Introduction

Although eye tracking has finding increasing use in psycholinguistic reading research in recent decades (for overview see [1]), there is a lack of combined studies relating to the manifestation of eye movements in different reading modes with respect to reading skills and reading acquisition. Reading mode (silent and oral reading, SOR) has already been investigated in competent adult reading (e.g. [2, 3]). Persons reading orally showed smaller saccade amplitudes and longer fixation duration compared to silent reading (summary in [4, 5]). A study with typical developed English-speaking children found higher numbers of fixations and longer fixation durations for oral compared with silent reading [6]. However, the transferability of these results into German-speaking readers is limited, as studies have shown that eye movement parameters differ during reading acquisition depending on orthographic consistency [7, 8]. Results have been taken into account by numerous studies investigating eye movements of children with reading disorder (RD) and with typical reading development (TD). Summarised the data show higher numbers and enhanced durations of fixations, an increased probability of regressions and smaller amplitudes of saccades [7-13].

A combined view on both reading mode and reading skills is provided by only one single study on adolescents: Showing emphasised differences in eye movements in SOR than less competent elderly readers, the authors suggest effects of reading skills on silent reading but limited on oral reading [14].

Because of the lack of combined studies on SOR with respect to reading skills of children during reading acquisition in German, we address the following question: Are there statistically significant differences in total reading time and eye movement parameters between children with TD and RD depending on reading mode in fourth grade? To the best of our knowledge, this study is one of the first to investigate SOR and eye movements in children, i.e. individuals in reading acquisition, with and without reading disorder. The results of TD indicate different characteristics of eye movement parameters depending on reading mode, corresponding with a study of adolescents in German [14]. In contrast, the data of RD show statistically and practically significant differences in SOR: In oral reading, there was no difference in fixation duration (p > 0.05) but in number of fixations (p < 0.05). In addition, differences in amplitudes and number of progressive intra- and inter-word saccades were found (p < 0.05). In contrast, in silent reading, the comparison only showed differences in number of fixations, fixation duration as well as number of progressive and regressive intra-word saccades (p < 0.05). In addition, regressive saccade amplitudes and number of regressive inter-word saccades showed no differences in SOR (p > 0.05).

Method

Eye Movement Recordings

Each participant read one text orally and one text silently. SOR texts are age-appropriate, matched for length and have nearly identical orthographic frequency (see table on the right).

Apparatus

Tobi Remote Eyetracker T120

Data rate: 120 Hz

Eye tracking technique: bright and dark pupil tracking

Screen size: 17” TFT

Result

Comparison between SOR (see figures)

Dependent on SOR within the groups, the results show statistically and practically significant differences between SOR for TD in the majority of parameters (p < 0.05, d > 2) with the exception of regressive saccade amplitudes and number of regressive intra-word saccades (p > 0.05). In contrast, RD showed only differences in SOR in restricted number of eye movement parameters. Differences were found in reading duration as well as number of progressive and regressive inter-word saccades. Other parameters showed no differences in eye movements in both reading tasks in RD, but in all of these parameters effect size indicated a practically significant difference (d > 2).

Comparison between reading skills (see tables)

Dependent on reading skills, the comparisons in SOR between TD and RD showed statistically and practically significant differences in some parameters (p < 0.05, d > 2). In oral reading, there was no difference in fixation duration (p > 0.05) but in number of fixations (p < 0.05). In addition, differences in amplitudes and number of progressive intra- and inter-word saccades were found (p < 0.05). In contrast, silent reading, the comparison only showed differences in number of fixations, fixation duration as well as number of progressive and regressive intra-word saccades (p < 0.05). In addition, regressive saccade amplitudes and number of regressive inter-word saccades showed no differences in SOR (p > 0.05).

Discussion

Results. To the best of our knowledge, this study is one of the first to investigate SOR and eye movements in children, i.e. individuals in reading acquisition, with and without reading disorder. The results of TD indicate different characteristics of eye movement parameters depending on reading mode, corresponding with a study of adolescents in German [14]. In contrast, the data of RD show only isolated differences. This discrepancy between TD and RD in eye movements except regressions, could indicate an adaptation of TD to demands of reading strategies as a function of reading skills. This assumption is supported by a study on adolescents showing emphasised differences in eye movements in SOR than less competent elderly readers, the authors suggest effects of reading skills on silent reading but limited on oral reading [14].

Limitations. It has to be taken into account that even with cautious construction of extensively matched texts, these could contain different linguistic requirements and therefore qualitative differences may arise [6, 14]. The knowledge gained in this pilot experiment needs further examination and differentiation. The long-term study BLab (see QR-Code) at the Humboldt-Universität zu Berlin represents a suitable basis for this due to its sample size and research design.

Practical relevance.

In the diagnosis of decoding ability during reading acquisition, analysis of oral reading dominates [20]. The results reported here point out to the differences in eye movements between TD and RD, indicating differences in adaptation of reading strategies. Reading instruction and intervention should be directed towards both reading modes and carefully facilitate the transition from oral to silent reading to support RD.

References


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