Introduction

- Children often display greater variability in their eye movement behaviours during reading compared to skilled adults (e.g., Joseph, Nation, & Liversedge, 2013).
- We explored three potential causes for this difference:
  1. Mismatched groups: Recruitment strategy may result in adult participants having higher reading abilities than child participants.
  2. Reading difficulty: Less skilled readers (e.g., children) are likely to experience greater processing difficulty than more skilled readers (e.g., adults) in experiments.
  3. Absolute vs. relative calculation of variability: Researchers typically calculate absolute measures of variance, but this may be proportional to group means.
- We expected that:
  - Individuals with high levels of reading skill would demonstrate less variability in their eye movements compared to poorer readers.
  - Group differences of eye movement variability would be reduced when measures of variance are calculated as relative values compared to calculations of absolute values.

Method

Participants: 132 adults (range: 18-34; M = 21.77; SD = 3.45); 132 children (range: 8-9; M = 8.49; SD = .50)

Materials and Measures:
- Stimuli: 129 single-line sentences created for 8-9-year-old children
- Reading ability measure: Weschler Individual Achievement Test – Second UK Edition
- Eye movement measures: Total sentence reading time, total fixation count, & fixation durations for all words in each sentence

Apparatus: Eyelink 1000 eye-tracker (SR Research)

Analyses:
- Data from three experiments were combined (Milledge et al., 2021, 2022a,b)
- All target words were excluded from the present analyses.

Results (1)

1. Correlations by Group:
Reading performance was related to global eye movement measures in children but not adults

2. Linear Mixed Effects Models (LMMs) of Group x WIAT Composite Score:
- Total sentence reading time and fixation count: WIAT score influenced both these measures in children but not adults.
- Fixation Duration: Children and adults showed a similar effect of WIAT score on fixation duration measures

Results (2)

4. Absolute vs. Relative Group Differences:
Group differences in eye movement variability are reduced, but not negated, when SDs are calculated as a proportion of the mean rather than as absolute values.

Discussion & Conclusions

- Eye movement behaviours are related to reading ability.
  - These relationships are not detected if there is not enough variability in the eye movement record (as demonstrated by the results of the adult groups). This may be because the sentences were suitable in difficulty for children, and thus very easy for the adults to read. We would expect the adults to show similar patterns to the children when reading age-appropriate materials.
  - Reading difficulty is systematically associated with variability in eye movement behaviours.
    - In the child groups, better readers found the sentences easier to read, and variability in the eye movement record increases at an individual level as reading ability decreases.
    - We did not find significant correlations in the adult group as these participants had relatively homogenous eye movement behaviours in this dataset. Previous research has shown that adult readers display similar patterns to the children in our dataset when reading age-appropriate material (e.g., Hyönä & Ekholm, 2016).
  - Further examination of the eye movement record is required to better understand the non-significant relationships related to fixation durations.
  - When comparing differences in eye movement variability during reading between adults and children, it may be important to consider SDs as a proportion of the mean to avoid overestimation of group differences.
  - Cognitive processing difficulty is likely a critical factor underlying variability in eye movement behaviours during reading.

References