

Influences of Font Format on Reading Comprehension: Implications of Font Personalization in K-8 Students

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Introduction

- Recent research demonstrates adults can benefit from personalized combinations of specific typographic features to enhance reading speed.
- We do not know whether, or to what extent, font personalization affects reading speed in developing readers.
- We also do not know whether font personalization can impact reading comprehension.

Aims

- The current study aimed to investigate the influence of typography on word- (Experiment 1) and passage-level (Experiment 2) reading speed and reading comprehension.
- We aimed to evaluate typographic effects at the **group-level** and at the **individual reader level (font personalization)**
- Typographic features (inter-letter spacing and character width) were carefully controlled to isolate effects.

Methods

Participants:

- 94 children in Kindergarten – 8th grade (43 girls, 51 boys; mean age = 9.25 years (SD = 2.55))
- All participants were able to read grade level sentences as indicated by parental report
- 4 participants had dyslexia, 7 had a learning and/or developmental disorder other than dyslexia (e.g., autism), and 1 participant had both dyslexia and developmental language disorder.

Overall Study Design

- All participants completed Experiments 1 and 2 in a single session
- Participants completed the experiment virtually using Gorilla experiment builder software
- Parent Questionnaire:** parents completed a questionnaire about their children's demographic and educational background, and their reading habits
- Student Questionnaire:** participants completed a questionnaire about their reading habits (e.g., how much they enjoy reading for school and for pleasure)
- Personal best font format was the format that yielded the highest accuracy for that individual within each experiment. In cases of an accuracy tie, the format with the fastest reading speed was selected as the best format.

Methods

Varied Spacing		Varied Width		Varied Spacing & Width	
Base*	readability	Nar_Width	readability	Extreme (Wide Spacing & Wide Width)	readability
Med_Space	readability	Base*	readability		
Wide_Space	readability	Wide_Width	readability		

Figure 1. Six Font Formats

Experiment 1 Design: Masked Semantic Categorization Task (Word-level)

- Completed a semantic categorization task comparing all six font formats
- K-2nd grade participants completed 3 blocks of 60 age-appropriate target words (30 animate, 30 inanimate)
- 3rd-8th grade participants completed 3 blocks of 90 age-appropriate target words (45 animate, 45 inanimate)
- Reaction time (RT) and accuracy was calculated

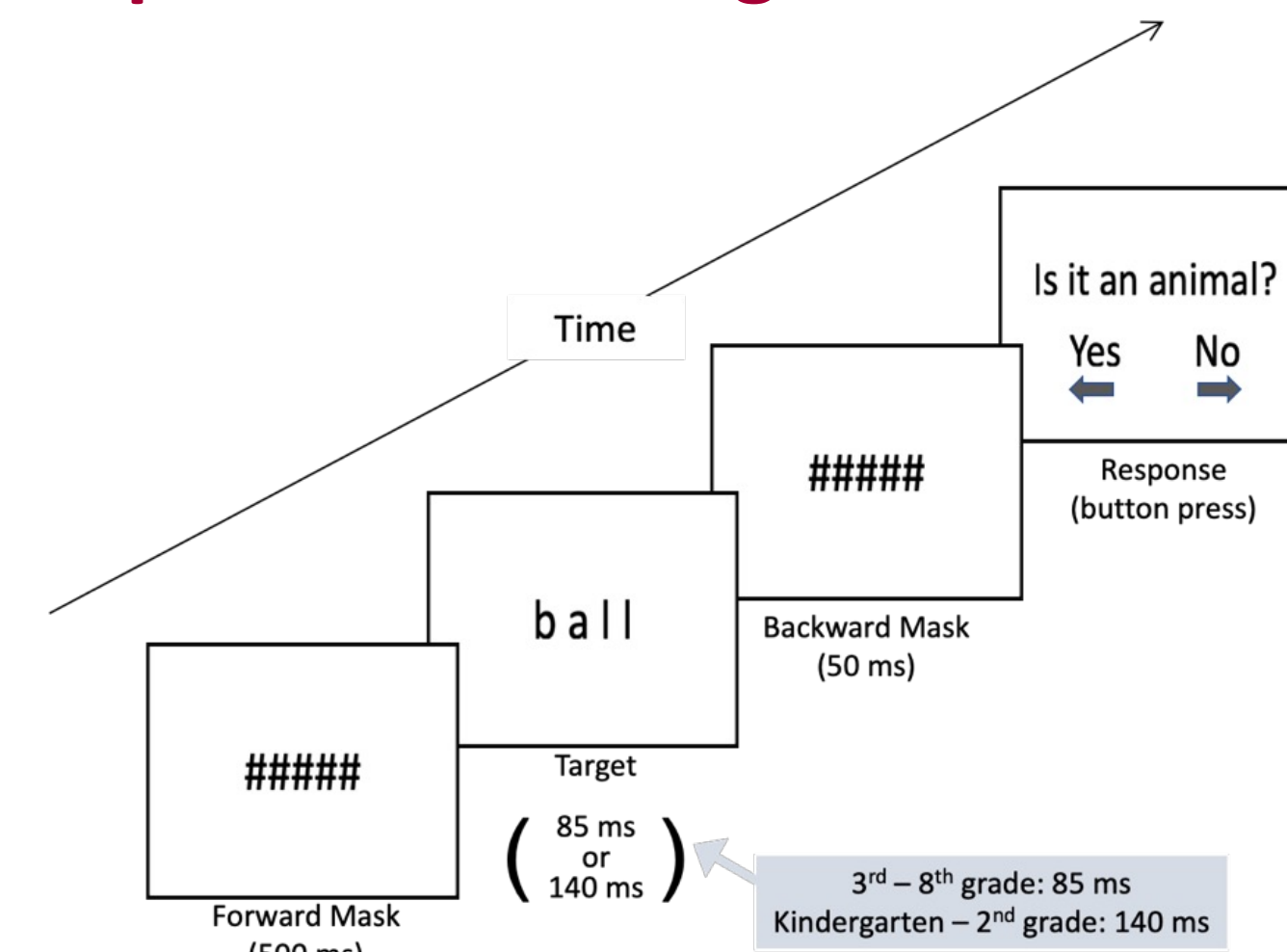


Figure 2. Experiment 1 Schematic of one trial

Experiment 2 Design: Passage-level Reading Comprehension

- Participants read 2 grade-level passages (from ReadWorks), each presented in a different font format, and answered three multiple-choice questions testing different levels of comprehension
- Each passage/font format combination was presented an equal number of times across participants
- Words read per minute (WPM) and comprehension accuracy were calculated

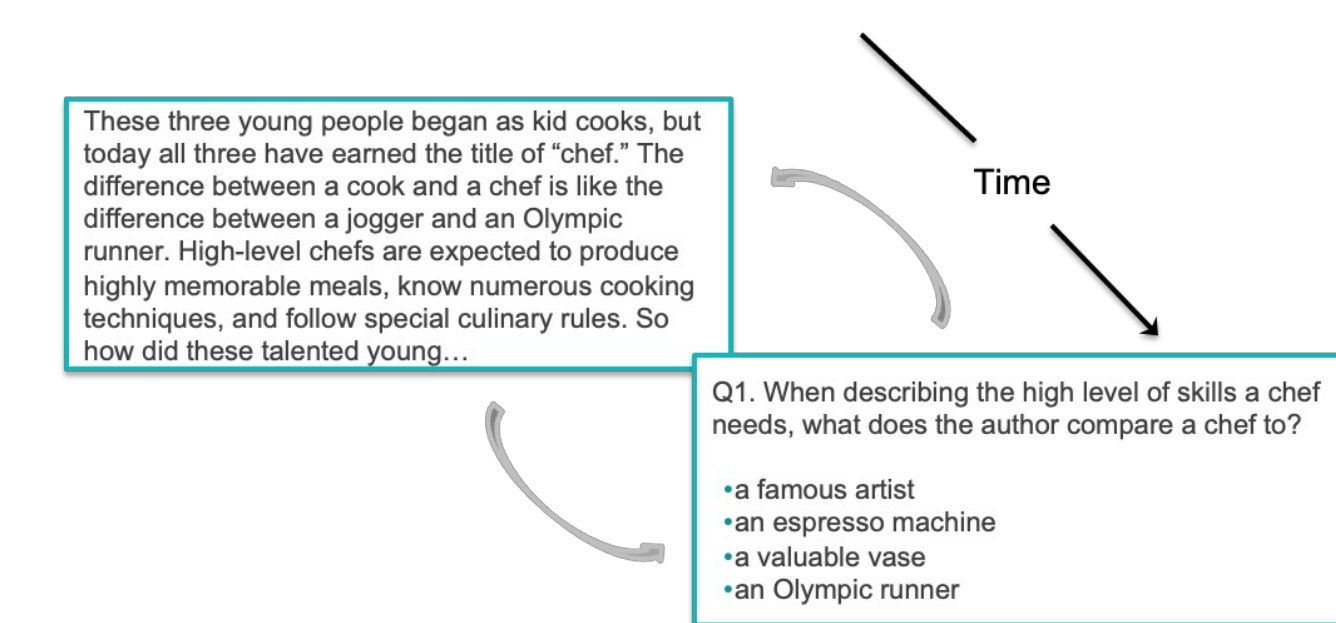


Figure 3. Experiment 2 Schematic passage task

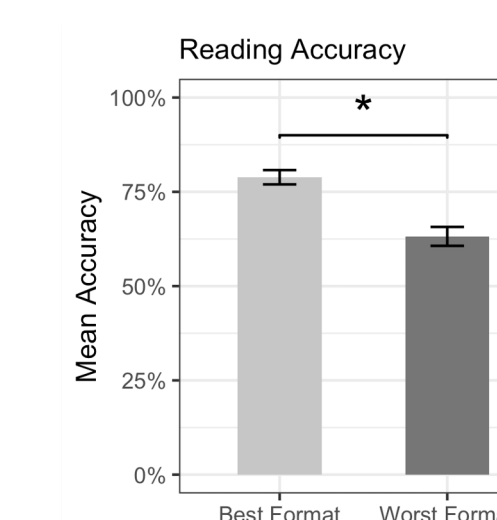
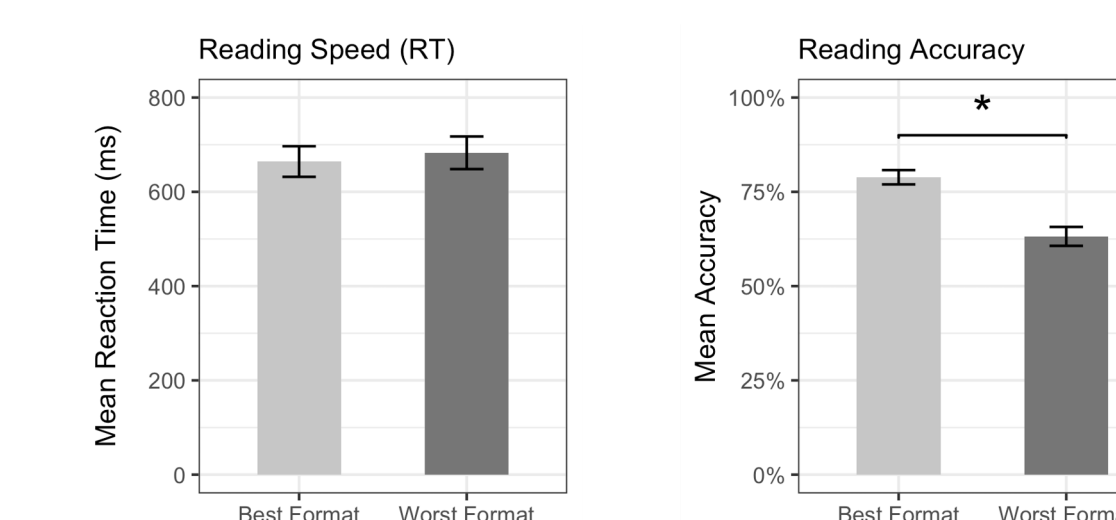
Statistical Analyses:

- Mixed-effects linear models examined the effect of font format on RTs and accuracy (Experiment 1), WPM and passage comprehension accuracy (Experiment 2) at the group level.
 - Experiment 1 analyses controlled for grade, average parent education, the child's rating of reading enjoyment, presence of dyslexia or other learning/developmental disability. Reading speed models included accuracy measures as covariates and vice versa. Participants were entered as a random effect.
 - Experiment 2 analyses included the same covariates as well as passage Lexile.
- Independent samples t-tests compared performance of personal best vs. worst font formats to test font personalization effects on reading speed and comprehension.

Results

- Group-level
 - Experiment 1:**
 - RT: No single font format predicted RT differences.
 - Comprehension Accuracy: Children in younger grades benefitted from the Wide Space format ($p = 0.036$).
 - Experiment 2:**
 - WPM: Wide Space ($p < 0.001$) and Extreme ($p < 0.001$) formats yielded the lowest WPM.
 - Comprehension Accuracy: Children with dyslexia had significantly lower accuracy when reading in the Nar Width format
- Individual-level

Experiment 1



Experiment 2

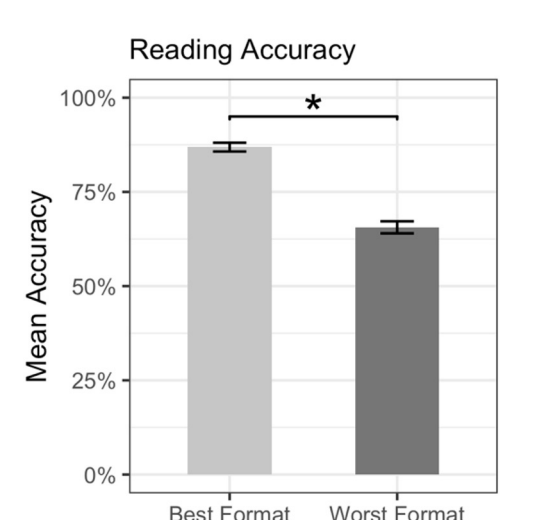
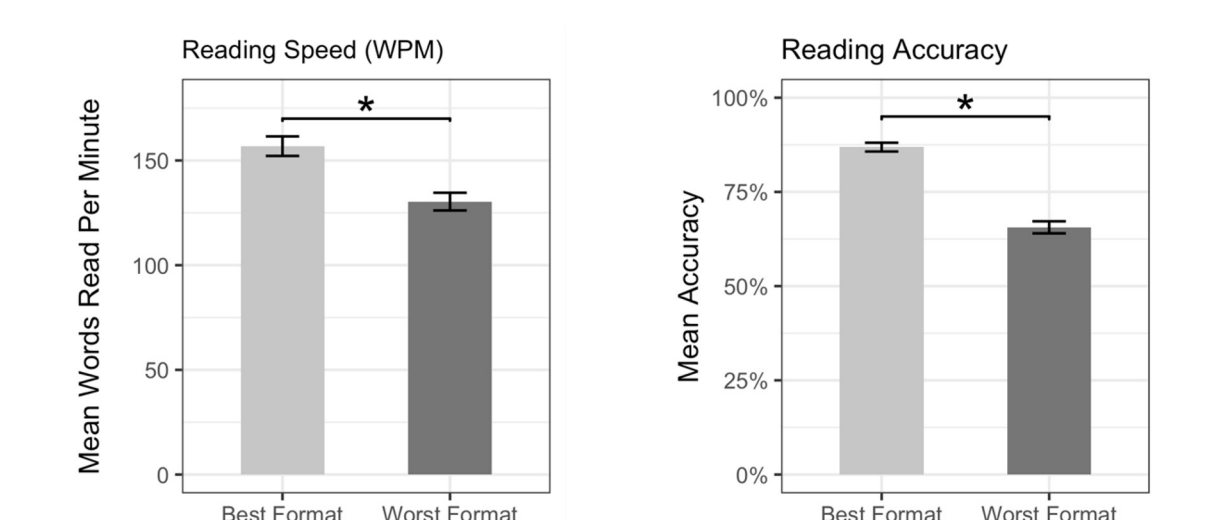


Figure 4. Font Personalization Effects in Experiments 1 and 2

- Experiment 1**
 - None of the six font formats was more likely to be the best or worst format.
 - Reading speed (RTs) did not differ between personal best vs. worst formats. Comprehension was 18.4% more accurate in the personal best font.
- Experiment 2**
 - None of the six font formats was more likely to be the best or worst format.
 - Reading speed was 20.1% faster and accuracy was 21.3% higher in the personal best vs. worst format.

Discussion

- Subtle changes to font format can impact reading speed and comprehension accuracy.
- Personalizing font format can significantly improve comprehension in developing readers across multiple reading tasks.
- As technology continues to improve, font personalization in eBooks and on educational apps may significantly improve reading comprehension in young developing readers and older readers who are faced with increasingly complex reading material.

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Cranial-lab.org
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