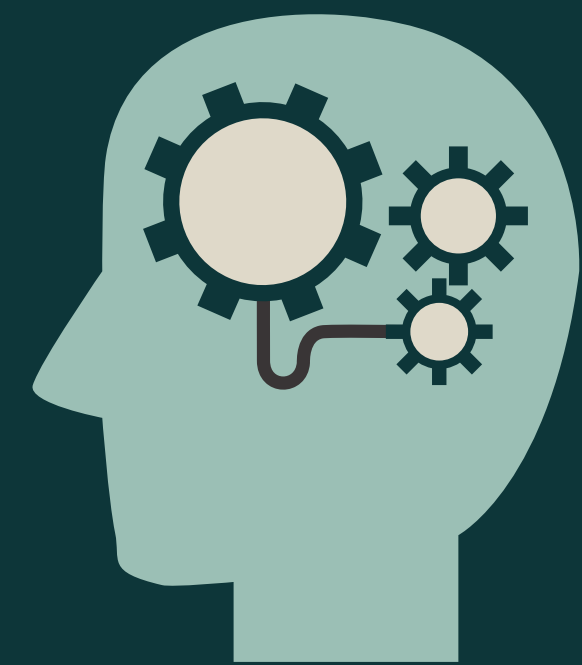


Investigating the Impact of Lexical Quality in Word Processing using Sentence Context with Various Spelling Abilities: Evidence from the N400 ERP Component



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Participants (n=74)

- Native English speaker
- Right-handed
- 18 - 35 years old
- Normal or correct-to-normal vision
- No known neurological abnormalities (self-declared)
- No known cognitive impairments (self-declared)

Results

- Linear Mixed Effects Analysis was used
- Better Spellers elicited a larger N400 amplitude effect across all conditions ($p < 0.05$)
 - Better Spellers elicited a larger N400 amplitude effect when looking at Expected vs. Unexpected ($p < 0.05$)
 - There is no significant interaction for the N400 amplitude effect between Spelling Ability and Expected vs. Neighbor Anomalous Constraint ($p = 0.0595$)

Conclusion

Previous studies have found facilitated retrieval upon encountering critical words for individuals with greater knowledge domain (Troyer et al., 2020). We suggest that the variable of spelling abilities accounts for greater knowledge effects thus facilitates the recognition of an unexpected word eliciting a larger N400 amplitude effect.

References

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How does spelling ability influence the use of context and impact of subsequent stages of processing?

| Sentence Constraints | Examples |
|----------------------|---|
| Expected | Lions at the circus are usually kept in a large cage |
| Anomalous | The hero looked majestic when the wind blew his large red cage |
| Unexpected | The man submitted a custom design for the special cage |

| | Est. | SE | t-value | p-value |
|--|-------|-------|---------|---------|
| Intercept | 2.77 | 0.332 | 8.34 | <0.001 |
| Constrained to Expected vs. Unexpected | 3.13 | 0.273 | 11.5 | <0.001 |
| Constrained to Anomalous vs. Expected | -2.69 | 0.276 | -9.76 | <0.001 |
| Spelling Ability | 0.952 | 0.381 | 2.50 | < 0.05 |
| Spelling: Constrained to Expected vs. Unexpected | 0.72 | 0.326 | 2.22 | < 0.05 |
| Spelling: Constrained to Anomalous vs. Expected | -0.62 | 0.331 | -1.89 | 0.0595 |

Figure 1: Example of experimental trial with target word and a letter probe task

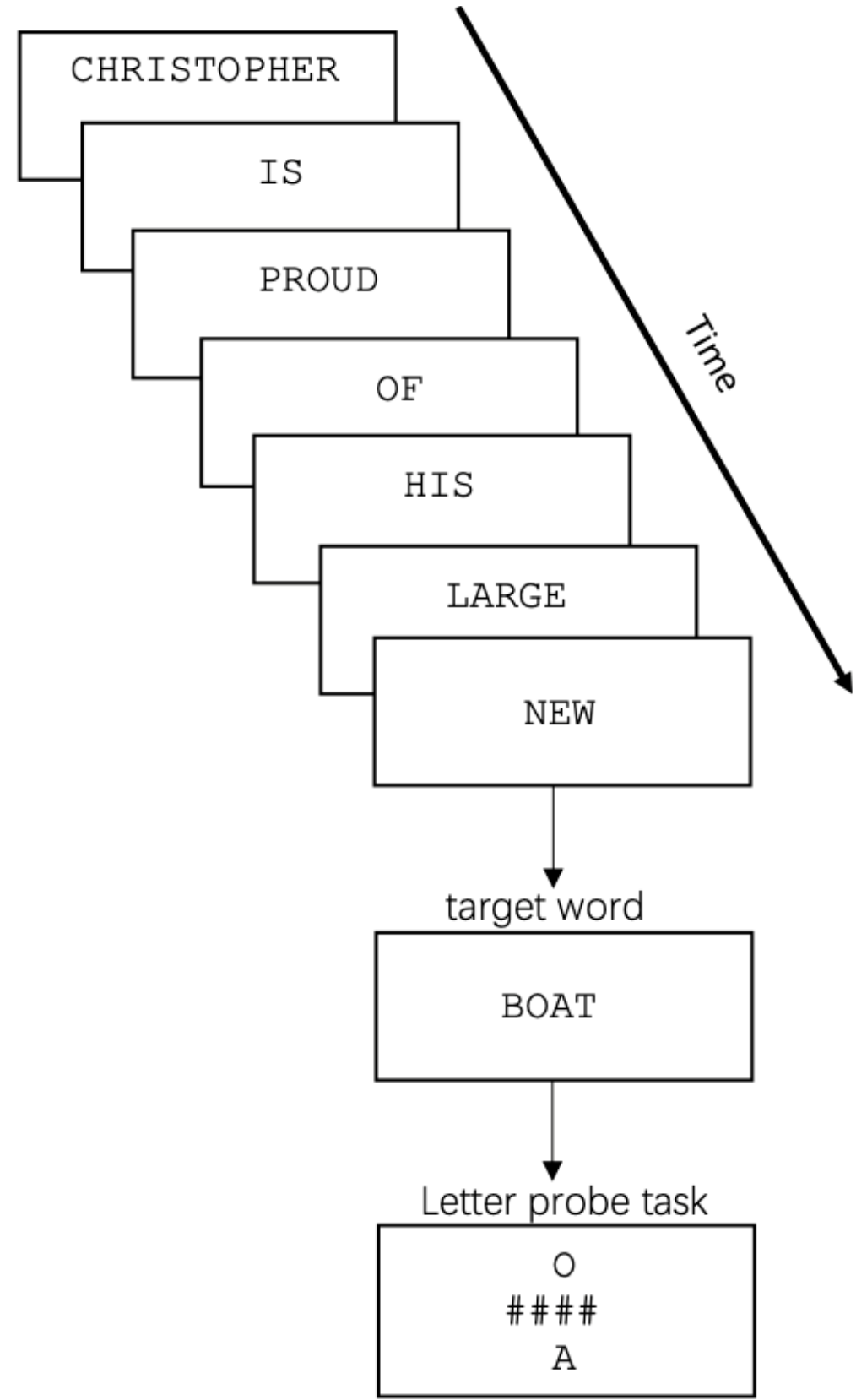


Figure 1 Caption: The participants are presented a sentence using the RSVP paradigm in the center of the screen. Then, they are presented a letter probe task. Each hashtag in the letter probe task represents a letter in the four-letter target word. Participants then select which letter they saw when reading the sentence.

Figure 2: N400 Amplitude as a Function of Sentence Constraint & Participant Spelling Ability

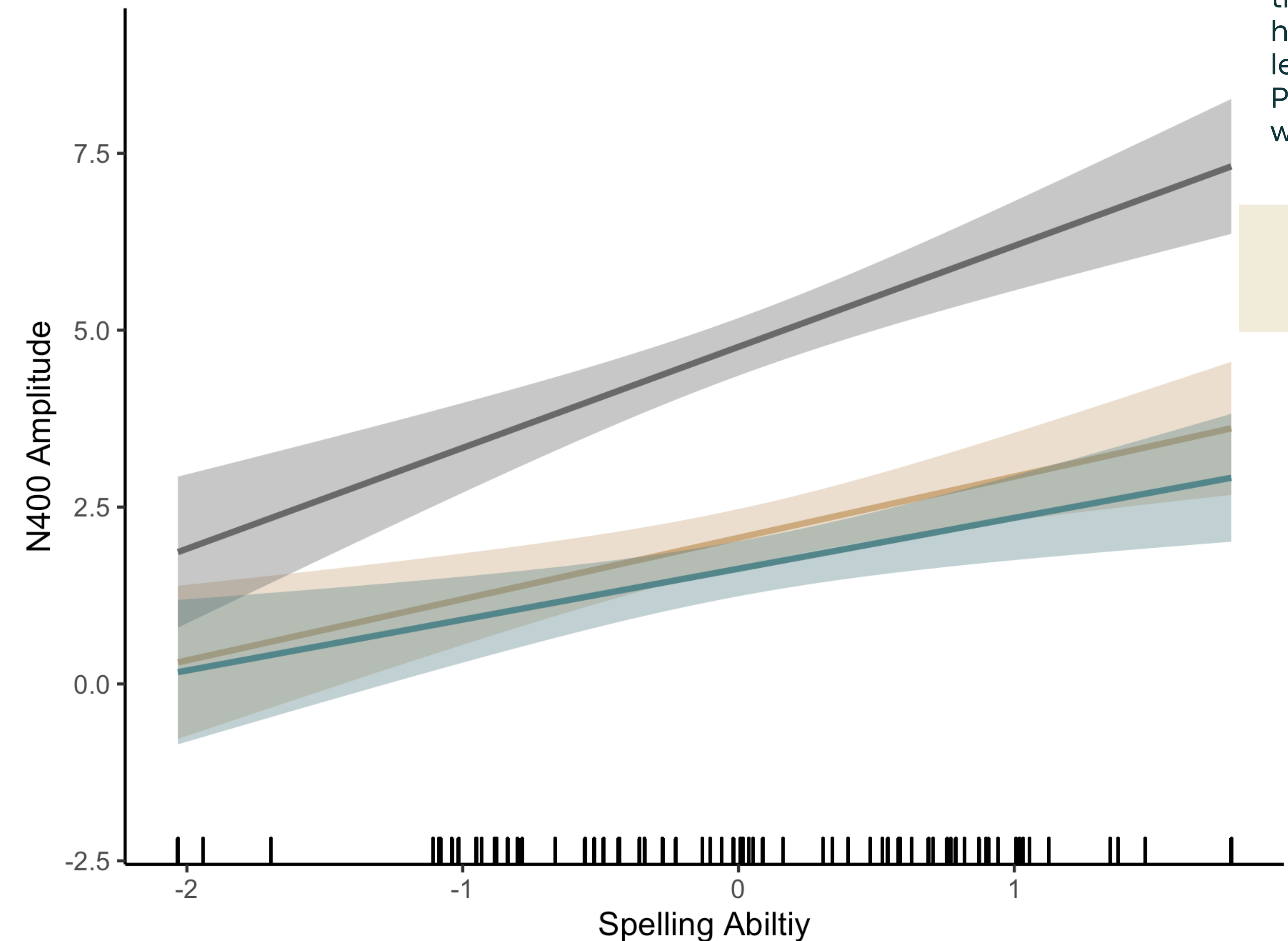
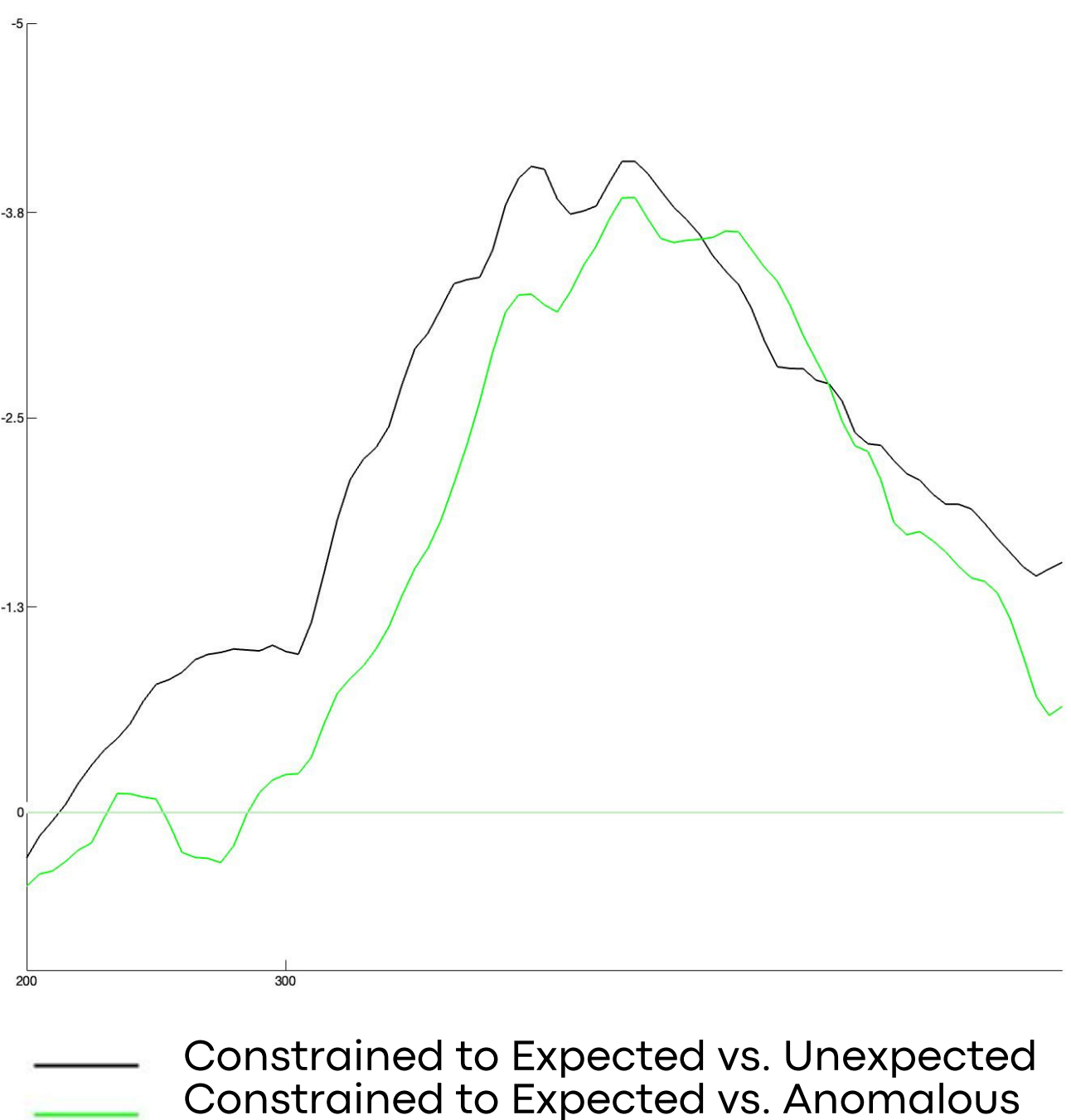


Figure 3: N400 When Comparing Expected to Unexpected & Anomalous Constraints



Introduction

This study examines how people read differently than others by looking at participants with variable spelling abilities and comparing their brain activity (i.e. differences in N400 amplitudes)

- The lexical quality hypothesis states that those with greater representations of words will have better reading and comprehension skills (Perfetti, 2007).
- Individual differences in knowledge have been seen to regulate event-related potentials according to sentence context and ending words (Troyer et al., 2020).
- The N400 is an event-related brain potential with a negative peak 400ms after the target word is displayed. This component is often used in lexical-semantic processing (Kutas & Federmeier, 2011).

Hypothesis

We expect spelling ability to influence the recruitment of context for word recognition (i.e., the N400) or post-lexical integration among unexpected and anomalous neighbor constraining contexts

Constrained to Expected vs. Unexpected

- If better spellers elicit a larger N400 amplitude, then they use more mental effort because they use context information more in the sentence
- If better spellers elicit a smaller N400 amplitude, then they require less mental effort because it is easier to recognize words compared to when there is no supporting context

Constrained to Expected vs. Anomalous Neighbor

- If better spellers elicit a larger N400 amplitude, it is because they require greater mental effort because they are better at discriminating between words that look similar
- If better spellers elicit a smaller N400 amplitude, then it is because of their familiarity with recognizing and identifying words due to greater lexical domain requiring less mental effort

Methodology

- Electroencephalography (EEG) Set Up
- Spelling production assessment: spell words heard from an audio recording (McGrew & Woodcock, 2001).
- Spelling recognition assessment: circle misspelled words (Andrews & Hersch, 2010)
- Other assessments were administered to test reading and language abilities
- Sentences were displayed using a RSVP paradigm as seen in figure 1
- Although some target words appeared in the parafovea, the analysis only focuses on those in the fovea

