3.1 Demographic Distribution of Participants

The cognitive psychology experiment enlisted a diverse range of participants. Their background characteristics have been visualized to provide an insight into the composition of our sample.

Dyslexia in Participants: The first bar chart depicts the distribution of participants based on whether they have dyslexia. The majority of the participants did not have dyslexia, while a smaller fraction identified as dyslexic.

Primary Language: The second bar chart shows that most of our participants do not have English as their primary language. However, a significant number still use English as their primary mode of communication.

Device Used for Participation: The third visualization indicates the device preference among participants. Most participants used devices other than phones, suggesting a preference for larger screens or more conventional computing devices.

Age Distribution: The histogram demonstrates the age distribution of our participants. A majority fall within the mid-age range, with fewer participants in the younger and older age brackets. The Kernel Density Estimation (KDE) curve offers a smooth representation of this distribution, highlighting the most frequent age range in the sample.

3.2 Data Visualization

From the boxplot, we can derive several key observations:

Dyslexic vs Non-Dyslexic: Dyslexic participants consistently exhibited longer reading times across both paragraph types compared to their non-dyslexic counterparts.

Paragraph Type Influence: Reading times for "highlighted" paragraphs appear slightly reduced when compared to the "plain" paragraph type. However, the difference is minimal.

Presence of Outliers: A notable trend is the higher occurrence of outliers, particularly among dyslexic participants.

These insights provide an initial understanding of the data distribution, paving the way for the upcoming mixed-effects model analysis.

3.3 LMMs

The interaction plot reveals several key observations:

Distinct Trends: The slopes of the lines for dyslexic and non-dyslexic participants differ, indicating a potential interaction between dyslexic status and paragraph type.

Dyslexic Participants: For those identified as dyslexic, reading time appears to decrease when transitioning from plain to highlighted paragraphs.

Non-Dyslexic Participants: Conversely, non-dyslexic participants display relatively consistent reading times regardless of paragraph type.

Magnitude of Effect: The difference in reading times between the two paragraph types seems more pronounced for dyslexic participants than for non-dyslexic ones.

In summary, the interaction plot indicates that the efficacy of highlighted paragraphs may vary depending on an individual's dyslexic status. This highlights the necessity of considering individual differences when crafting reading materials or interventions.

4. Model Comparison and Selection

Two linear mixed models were compared to determine the best fit for our data:

Model 1 (Simplified Model): This model includes the fixed effects of paragraph type and dyslexic status, their interaction, and a random intercept for subjects.

reading\_time

∼

paragraph\_type

×

is\_dyslexic

+

(

1

∣

subject

)

reading\_time∼paragraph\_type×is\_dyslexic+(1∣subject)

Model 2 (Complex Model): In addition to the fixed effects in Model 1, this model incorporates random slopes for both paragraph type and dyslexic status within subjects.

reading\_time

∼

paragraph\_type

×

is\_dyslexic

+

(

1

+

paragraph\_type

+

is\_dyslexic

∣

subject

)

reading\_time∼paragraph\_type×is\_dyslexic+(1+paragraph\_type+is\_dyslexic∣subject)

Model Comparison Results:

Given these results, Model 2 (the complex model with additional random slopes) is favored over Model 1 for further interpretation and analysis.

3.5 Detailed Analysis of the Selected Model

The selected model indicates an interaction between paragraph type and dyslexic status on reading time. Although the individual effects of paragraph type and dyslexic status aren't statistically significant, their interaction suggests a potential modulation of the effect of paragraph type by dyslexic status. This emphasizes the importance of considering both factors in tandem when assessing reading times.

3.6 Analysis of Correct Response Using a Generalized Linear Mixed Model (GLMM)

To determine the factors influencing participants' correct responses, a generalized linear mixed model (GLMM) with a binomial family (logit link) was employed. The model assesses the effects of paragraph type, dyslexic status, and their interaction while accounting for random intercepts for subjects.

The GLMM analysis indicates that neither the paragraph type nor the dyslexic status, nor their interaction, significantly impact the likelihood of a correct response. The sole significant predictor is the intercept, suggesting that other unexamined factors might influence the correct response. Further exploration and the potential inclusion of additional predictors might help shed light on the factors affecting correct responses.