



How Do Children Read Words? A Focus on Reading Processes
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Summary

Being able to read is very important in our literate society. Many studies, therefore, have examined children's reading skills to improve our understanding of reading development. In general, there have been two types of studies. On the one hand, there is a line of research that focuses on the development of the reading system. According to prominent theories of reading development, there is a gradual shift in the reading processes underlying word identification from initial serial reading strategies, such as sounding out letters one-by-one, toward the ability to process letters in parallel and retrieve whole word pronunciations from memory. On the other hand, there are studies that examined cognitive skills that foster reading performance. Phonological skills, more specifically phonological awareness and rapid naming, for example, have been shown to be important predictors of reading development. The majority of these studies, however, focused on the relation of cognitive skills with the outcome of the reading system in terms of reading speed or accuracy. Surprisingly few studies have focused on the relations with the processes underlying word identification. The studies in the current dissertation were aimed at bridging the gap between studies that focused on the development of reading processes, and studies that examined cognitive skills that foster reading development.

Visual attention span appears to be an interesting predictor of reading abilities in this respect, because different from phonological skills, it has been explicitly linked to reading processes. Evidence for the relation of visual attention span, that is the amount of orthographic information that can be processed in parallel, with reading performance, however, mainly comes from one research group that studied children learning to read opaque orthographies (i.e., French and English). In the current studies it was first examined whether visual attention span is an independent predictor of reading fluency in a more transparent orthography. Next, the focus shifted toward reading processes and it was examined how visual attention span, as well as phonological skills, related to parameters of the reading system. This study led to the broader question of how reading processes can and should be studied. Two methods

were examined that have been proposed to identify the processes underlying word, as well as nonword identification.

In the first study, the relevance of visual attention span to reading skills in a more transparent orthography was examined (Chapter 2). Visual attention span was found to be a predictor of reading fluency in beginning as well as more advanced readers. Two unresolved issues concerning visual attention span were addressed, that is its independence of rapid naming and its relation with spelling performance. The relation between visual attention span and reading fluency was shown to be independent of rapid naming, in addition to the previously established independence of phonological awareness. Furthermore, a unique relation was also found with orthographic knowledge and spelling performance. These results indicate that visual attention span indeed is an important predictor of literacy skills, also in a more transparent orthography. However, the results also called for a slightly different interpretation of visual attention span.

Further insight into the nature of the relation of visual attention span, but also phonological awareness and rapid naming, with reading performance was gained in the second study that focused on oral and silent reading (Chapter 3). The subtle, but significant difference found between the two reading modes is important in and of itself, since insights gained through research on oral reading are often tacitly generalized to the less studied, but actually more dominant silent reading mode. The cognitive skills were found to correlate significantly with both oral and silent reading. Visual attention span related equally strongly to both reading modes, and the same was found for phonological awareness. Rapid naming, however, related more strongly to oral than to silent reading, suggesting that verbal output is important in understanding the nature of rapid naming.

In the other three studies, the focus shifted to the processes underlying word and nonword identification. In the third study the relations of visual attention span, phonological awareness, and rapid naming with reading processes, rather than reading outcomes were examined (Chapter 4). Length effects were taken as indicators of underlying reading processes and were decomposed into an overall speed factor and the degree of serial processing. For both word and nonword reading, visual attention span and phonological awareness were shown to have a specific relation with serial

reading processes. Rapid naming, in contrast, was found to relate only to overall reading speed.

The fourth study aimed to examine length effects in more detail (Chapter 5). Length effects are expected when reading processes are known to be serial. When words are decoded, it follows that reading latencies increase with every additional letter. The reverse, however, that is inferring that the underlying reading process was serial when a length effect is found, is more problematic. To establish the reliability of using length effects to infer underlying reading process, independent evidence for the serial nature of the reading process is called for. In this study, length effects were found in children's lexical decisions, while independent evidence from both neighborhood size and articulatory suppression indicated that items were processed in parallel. These results question the reliability of using length effects to study reading processes.

Therefore, an alternative method to identify reading processes was examined in the fifth and final study (Chapter 6). If a word is processed in parallel, a high correlation is expected between reading a word and naming a single digit, because in both tasks a phonological code is retrieved from memory. If, however, a word is processed serially, a stronger relation is expected with a serial naming task, presenting multiple digits in a row. It was found that the relations of reading with serial and discrete digit naming could be used to sort children into two classes of readers, that is children who relied on predominantly serial or mainly parallel reading processes. Surprisingly, two classes were identified for both word and nonword reading fluency. The results indicated that a developmental shift seems to occur from processing all letter strings serially, toward parallel activation of phonology from print first for words, and later on also for nonwords.

The findings of the current studies have important implications for our understanding of the nature of the relations of visual attention span and rapid naming with reading. Furthermore, the results do not fit with current models of reading processes and thus call for a new model of the reading system. These issues, as well as practical implications and suggestions for further research are discussed in Chapter 7.