Reading comprehension in elementary school children: cognitive studies of the reader, the text, and the task

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Chapter 3

The Effect of Upper Elementary School Children's Online Reading Profiles on their Memory Representation of Narrative and Expository Texts

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The Effect of Upper Elementary School Children's Online Reading Profiles on their Memory Representation of Narrative and Expository Texts

Abstract

We examined 9-11-year-old children's ability to selectively recall more central information than peripheral information from text (the recall centrality effect) as a function of their online reading profiles (Elaborating, Paraphrasing, and Literal Readers) and text genre (narrative and expository texts). Elaborating Readers generate more inferences than Paraphrasing Readers, who in turn generate more inferences than Literal Readers. We anticipated that children in profiles that generate a larger number of inferences while reading would show a larger centrality effect because making inferences help in understanding what is interconnected, and hence central, in a text. Children in all reading profiles showed a centrality effect for narrative text. Elaborating Readers showed a larger centrality effect than Paraphrasing Readers, but Literal Readers perform similar to both other profiles. There was no centrality effect for expository texts for children in any of the three reading profiles. We conclude that the use of online inferences alone does not predict differences in text memory and suggest that children in the reading profiles use the text approach that is most suitable for their cognitive abilities to understand the text.

Keywords: Reading Profiles, Online Processes, Centrality Effect, Offline Representation, Text Genres

3.1 Introduction

To understand a text, readers engage in various online reading processes to form a structured and coherent offline memory representation of that text, a situation model (van Dijk & Kintsch, 1983). This memory representation enables readers to remember the meaning of the text, and to learn from it. Children need to build an extensive repertoire of reading processes and learn to apply them optimally, eventually more or less automatically, to different types of texts. Children in elementary school differ in the numbers and types of online reading processes they engage in while reading. Recent studies show that developing readers can be classified into distinct reading profiles based on their online reading processes (Carlson, Seipel, & McMaster, 2014; Karlsson et al., 2018 (chapter two); Kraal, Koornneef, Saab, & van den Broek, 2017; McMaster et al., 2012). These profiles suggest that children use different approaches to text: some stay close to the literal meaning of sentences whereas others generate more inferences to make connections between sentences and with their background knowledge. This research has given us insight into individual differences in the collective set of online reading processes in which beginning readers engage. However, much less is known about possible differences in the memory representation that result from these profiles' online reading processes. Because the memory representation is the basis for learning from texts in school, it is important to understand if children with different reading profiles create different memory representations.

Beginning readers initially learn to read in the context of narrative texts, later they are required to read expository texts that are used for knowledge transfer in higher grades. Because the two text genres differ in their demands on the reader and require partly different reading processes (Lorch, 2017), beginning readers find narrative texts easier to comprehend than expository texts (e.g. Best, Floyd, & McNamara, 2008). Therefore, to gain a more wholistic understanding of how children's online reading processes affect their resulting memory representation, it is important to consider the influence of text genre. In the current study we investigate the effect of children's (9-11 years old) online reading profiles on their memory for narrative and expository text. We do so by examining their ability to build and recall a memory representation, structured around the central information in the text.

3.1.1 Online Text Processes and Offline Text Representation

A general consensus has emerged from scientific models of reading comprehension that readers'online reading processes affect their offline text representation (McNamara & Magliano, 2009; van den Broek, Young, Tzeng, & Linderholm, 1999; van Dijk & Kintsch, 1983). The text representation that readers build can vary in depth and richness of information. For example, readers' text comprehension ranges from a surface level, to a literal understanding, to a situation-model level. The latter is an elaborate mental representation where information from the text is combined with background knowledge to yield an in-depth understanding of the meaning of the text (van Dijk & Kintsch, 1983). These qualitatively different representations are the result of the cognitive processes in which readers engage during reading. Use of elaborate online processes is thought to lead to a more elaborate mental representation. Rereading parts of the text is an example of relatively less elaborate processing, whereas generating inferences using different types of background knowledge is an example of more elaborate processing (e.g. Karlsson et al., 2018; Magliano & Millis, 2003; Seipel, Carlson, & Clinton, 2017). Inferences in particular are important for building a situation model because they help readers create connections between units of information within the text and interrelate these connections with their background knowledge (Graesser, Singer, & Trabasso, 1994; O'Brien, Cook, & Lorch, 2015; van den Broek, 1990). Inference generation has been positively related to good text comprehension in both adult (Graesser et al., 1994; Tun, 1989) and developing readers (Bowyer-Crane & Snowling, 2005; Cain & Oakhill, 1999; Lynch et al., 2008; McGee & Johnson, 2003).

A good mental representation of a text not only contains the information that the text conveyed, but also differentiates information that is central in the text. Information that is central describes the gist or main idea of the text. Central information is usually strongly connected within the text (e.g. Omanson, 1982a; van den Broek, 1990) and, thus, forms an interconnected set of concepts that provide strong memory access routes for readers when they try to recall the text (Albrecht & O'Brien, 1991; O'Brien, & Myers, 1987). Therefore, the text representation of reading-proficient adults and children shows a *centrality effect*, i.e. readers show better memory for central than for peripheral text information (Albrecht & O'Brien, 1991; Armbruster, Anderson, & Ostertag, 1987; Bauer & San Souci, 2010; Kendeou, van den Broek, White, & Lynch, 2007; Mo, Chen, Li, Chen, & He, 2007; Miller & Keenan, 2009; Yeari, Oudega, & van den Broek, 2016; Yeari, van den Broek, & Oudega, 2015; Yekovich & Walker, 1986). To summarize, a good memory representation of a text is the result of cognitive processes during reading and is sensitive to the centrality of information from the text. An open

question is if individual differences in online comprehension processes, such as those captured by the different reading profiles, translates into offline memory representations that systematically differ with respect to the centrality effect.

3.1.2 Reading Profiles

Investigations of online reading processes often focus on a particular process, such as inference generation, in isolation of other processes. However, readers' collective set of processes while reading a full text are equally important to consider, to understand how each process affects the next (van den Broek et al., 1999) and how readers gradually form an offline representation of the text they are reading (Hyönä, Lorch, & Kaakinen, 2002). Cluster analyses of children's overt thoughts while reading (think-aloud responses) have revealed distinct reading profiles in elementary school children. Although children engage in a variety of processes while reading, they differ in the kinds of processes in which they engage the most (Carlson et al., 2014; Karlsson et al., 2018; Kraal et al., 2017; McMaster et al, 2012; Seipel et al., 2017). Children who go beyond the literal text and extensively generate inferences have been called *Elaborators* (Carlson et al., 2014; Karlsson et al., 2018; Kraal et al, 2017; McMaster et al, 2012; Seipel et al., 2017). Elaborating readers predominantly use text-connecting, elaborating, and predictive inferences to connect the information in the text to their existing knowledge of the world. Children who stay close to the literal text make up other reading profiles, such as *Paraphrasers*. In previous research, Paraphrasers respond with many literal repetitions and paraphrases (Carlson et al., 2014; Kraal et al, 2017; McMaster et al, 2012; Seipel et al., 2017). However, we recently found a further refinement as cluster analyses also revealed the profile *Literal Readers* (Karlsson et al., 2018 (chapter two)). In this study Paraphrasing Readers predominantly rephrase the text into own words but also generate some inferences, whereas Literal Readers predominantly repeat the text verbatim (Karlsson et al., 2018).

Using background knowledge to generate inferences while reading has a positive impact on the offline mental representation (Bowyer-Crane & Snowling, 2005; Cain & Oakhill, 1999; Lynch et al., 2008; McGee & Johnson, 2003). Specifically, inferences that recruit relevant background knowledge help readers make connections between text events and recognize central aspects of the text (van den Broek, 1990). Because children in the three reading profiles (Elaborating, Paraphrasing, and Literal Readers) differ in the number of such inferences they generate, they may show differences in their ability to extract central text information. Therefore, we expect children in profiles characterized by more inference generation to show a stronger centrality effect than children in profiles characterized by less inference generation.

3.1.3 Text Genre Differences

Text genre influences reading processes and memory of text content (Best et al., 2008; McNamara, Ozuru, & Floyd, 2011; Tun, 1989; Wolfe, 2005; Wolfe & Woodwyk, 2010; Zabrucky & Ratner, 1992). Two genres are frequently contrasted in reading research as they differ from one another in multiple ways: narrative and expository texts. Narrative text intends to tell a story in which the goal of a protagonist and the ensuing actions to fulfil that goal form a causal/temporal line, from beginning to middle and end (Mandler & Johnson, 1977; Omanson, 1982a; Wolfe, 2005). Narratives cover events that are often similar to readers' everyday experiences and use everyday vocabulary (Britton & Pelligrini, 1990; Medina & Pilonieta, 2006). The causal story line and well-known words ease comprehension processes: readers fairly easily can read a sentence, make associations and inferences to relevant concepts of previous text or background knowledge, and then evaluate and integrate these pieces of information (Lorch, 2017; Omanson, 1982a; van den Broek, 1990). Expository texts intend to convey information to the reader. They tend to be more descriptive, often explaining a main idea and subordinate facts but do not necessarily entail a causal/temporal line that facilitates readers' memory for the textual information (Meyer, 1985; Taylor, 1980; Tun, 1989; Wolfe, 2005). In addition, expository texts often use novel words and concepts, abstract relations, and a higher information density compared to narrative texts. These properties tend to increase processing demands on readers and reduce inference making (Best et al., 2008; Lorch, 2017; Zabrucky & Ratner, 1992). Indeed, children in all reading profiles make fewer inferences when reading expository texts than when reading narrative texts (Karlsson et al., 2018). Therefore, we expect children to show a stronger centrality effect for narrative texts than for expository texts.

3.1.4 Current study

This study is part of a larger project. In the first part of the project we identified three reading profiles in 9-11-year-old children based on their online reading processes, think-aloud responses to text (Karlsson et al., 2018). In the current chapter, readers in the profiles Elaborating, Paraphrasing, and Literal Readers are compared on their ability to form a structured offline memory representation of narrative and expository texts, i.e. recalling information that is central to each text. Following prior research (Albrecht & O'Brien, 1991; Miller & Keenan, 2009; 2011; Omanson, 1982a, 1982b), we determined centrality of text units by importance ratings. We then examined the children's recall of units rated as highly important and central to the text, and units rated as peripheral and less important.

There are two research questions. First, do the children with different reading profiles show similarities or differences regarding the centrality effect? We anticipate Elaborating Readers, who routinely use background knowledge and generate inferences, to show a larger centrality effect compared to Paraphrasing and Literal Readers. This would be reflected in a larger difference in their recall of central and peripheral text units. Furthermore, Paraphrasing Readers engage in more inference generation than Literal Readers and are expected to show a larger centrality effect than Literal Readers. Second, do any observed effects depend on text genre? Children in all profiles generated fewer inferences and showed an approach closer to the text for expository than for narrative texts (Karlsson et al., 2018). Therefore, it is possible that readers in all profiles show a larger centrality effect in their recall of narrative texts than of expository texts.

3.2 Methods

3.2.1 Participants

One hundred and seven children (61 girls) between nine and eleven years old (M = 10.3, SD = 0.73) participated in the current study. Children from grades six and seven were recruited from 16 schools in the south-west of the Netherlands. Inclusion criteria were typical development, Dutch as native language, and average to good word decoding skills (the latter meaning scoring above the 40th percentile on the Dutch national standardized test, CITO Drie Minuten Toets, DMT; Krom, Jongen, Verhelst, Kamphuis & Kleintjes, 2010). Parents gave written consent and children gave oral consent for participation. The study was carried out in accordance with the Declaration of Helsinki and was approved by the Ethical Committee at Leiden University.

3.2.1.1 Defining Reading Profiles

In this study we analyse the recall data of participants from three different reading profiles that were identified in the first part of this project (for a detailed description of the procedure see Karlsson et al., 2018). The reading profiles were characterized by their think-aloud responses while reading. First, the think-aloud responses from each child were assigned to six categories. Second, the response data were used to create six variables: the percentage of text repetitions, paraphrases, text-connecting inferences, valid elaborative inferences, predictive inferences, and invalid elaborative inferences. These steps were conducted for the narrative and the expository texts separately. Third, two Latent Profile Analyses (LPA; Hagenaars & McCutcheon, 2002; Oberski, 2016) were performed on the responses from reading narrative and expository texts, respectively.

The Latent Profile Analyses (LPA) revealed three distinct reading profiles that differ in the number and types of inferences the readers make (Karlsson et al., 2018). The same reading profiles were found for both narrative and expository texts. For narratives, the profiles Literal, Paraphrasing, and Elaborating Readers comprised 23, 46, and 37 children, respectively. For expository texts, the profiles Literal, Paraphrasing, and Elaborating Readers comprised 29, 50, and 27 children, respectively. A significant majority, 75.4%, of the children had the same profile membership for narrative and expository texts (Karlsson et al., 2018). Elaborating Readers mainly use elaborative inferences, explaining the text to themselves, but also use text-connecting- and predictive inferences. Paraphrasing Readers mainly extract the meaning from the text, paraphrasing, but also engage in some text-connecting and elaborative inferences. Literal Readers focus on repeating the text verbatim during the think-aloud task and engage in few inferential processes. Expository texts generally elicited a smaller number of inferences. In the current paper, two mixed design ANOVAs are used to analyse children's recall. For these analyses, the children's profile membership for narrative and for expository texts, respectively, will be used as between-subject variable.

3.2.2 Texts and Tasks

Participants read and were asked to recall two narrative and two expository texts. The narrative texts followed a typical story structure (e.g., Mandler & Johnson, 1977). The narratives began by introducing a protagonist who had a specific goal, which for both stories was to find a suitable gift for a family member. The narratives then sketched the protagonist's attempts to fulfil this goal and ended with the successful attainment of the goal. The expository texts followed a descriptive text structure with main and subordinate ideas (Meyer, 1987). The texts included different kinds of elements such as causal relations and descriptions of places. One text about snakes in the Netherlands explained the effect of temperature on hatching eggs and described well-known places where snakes live. The second text explained the cause of earthquakes and locations in Europe where they commonly occur. Texts from the two genres were fairly similar with respect to text-length characteristics (measured with P-CLIB version 3.0; Evers, 2008), and syntactic complexity (measured by the Development Level with T-Scan; Pander Maat, Kraf, & Dekker, 2017). One of the expository texts had a higher grade difficulty, because of a lower percentage of frequent words. In addition, the expository texts had a higher information density than narratives as indicated by the type-token ratio. However, they also showed higher text cohesion as indicated by a higher density of connectives. Further data on text characteristics and English translations of the four texts are published in Karlsson et al., 2018.

Each child received a booklet with the four texts, with each sentence printed on a separate page. Participants were instructed to read each sentence aloud and then report what they were thinking before continuing with the next sentence (for a detailed description of the procedure, see Karlsson et al., 2018). At the end of each text participants were asked to recall the text. To encourage the children to recall as much as possible they were asked to retell the whole text, as if they were telling the story to a friend who had not heard it. Children were prompted twice at the end of each recall with the question 'Is there something else you can remember?'

3.2.2.1 Defining Central and Peripheral Text Units

To distinguish between central and peripheral text units, each text was rated by 30 native Dutch speaking undergraduate students (15 women, mean age 20 years). The students provided informed written consent and were then tested individually at the university. They received a small payment or course credits for participation. Each text was parsed into subject-verb clauses (idea units), yielding a total of 56 and 40 idea units for the two narrative texts and 47 and 35 idea units for the two expository texts, respectively. To rate the texts the students received a booklet with a paper-and-pencil task. Each text was presented as a regular text on one page. A list of the idea units of that text was presented on the next page. After having read the text, students were asked to rate on the list version how important each unit was to understand the text as a whole. Importance was rated on a scale from 1-7, with 1 being least important and 7 most important. There was a high agreement among students' rating on all four texts, all Cronbach alpha coefficients > .93, and all ICC (2, 30) > .935 (Landers, 2015). The units for each text were divided into three equal parts: top, middle, and bottom ranked units. The top third and bottom third ranked units were used to examine children's memory of central and peripheral units, respectively. The respective mean rating for top and bottom thirds were 5.05 (SD = 0.63) and 2.22 (SD = 0.65) for the narrative texts and 4.98 (SD = 0.67) and 2.80 (SD = 0.66) for the expository texts. A repeated measures ANOVA showed an interaction effect of text genre by importance level, F (1, 29) = 30.04, $p < .001$, $\eta_p^2 = .51$. Follow-up analyses showed that top ratings were significantly higher than bottom ratings for both narrative (F (1, 29) = 412.66, $p < .001$, $\eta_p^2 = .93$) and expository texts (F (1, 29) = 223.91, $p < .001$, $\eta_p^2 = .88$). Whereas top ratings did not differ between the two text genres (F (1, 29) = 0.71, $p = .408$, $\eta_p^2 = .02$), bottom ratings for expository texts were higher than those for narrative texts (F (1, 29) = 38.17, $p < .001$, $\eta_p^2 = .57$).

3.2.3 Procedure

The recall data for the children was gathered in a quiet room at school in an individual session. During this session children received the combined think-aloud and recall task, as well as additional tasks described in the previous publication (Karlsson et al., 2018). The session lasted approximately one hour, including instructions and a short break. Participants were given verbal instructions and one practice text. After completion of the experiment children received a small gift to thank them for their participation.

The think-aloud and recall session for each participant was recorded and later transcribed. Two test leaders categorized the recall data with good interrater reliability, $K = 0.76$, $p < .001$. One point was given for each accurately remembered idea unit. For each participant, averaged recall scores were computed for central and peripheral units, respectively. This was done separately for the narrative texts and the expository texts. This created four within-subject conditions: recall of central and peripheral units in narrative and in expository texts, respectively.

3.2.4 Analyses

We analyzed children's recall of central and peripheral text units as a function of their reading profiles. Two separate mixed-design analyses of variances were performed, one for narrative and one for expository texts. No outliers were found. Recall data from one child were partly missing due to technical problems, therefore, the analyses include data from 106 children. In the first 2 (recall of central and peripheral narrative text units) x 3 (reading profiles) mixed design ANOVA, profiles were based on narrative texts. In the second 2 (recall of central and peripheral expository text units) x 3 (reading profiles) mixed design ANOVA, profiles were based on expository texts.

3.3 Results

3.3.1 Recall of Narrative Text

In the 2 x 3 ANOVA, a main effect of centrality revealed better recall of central than of peripheral units, $F(1, 103) = 457.02$, $p < .001$, $\eta p^2 = .82$ (see Figure 3.1). There was no main effect of reading profile, $F(2, 103) = 1.40$, $p = .253$. However, there was a centrality-by-profile interaction, $F(2, 103) = 4.30$, $p = .016$, $\eta p^2 = .08$. This interaction was examined in three steps. First, separate follow-up ANOVAs for each of the three reading profiles showed that children in all profiles recalled more central information than peripheral information, all ps $< .001$ (see Figure 3.1a). Second, we calculated a difference score for each child by subtracting the percentage of recalled peripheral units from the percentage of recalled central

units. An ANOVA comparing the reading profiles on the children's difference scores showed that the Elaborating Readers had a larger difference score (M = 29.99, SE = 1.95) than did Paraphrasing Readers (M = 22.37, SE = 1.75), p = .013 (see Figure 3.1a). Literal Readers (M = 24.68, SE = 2.47) did not differ from Elaborating or Paraphrasing Readers, ps > .285. Third, follow-up ANOVAs examining central and peripheral units separately, revealed no significant differences in the number of central units recalled across the profiles (p > .353) and no differences in the number of peripheral units recalled (p > .162).

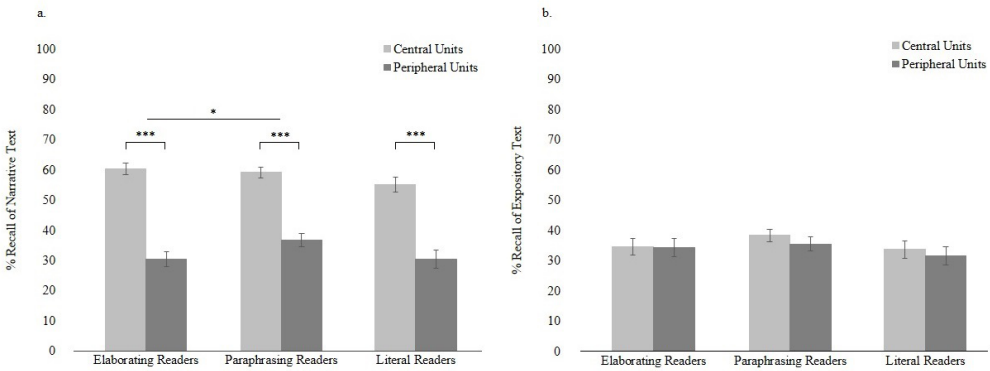

Figure 3.1. Mean percentage recall of central and peripheral units in narrative text (a) and expository text (b) by the three reading profiles, Elaborating, Paraphrasing, and Literal Readers. For narratives, children in all profiles showed a centrality effect of p < .001 (***), also, Elaborating Readers showed a larger centrality difference score than Paraphrasing Readers, p = .013 (*).

3.3.2 Recall of Expository Text

The 2 x 3 ANOVA, revealed no significant main effect of centrality, F (1, 103) = 1.29, p = .259 (see Figure 3.1b), no significant main effect of reading profile, F (2, 103) = 0.95, p = .391, and no centrality-by-profile interaction, F (2, 103) = 0.26, p = .773.

3.4 Discussion

The aim of this study was to examine whether the memory representation of narrative and expository texts of Dutch elementary school children (9-11 years old) differs as a function of their reading profile: Elaborating, Literal, and Paraphrasing Readers. Children in all three profiles showed a centrality effect in their recall of narrative texts. On average, they all arrive at a situation model in which central information is more prominent than peripheral information, a centrality effect. However, the Elaborating Readers distinguish between central and peripheral information in narrative texts more strongly than Paraphrasing Readers. Children's recall of expository texts did not show a centrality effect in any of the profiles, suggesting that all groups of children struggled to distinguish central and peripheral information in the expository texts.

3.4.1 Reading Profiles

In line with previous research (Bowyer-Crane & Snowling, 2005; Cain & Oakhill, 1999; Graesser et al., 1994; Kraal et al., 2017; Lynch et al., 2008; McGee & Johnson, 2003; van den Broek & Kendeou, 2017), we find that inference-making contributes to a readers' understanding of the text. Although children in the three profiles differ in the number of inferences they make, they all engage in inference generation during reading to some degree. Our findings suggest that this inference generation is sufficient to extract central information in narratives. However, the number of online inferences alone cannot fully predict the strength of the centrality effect in the resulting memory representation. Consistent with our predictions, the Elaborating Readers displayed a larger centrality effect than Paraphrasing Readers. However, counter to our predictions, memory for the text of Elaborating Readers and Paraphrasing Readers did not differ significantly from that of Literal Readers.

To better understand these seemingly contradicting results we may turn first to studies considering other reader characteristics and second to further reader characteristics of the children in the current three reading profiles. Previous research shows that seven-to-ten year old children develop various memory strategies; from strategies that are less cognitively demanding, such as repetition, to strategies that are more demanding, such as sorting, chunking, drawing on background knowledge, or combinations of strategies (Schneider, Kron-Sperl, & Hünnerkopf, 2009). Repeating content is more effective for text memory than using no strategies (Jonsson, Wiklund-Hörnqvist, Nyroos, & Börjesson, 2014), but the use and efficiency of strategies seems to vary with children's cognitive resources. For example, children with high Working Memory Capacity (WMC) benefit from using elaborate memory strategies, whereas children with low WMC benefit from using

less elaborate strategies, such as repetition (Jonsson et al., 2014; Turley-Ames & Whitfield, 2003). In the previous paper (Karlsson et al., 2018), our Elaborating Readers proved not only to generate more inferences than the other two profiles while reading, but also showed better word decoding and non-verbal reasoning abilities in ancillary measures. With this knowledge, the results of this study may indicate that Elaborating Readers, who have good reading fluency and good reasoning abilities, utilize their resources to engage in elaborative processes that result in a well-structured memory representation of the text. Paraphrasing and Literal Readers with relatively poor reading fluency and reasoning abilities have fewer resources available for cognitively demanding reading processes compared to Elaborating Readers and pay more attention to the focal sentence, but are able to arrive at a structured text memory in this recall task. Similarly to previous research (Jonsson et al., 2014; Turley-Ames & Whitfield, 2003), we suggest that these three reading profiles use the text approach that is most suitable for their cognitive abilities to pursue the aim of comprehending the text. However, although Paraphrasers have comparably fewer cognitive resources at their disposal, they are perhaps trying out or developing more elaborate online reading strategies. Taxing their cognitive capacities in this way may, in comparison to Elaborating Readers, render a somewhat less structured memory representation, shown by a smaller centrality effect.

3.4.2 Text Genre Differences

The current results show that expository texts are challenging to recall for elementary school children. Compared to narrative texts, children from all profiles tended to recall less information from the expository texts as they struggled to extract central information. In the current study, 'centrality' of textual information was determined through ratings by college students. It is possible that children struggle with exposition in elementary school years as they still need to learn to recognize different text structures and build up a body of background knowledge to have reference points to new knowledge in exposition (Best et al., 2008; Meyer, Brandt, & Bluth, 1980; Taylor, 1980). The difficulties in recalling expository texts may have limited our ability to reliably specify differences in memory for central and peripheral information, as well as differences between profiles. However, recall of peripheral information is similar across text genres, suggesting that readers in all groups had at least a basic understanding of all texts, and their difficulties in recognizing central information must have a different cause. An alternative explanation may be that the results reflect differences between narrative and expository texts regarding the role that inferences play in centrality. For example, centrality in narratives may depend on numbers of connections and of inferences that create

these connections. However, centrality in expository texts may depend more on logical structure (Lorch, 2017), such as process inferences that specify the detailed steps or dynamic characteristics of an event as it unfolds (Snow & RAND, 2002). Probing children's reading processes that contribute to logical text structures in expository texts may be a promising venue for further research on how children create a coherent mental model of expository text.

3.4.3. Limitations and Future Research

Pronounced profile differences in the think-aloud task but small profile differences in the recall task may stem from task differences. The think-aloud task may be a particularly sensitive tool to show children's processing differences in all types of readers; those who are still developing, and those who have already mastered the ability to generate inferences. Although the free recall scores do not show a ceiling effect, hence indicating that the task was not too easy for the children, it may have been less sensitive in picking up differences specifically related to inference generation in online text processing. For example, in contrast to a summarizing task, which demands the reader to extract the meaning of the text (e.g. Brown & Day, 1983), the free recall task encourages little individual interpretation and allows for a more general memory recollection such that children with varying processing abilities may show similar performance. Research linking online and offline reading tasks often shows that there is a relation between the two; however, results are often described as giving "tenuous" support that the online and offline measures under investigation really are tapping into direct comparisons of comprehension (Anmarkrud, McCrudden, Bråten, & Strømsø, 2013; Rapp & Mensink, 2011). Perhaps because online measures tap into moment-by-moment reading comprehension, whereas offline tasks measure post-reading comprehension, they will at best match only in part. Hence, showing exactly how online and offline comprehension processes are linked is difficult, because they are in part per definition different. The current results provide a similar picture; results in the offline task cannot be explained by performance in the online task alone, other reader characteristics seem just as important to consider.

Future endeavours of research into reading profiles may also investigate how comprehension differences transfer to long-term learning. Long-term memory of text, or learning over time, builds on online process in a similar way as offline comprehension (e.g. Beker, Jolles & van den Broek, 2017). However, memory decays over time. Examining long-term memory of text in these profiles may be informative in showing how the collective set of reading processes predict learning from text.

3.5 Conclusions

Because text memory forms the basis for learning in school, it is important to understand whether children with different reading profiles create different memory representations. The results of the current study show that children in the reading profiles Literal, Paraphrasing, and Elaborating Readers all build a structured memory of narrative texts. Subtle differences in children's narrative text memory could not be related to the number of online inferences alone, but a combination of considering children's reading profiles and other reader characteristics provided a better explanation. Therefore, we suggest that children in the reading profiles use the text approach that is most suitable for their cognitive abilities to remember the text.

Children in all profiles struggled to extract central information from expository texts. Possibly the role that inferences play in centrality for narrative and expository texts is different. We suggest that research in developing readers routinely needs to consider different text genres to better understand how online processes affect memory and ultimately learning from text.