web pages, and many e-reading file standards are closely based on the HTML (Hypertext Markup Language) and CSS (Cascading Style Sheets) standards. None, however, are entirely compatible with HTML/CSS (HTML contains text and codes which identify whether each part of that text is a paragraph, a heading, a hyperlink, etc. CSS is a 'style sheet' which says how a paragraph etc. should be displayed: its colour, typeface size, line spacing etc.). Moreover, most incorporate optional or required use of proprietary digital rights management software, to prevent unauthorised copying of the e-book. This adds some complexity to the design process.

On the web, pages are viewed in Internet browser software such as Internet Explorer, Chrome or Firefox. A given set of HTML and CSS files will display near-identically on any web browser, and open standards for HTML/CSS specify what that appearance should be. E-reader software products such as Kindle or iBook can be seen as 'browsers' for one or more e-reading file formats. They often require, or focus on, proprietary markup and style formats, so there is no real equivalent of the consistency in appearance across web browsers. Where E-readers do support 'open' standards such as EPUB2 or EPUB3, they tend to do so in idiosyncratic and partial ways (IDPF, 2010; IDPF, 2017).

All e-book software can accept and display 'flowed' books provided in 'EPUB' markup defined by the International Digital Publishing Forum.[2] Designers influence the look and behaviour of an EPUB e-book mainly by creating CSS stylesheets for it. The resulting EPUB file is submitted to an e-book publishing service, such as Kindle, Apple iBook or Android Play, and is in turn made available to users of appropriate devices and services. This process creates different user experiences on different devices and services even if the same original code is submitted. For example, on a Kindle, the designer's style instructions for space between the lines

1. See https://en.wikipedia.org/wiki/Comparison_of_e-book_formats.
2. http://idpf.org.

may be overridden by Kindle's defaults (or by the user's stored preferences). This limits the control the designer has over the user/reader experience. Current developments in e-reader standards and devices e.g. EPUB 3 are tending to increase the control over the reading experience available to designers.[3]

5.2 Pictures of pages: Fixed page-layout

Most e-reading platforms support one or more fixed layout file format, most commonly PDF, or a format based on PDF. Most integrated texts – books with large numbers of illustrations and close relations between text and image – are carefully-designed for print and published electronically as 'pictures of pages'. The key advantage of fixed layouts is that designers have complete control over how the page is arranged. PDFs may be appropriate in situations where the physical size, resolution and operating system of users' devices is controlled and consistent; this may be true within a particular institution or school system. However, fixed layouts have disadvantages for a number of reasons including:

- accessibility features such as read-aloud may be unavailable
- by default fixed-layout formats 'scale' to the size of the device they are displayed on. Type and pictures are likely to be displayed at a different (normally smaller) size than they were designed for. The user can normally enlarge by zooming into a part of the page, sacrificing a complete view of the page as it was designed.

The impact of these features on usability will depend on the particular e-book or series of e-books (for example, a publisher's integrated reading scheme) and would need specific usability testing. There are therefore no generally-applicable research results to provide guidance.

6. Finding out what works with beginner and emerging readers

The impact of technology on the visual attributes and materiality of e-reading and the resulting variations that occur emphasise the importance of eliciting feedback from users as part of the design process. Involving children in this is regarded as good practice in HCI (e.g., Druin, 2002; Bruckman et al., 2012; Nielsen, 2010). Druin, for example, identifies the roles that children have assumed: from 'users' to 'testers', 'informants' and, latterly, 'design partners', summarising the historical

3. See http://epubtest/testsuite/epub3/.

context of each approach, the methods used, the impact on the technologies concerned, and the challenges and strengths of working with children in each case. Information designers also take seriously the need to involve the readers and users of their work in its development and typically elicit feedback through:

- observation and feedback sessions to discover how children use and report using reading materials, with a view to understanding what works well within a particular learning setting (see e.g., in relation to classroom use of CD-ROMS, Walker, Reynolds & Edwards, 1999)
- exploration of whether there are specific aspects of the design of e-books that affect an individual child's reading
- user testing to find out whether materials under development are easy for children to read and use; in this case, aspects of the design that appear to cause difficulties can be revised and the materials re-tested in an iterative process
- preference judgements, which may produce generalisable findings, to discover whether different devices and/or layout strategies have different levels of appeal to children; children may make their choice of books according to different design criteria from those of teachers, parents, or other adults.
- investigative examination, to produce generalisable findings, of whether there are aspects of the design of materials that affect the reading performance of children at different stages of reading development; such investigation may focus on specific reading tasks, such as letter, grapheme or word recognition, sustained reading or searching for information within a page or a document.

These approaches vary both in their intentions – from diagnostic testing to investigative research – and in the level of formality of the investigation; see Dyson (2017) for a characterisation of different types of testing according to purpose. Depending on the goal of testing e-books or other digital reading materials, study tasks may range from group discussions to individual testing of reading performance. Studies of performance may yield information about the process of reading (for example, by tracking eye movements and the characteristics of reading errors or pages accessed) or its outcomes (the time taken to read, comprehension, successful retrieval of information); see Dillon (2004) for further discussion of the process–outcome distinction.

As we have seen, the design of texts of any kind involves the manipulation of multiple variables, from typeface choice, size, line length, and vertical spacing of lines, through to the number of lines on a page and the differentiation of different types of text (for example, headings and paragraphs). A decision-making process is needed in order to decide which variables are most important to control and which allow variation in order to examine the specific issue of interest. Involving a designer with experience in text design may help steer decisions

further value in working with insights obtained through evaluating documents with intended users, and within particular contexts of use.

Looking ahead, design for e-reading requires collaboration between and involvement with children, teachers, and technologists. Information designers welcome this way of working and also understand the relationship between language and its visual presentation, whether through type or images. In the words of Andrew Dillon (2017, p. 298):

> Much as doctors use test findings and medical science in a skilled reading of contexts and patients to reach a diagnosis, a skilled designer needs multiple forms of knowledge to make the right choices. The science does matter, the principles of good design will always apply, but creating useful, usable, and attractive information tools requires a representation of human actions in context to enable appropriate design constraints to be envisaged. Such representations are worthy of our serious attention now.

References

Bateman, J. (2014). *Text and image: A critical introduction to the visual/verbal divide*. London: Routledge.

Beier, S. (2012). *Reading letters: Designing for legibility*. Amsterdam: BIS.

Beier, S., & Dyson, M. C. (2014). The influence of serifs on 'h' and 'l': Useful knowledge from design-led scientific research. *Visible Language*, 47(3), 74–95.

Beier, S., & Larsen, K. (2010). Design improvements for frequently misrecognised letters. *Information Design Journal*, 18(2), 118–137. doi: 10.1075/idj.18.2.03bei

Bernard, M. (2000). Examining user expectations of the location of web objects. *Internetworking*, 3(3).

Bernard, M. (2001). Developing schemas for the location of common web objects. *Usability News*, 3(1). doi: 10.1177/154193120104501502

Bessemans, A. (2012). Letterontwerp voor kinderen met een visuele functiebeperking. (Unpublished PhD thesis). Leiden University & Hasselt University, Netherlands & Belgium.

Bessemans, A. (2016). Matilda, a typeface for children with low vision. In M. Dyson & C. Y. Suen (Eds.), *Digital fonts and reading* (pp. 19–36). Singapore: World Scientific Publishing. doi: 10.1142/9789814759540_0002

BAAS (British Association for the Advancement of Science). (1913). *Report on the influence of schoolbooks upon eyesight*. London: John Murray.

Black, A., Luna, P., Lund, O., & Walker, S. (Eds.). (2017). *Information design: Research and practice*. London: Routledge.

Bringhurst, R. (1992). *The elements of typographic style*. Point Roberts, WA: Hartley & Marks.

Bruckman, A., Bandlow, A., Dimond, J., & Forte, A. (2012). Human-computer interaction for kids. In J. Jacko (Ed.), *The human computer interaction handbook* (pp. 841–862). Boca Raton, FL: CRC Press. doi: 10.1201/b11963-42

Coghill, V. (1980). Can children read familiar words set in unfamiliar type? *Information Design Journal*, 1(4), 254–60.

Dillon, A. (2004). *Designing usable electronic text* (2nd ed.). Boca Raton: CRC Press. doi: 10.1201/9781420025170

Dillon, A. (2017). Applying science to design: The quest for bridging representation. In A. Black, O. Lund, P. Luna, & S. Walker (Eds.), *Information design research and practice* (pp. 291–299). London: Routledge.

Druin, A. (2002). The role of children in the design of new technology. *Behaviour and Interaction Technology*, 21(1), 1–25. doi: 10.1080/01449290110108659

Duschastel, P. (1978). Illustrating instructional texts. *Educational Technology*, 18(11), 36–39.

Dyson, M. C. (2005a). How do we read text on screen? In H. van Oostendorp, L. Breure, & A. Dillon (Eds.), *Creation, use, and deployment of digital information* (pp. 279–306). Mahwah, NJ: Lawrence Erlbaum Associates.

Dyson, M. C. (2005b). Producing legible text on screen: Where do we look for guidance? *Typo*, 13, 30–35.

Dyson, M. C. (2013). Where theory meets practice: A critical comparison of research into identifying letters and craft knowledge of type design. *Design Journal*, 16(3), 271–294. doi: 10.2752/175630613X13660502571741

Dyson, M. C. (2017). Information design research methods. In A. Black, O. Lund, P. Luna, & S. Walker (Eds.), *Information design research and practice* (pp. 435–449). London: Routledge.

Dyson, M. C., & Suen, C. Y. (2016). *Digital fonts and reading*. Singapore: World Scientific. doi: 10.1142/9968

Emery, D. (1993). Developing effective instructional graphics. *Journal of Interactive Instruction Development*, 6(2), 20–124.

Filippatou, D., & Pumfrey, P. (1996). Pictures, titles, reading accuracy and reading comprehension: A research review (1972–95). *Educational Research*, 38(3), 147–53. doi: 10.1080/0013188960380302

Fiset, D., Blais, C., Ethier-Majcher, C., Arguin, M., Bub, D., & Gosselin, F. (2008). Features for identification of uppercase and lowercase letters. *Psychological Science*, 19(11), 1160–1167. doi: 10.1111/j.1467-9280.2008.02218.x

Gambrell, L. B. (2011). Seven rules of engagement: What's most important to know about motivation to read. *The Reading Teacher*, 65(3), 172–178. doi: 10.1002/TRTR.01024

Goldfarb, C. F., & Rubinsky, Y. (1990). *The SGML handbook*. London: Oxford University Press.

Goldsmith, E. (1984). *Research into illustration*. Cambridge: CUP.

Gunn, J. (1906). *The infant school: Its principles and methods*. London: Nelson.

Haber, R. N., & Haber, L. R. (1981). Visual components of the reading process. *Visible Language*, 15(2), 147–182.

Hartley, J. (1987). Designing electronic text: The role of print-based research. *Educational Communication and Technology*, 35(1), 3–17. doi: 10.1007/BF02769448

Hartley, J., & Burnhill, P. (1971). Experiments with unjustified text. *Visible Language*, 5, 265–278.

Hartley, J., & Trueman, M. (1985). A research strategy for designers: The role of headings. *Instructional Science*, 14(2), 99–155. doi: 10.1007/BF00052394

Hartley, J., Burnhill, P., & Davis, L. (1978). The effects of line length and paragraph denotation on the retrieval of information from prose text. *Visible Language*, 12(2), 183–94.

Hochuli, J. (2008). *Detail in typography: Letters, letterspacing, words, wordspacing, lines, linespacing, columns* (2nd ed.). London: Hyphen Press.

Horton, W. (1990). Visual rhetoric for online documents. *IEEE Transactions on Professional Communication*, 33(3), 108–113. doi: 10.1109/47.59084

Huey, E. (1908). *The psychology and pedagogy of reading with a review of the history of reading and writing and of methods, texts and hygiene in reading*. New York: Macmillan.

Hughes, L., & Wilkins, A. (2000). Typography in children's reading schemes may be suboptimal: Evidence from measures of reading rate. *Journal of Research in Reading*, 23(3), 314–324. doi:10.1111/1467-9817.00126

Hughes, L., & Wilkins, A. (2002). Reading at a distance: Implications for the design of big books. *British Journal of Educational Psychology*, 72, 213–226. doi:10.1348/000709902158856

IDPF. 2010. *Open Publication Structure (OPS) 2.0.1 v1.0.1*. International Digital Publishing Forum. http://www.idpf.org/epub/20/spec/OPS_2.0_latest.htm

IDPF. 2017. *EPUB 3.1*. International Digital Publishing Forum. http://www.idpf.org/epub/31/spec/epub-spec.html

de Jong, M. T., & Bus, A. G. (2003). How well suited are electronic books to supporting literacy? *Journal of Early Childhood Literacy*, 3(2), 147–164. doi:10.1177/14687984030032002

Kerr, J. (1904). Eyesight in school life. In A. Newsholme, & W. C. Pakes (Eds.), *School hygiene: The laws of health in relation to school life*. London: Swann Sonnenschein & Co.

Kolers, P. (1969). Clues to a letter's recognition: Implications for the design of characters. *Journal of Typographic Research*, 3(2), 145–168.

Kostelnick, C., & Hassett, M. (2003). *Shaping information: The rhetoric of visual conventions*. Carbondale: Southern Illinois University Press.

Kozma, R. B. (1991). Learning with media. *Review of Educational Research*, 61(20), 179–211. doi:10.3102/00346543061002179

Kress, G., & van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. London: Routledge.

Kucirkova, N., Littleton, K., & Cremin, T. (2015). Young children's reading for pleasure with digital books: Six key facets of engagement. *Cambridge Journal of Education*, 1–18. doi:10.1080/0305764X.2015.1118441

Larson, K. (2004). *The science of word recognition or how I learned to stop worrying and love the bouma*. Advanced Reading Technology, Microsoft Corporation. Retrieved from https://www.microsoft.com/typography/ctfonts/WordRecognition.aspx

Legge, G. E., & Bigelow, C. A. (2011). Does print size matter for reading? A review of findings from vision science and typography. *Journal of Vision*, 11(5), 8, 1–22. doi:10.1167/11.5.8

Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: A review of research. *Educational Communication and Technology Journal*, 26(1), 195–232. doi:10.1007/BF02765184

Lund, O. (1999). Knowledge construction in typography: The case of legibility research and the legibility of sans serif typefaces. (Unpublished PhD thesis). University of Reading, England, UK.

Mangen, A., (2017). Textual reading on paper and screens: Implications for design. In A. Black, P. Luna, O. Lund, & S. Walker (Eds.), *Information design research and practice* (pp. 275–290). London: Routledge.

Moys, J-L. (2017). Visual rhetoric in information design. In A. Black, P. Luna, O. Lund, & S. Walker (Eds.), *Information design research and practice* (pp. 204–220). London: Routledge.

Nielsen, J. (2010). Children's websites: Usability issues in designing for kids. Retrieved from https://www.nngroup.com/articles/childrens-websites-usability-issues/

Peeck J. (1987). The role of illustration in processing and remembering illustrated text. In D. M. Willows, & H. A. Houghton (Eds.), *The psychology of illustration. Vol. 1 basic research* (pp. 115–151). New York: Springer Verlag. doi:10.1007/978-1-4612-4674-9_4

Pelli, D. G., & Tillman, K. A. (2007). Parts, wholes, and context in reading: A triple dissociation. *PLoS ONE*, 2(8), e680. doi:10.1371/journal.pone.0000680

Pelli, D. G., Burns, C. W., Farrel B., & Moore-Page, D. C. (2006). Feature detection and letter identification. *Vision Research*, 46(28), 4646–4674. doi:10.1016/j.visres.2006.04.023

Pelli, D. G., Farrell, B., & Moore, D. C. (2003). The remarkable inefficiency of word recognition. *Nature*, 423, 752–756. doi:10.1038/nature01516

Philips, R., & diGiorgio, A. (1997). Design. In R. Phillips (Ed.), *Developer's handbook to interactive multimedia: A practical guide for multimedia applications* (pp. 59–194). London: Kogan Page.

Pyke, R. L. (1926). *Report on the legibility of print*. Medical Research Council Special Report, no. 20. London: HMSO.

Raban, B. (1982). Text display effects on the fluency of young readers. *Journal of Reading Research*, 5, 7–28. doi:10.1111/j.1467-9817.1982.tb00126.x

Raban, B. (1984). Survey of teachers' opinions: Children's books and handwriting styles. In D. Dennis (Ed.), *Reading: Meeting children's special needs* (pp. 123–129). London: Heinemann.

Reynolds, L., & Walker, S. (2004). 'You can't see what the words say': Word spacing and letter spacing in children's reading books. *Journal of Research in Reading*, 27(1), 87–98. doi:10.1111/j.1467-9817.2004.00216.x

Reynolds, L., Walker, S., & Duncan, A. (2006). Children's responses to line spacing in early reading books or 'Holes to tell you which line you're on'. *Visible Language*, 40(3), 246–267.

Ripoll, J. C. (2015). Font legibility in first year primary students / Legibilidad de distintos tipos de letra en alumnus de primero de primaria. *Infancia y Aprendizaje*, 38(3), 600–616. doi:10.1080/02103702.2015.1054668

Rockley, A. (1994). Planning a multimedia documentation project. *Technical Communication*, 41(4), 414–421.

Roth, S. P., Schmutz, P., Pauwels, S. L., Bargas-Avila, J. A., & Opwis, K. (2010). Mental models for web objects: Where do users expect to find the most frequent objects in online shops, news portals, and company web pages? *Interacting with Computers*, 22(2), 140–152. doi:10.1016/j.intcom.2009.10.004

Salmerón, L., & García, V. (2011). Reading skills and children's navigation strategies in hypertext. *Computers in Human Behavior*, 27(3), 1143–1151. doi:10.1016/j.chb.2010.12.008

Sanocki, T. (1987). Visual knowledge underlying letter perception: Font-specific schematic tuning. *Journal of Experimental Psychology: Human Perception and Performance*, 13(2), 267–278. doi:10.1037/0096-1523.13.2.267

Sanocki, T., & Dyson, M. (2012). Letter processing and font information during reading: Beyond distinctiveness, where vision meets design. *Attention, Perception, & Psychophysics*, 74(1), 132–145. doi:10.3758/s13414-011-0220-9

dos Santos Lonsdale, M. (2014). Typographic features of text: Outcomes from research and practice. *Visible Language*, 48(3), 29–67.

Sassoon, R. (1993). Through the eyes of a child: Perception and type design. In R. Sassoon (Ed.), *Computers and typography* (pp. 150–177). Oxford: Intellect Books.

Shaikh, A. D., & Lenz, K. (2006). Where's the search? Re-examining user expectations of web objects. *Usability News*, 8(1).

Schriver, K. (1997). *Dynamics in document design: Creating text for readers*. New York: Wiley.

Smith. F. (1994). *Understanding reading*. Hillsdale, NJ: Lawrence Erlbaum.

Sorkin, E. (2016). Optimizing type for use in specific media. In M. Dyson & C. Y. Suen, *Digital fonts for reading*. New Jersey: World Scientific. doi:10.1142/9789814759540_0008

Southall, R. (1984). First principles of typographic design for document production. *TUGboat* 5(2): 79 –90.

Spencer, H. (1969). *The visible word*. London: Lund Humphries.

TechKnowledge. (2014). The use of tablets in UK schools, a research report. September 2014, Techknowledge for Schools. Retrieved from https://learningfoundation.org.uk/wp-content/uploads/2016/04/FKY-The-Use-of-Tablets-in-UK-Schools-September-2014.pdf

Tinker, M. (1968). Suitable typography for beginners in reading. *Education*, 88(4), 317–320.

Twyman, M. (1982). The graphic presentation of language. *Information Design Journal*, 3(1), 2–22. doi:10.1075/idj.3.1.01twy

Venezky, R. (1984). The history of reading research. In D. Pearson, R. Barr, M. L. Kamil, & P. Mosenthal (Eds.), *Handbook of reading research* (Vol. 1, pp. 3–38). London: Longman.

Walker, S. (2001). *Typography and language in everyday life: Prescriptions and practices*. Harlow: Longman.

Walker, S. (2005). *The songs the letters sing: Typography and children's reading*. Reading: National Centre for Language and Literacy.

Walker, S. (2013). *Book design for children's reading: Typography, pictures, print*. London: St Bride Foundation.

Walker, S., & Reynolds, L. (2000). Screen design for children's reading: Some key issues. *Journal of Research in Reading*, 23(2), 224–234. doi:10.1111/1467-9817.00116

Walker, S., & Reynolds L. (2002/3). *Serifs sans serif and infant characters in children's reading books*. *Information Design Journal*, 11(2/3), 106–122.

Walker, S., Reynolds, L., & Edwards, V. (1999). *Interactive multimedia in primary schools: Children's use and understanding of informant texts on CD-ROM, and implications for teachers and designers*. British Library Research and Innovation report 157. London: British Library.

Waller, R. (1991). Typography and discourse. In R. Barr, et al., (Eds.), *Handbook of reading research, 2* (pp. 341–380). New York: Longman.

Waller, R. (2012). Graphic literacies for a digital age: The survival of layout. *The Information Society: An International Journal*, 28(4), 236–252. doi:10.1080/01972243.2012.689609

Watts, L., & Nisbet, J. (1974). *Legibility in children's books: A review of research*. Slough: NFER Publishing Company Ltd.

Wilkins, A., Cleave, R. Grayson, N., & Wilson, L. (2009). Typography for children may be inappropriately designed. *Journal of Research in Reading*, 32(4), 351–434. doi:10.1111/j.1467-9817.2009.01402.x

Wilkins, A. J., Smith, J., Willison, C. K., Beare, T., Boyd, A., Hardy, G., Mell, L., Peach, C., & Harper, S. (2007). Stripes within words affect reading. *Perception*, 36(12), 1788–1803. doi:10.1068/p5651

Williams, T. R. (1993). What's so different about visuals? *Technical Communication*, 40, 669–676.

Wigfield, A., & Guthrie, J. T. (2000). *Engagement and motivation in reading*. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research, 3* (pp. 403–422). New York: Routledge.

Winn, W. (1989). The design and use of instructional graphics. In H. Mandl & J. Levin (Eds.), *Knowledge acquisition from text and pictures* (pp. 125–144). Amsterdam: Elsevier. doi:10.1016/S0166-4115(08)62151-2

Woods, R. J., Davis, K., & Scharff, L. V. F. (2005). Effects of typeface and font size on legibility for children. *American Journal of Psychological Research*, 1(1), 86–102.

Wright, P., Lickorish, A., & Milroy, R. (1994). Remembering while mousing: The cognitive costs of mouse clicks. *ACM SIGCHI Bulletin*, 26(1), 41–45. doi:10.1145/181526.181534

Yule, V. (1988). The design of print for children: Sales-appeal and user-appeal. *Reading*, 22(2), 96–105. doi:10.1111/j.1467-9345.1988.tb00662.x