

Stress and rhythm patterns as elements of contextual predictions in silent reading



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Background

- Reading = higher cognitive process consisting of several **lower-level mental representations**
- One of these mental representations is sound-based, sometimes presented *textually*
- Stress/rhythm patterns are *not represented textually*, so any expression of them suggests a connection between silent reading tasks and the use of the **inner voice** [1]
- Extensive prior literature suggests the existence of the **mental lexicon** [2], which stores words based on their linguistic characteristics
- Parafoveal preview** allows for processing a word before we look at it

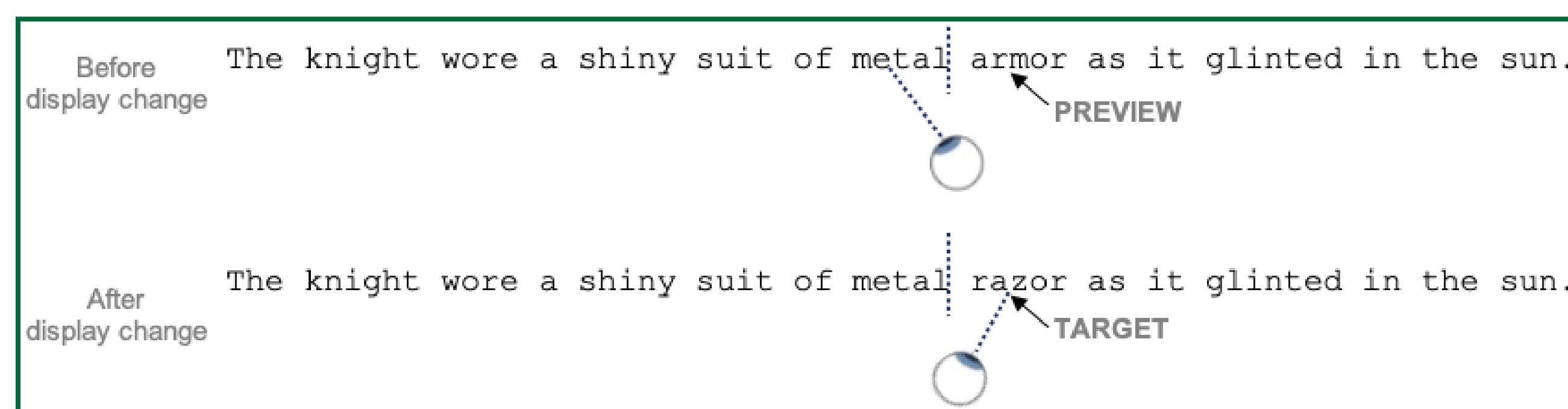


Figure 1 Gaze-contingent boundary paradigm [3]

Are **stress patterns**, which are *not textually* represented, activated with the use of the **"inner voice"** in silent reading?

Method

Participants: 36 USF students

Eye movements were recorded (SR Research EyeLink 1000) while participants read 144 experimental sentences (48 per condition)

Parafoveal preview manipulated using the **gaze contingent boundary paradigm**

2x3 design:

Constraint	Sentence	Pre-target	Preview Condition		
			Identical	Matched	Mismatched
High	The knight wore a shiny suit of	metal	armor	razor	canal
Low	John went to the museum and watched the	historic	armor	razor	canal

Table 1 Sample stimuli with different target words for each condition

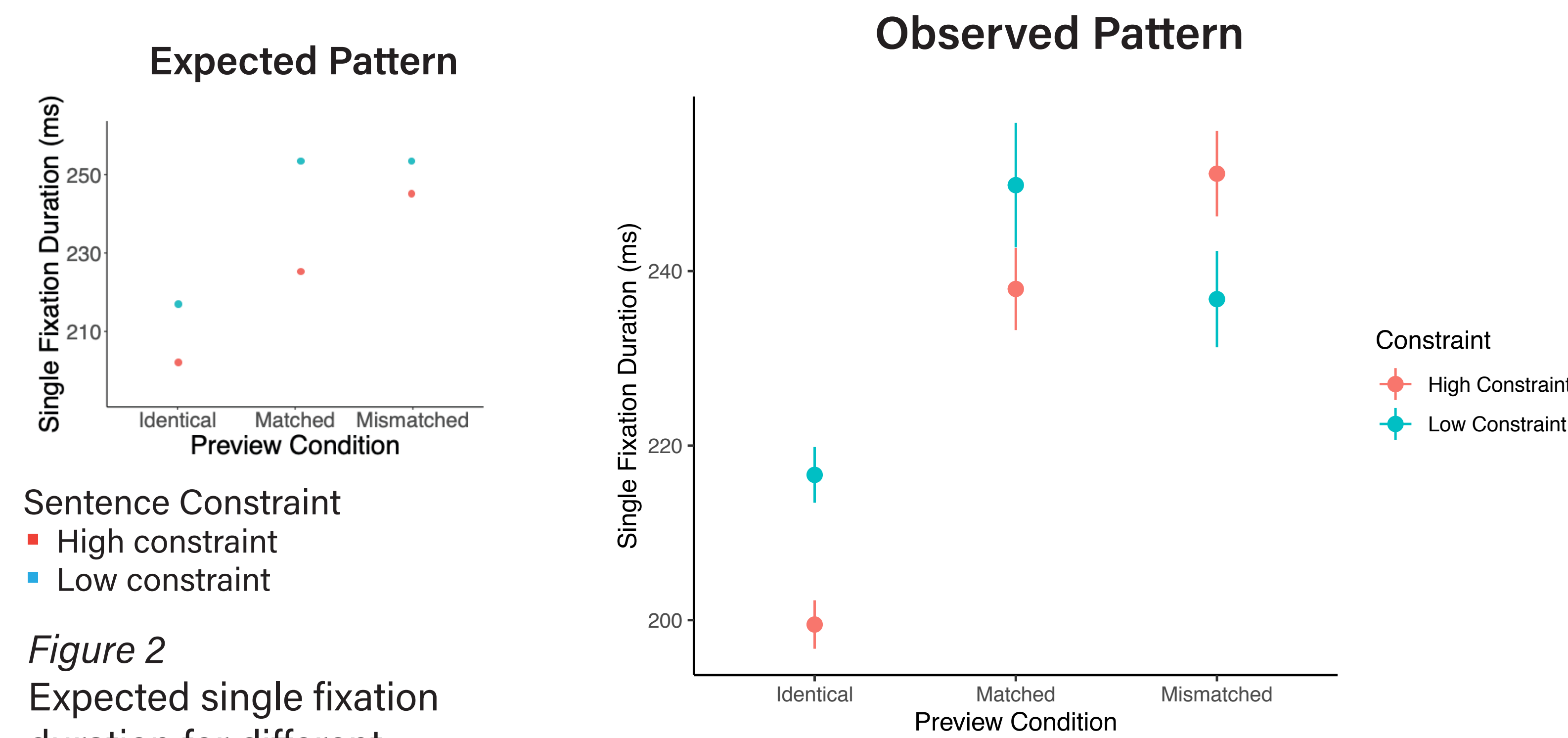


Figure 2 Expected single fixation duration for different preview conditions and sentence constraints

Figure 3 Actual single fixation duration for different preview conditions and sentence constraints

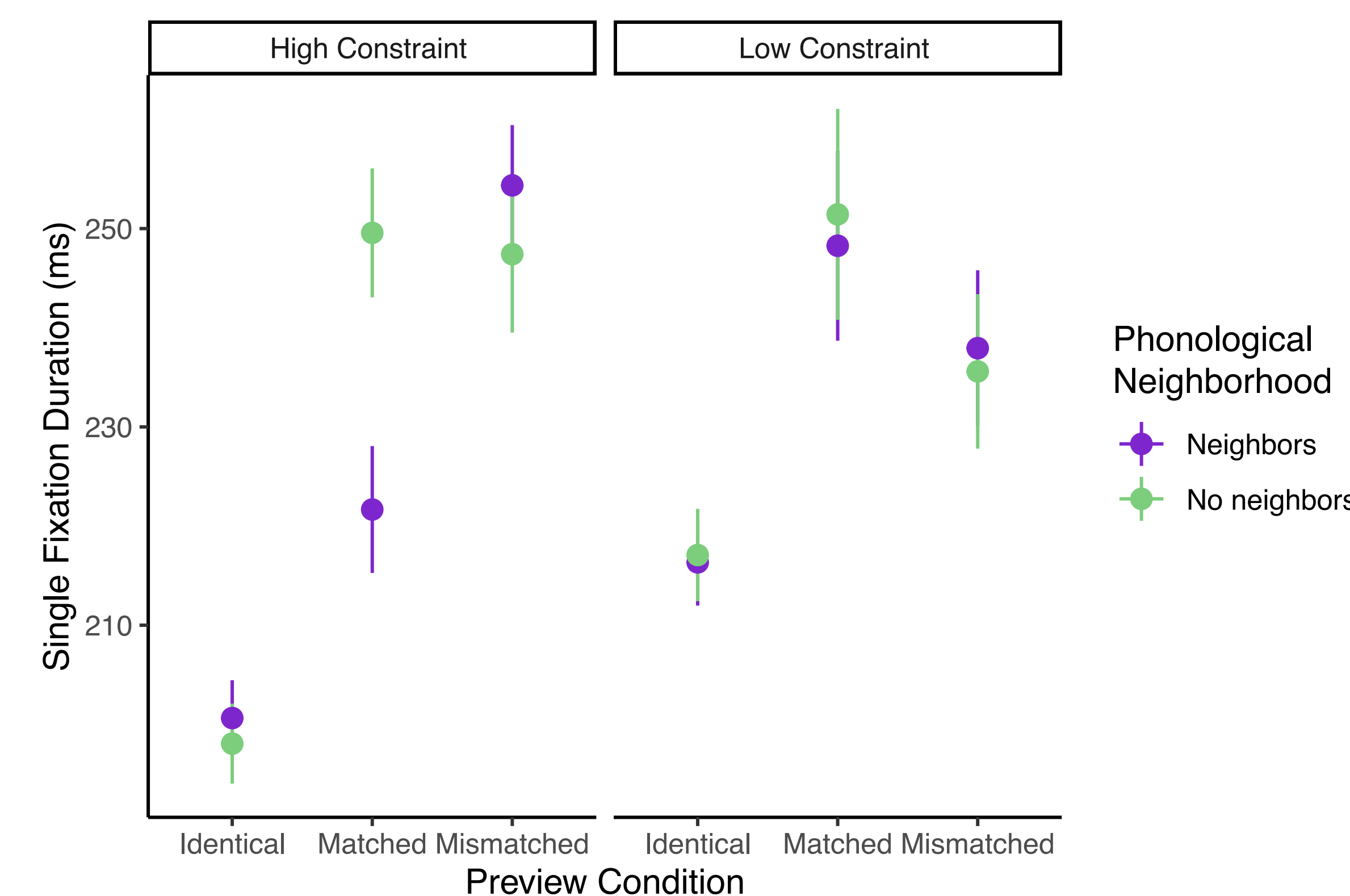


Figure 4 Single fixation duration for different preview conditions based on constraint and phonological neighbors

Statistical Analysis

Fixed effects	Estimate	Std. Error	t value
(Intercept)	229.425	5.310	43.209***
Matched vs. identical	32.699	4.066	8.042***
Mismatched vs. matched	-1.369	4.797	-0.285
Constraint	-5.465	3.469	-1.576
Phonological neighborhood	1.548	3.933	0.393
Matched vs. identical × Constraint	1.054	7.898	0.133
Mismatched vs. matched × Constraint	24.953	9.281	2.689**
Matched vs. identical × Phonological neighborhood	5.140	8.861	0.580
Matched vs. identical × Phonological neighborhood × Constraint	-3.770	10.456	-0.361
Constraint × Phonological neighborhood	14.972	6.938	2.158*
Matched vs. identical × Constraint × Phonological neighborhood	25.937	15.978	1.623
Mismatched vs. matched × Constraint × Phonological neighborhood	-21.146	18.603	-1.137

Table 2 LMER analysis; significance codes: 0.001 ***; 0.01 **, 0.05 *

Linear mixed-effects regression **excluding** low plausibility sentences

- Significant difference between **stress conditions** ($t = 8.04$)
- Significant interaction between **stress conditions & constraint** ($t = 2.69$)
- Significant interaction between **constraint & phonological neighborhood** ($t = 2.16$)

Discussion

- Prosody is a **subset** of phonology
- In order for preactivated information to help in processing, the parafoveal **preview must match the expectation** generated by constraint
- High constraint **facilitates expectations of upcoming words**; based on these expectations, we can **access** specific phonological and stress-related characteristics
- Low constraint = **expectations unlikely**; harder to access phonological information, thus **harder to access** stress-related information

Conclusions & Future Direction

- Processing during silent reading is most facilitated in **highly constrained and phonologically common environments**
- Phonology **facilitates activation** of stress pattern information in high constraint environments, where expectations are present
- Follow-up study will incorporate **stimulus redesign** to **strictly control** phonological neighborhood and stress patterns between conditions

Preliminary Results

- Highly constrained words with phonological neighbors **maintained the expected pattern**
- Low constraint **violated the expected pattern** regardless of presence of phonological neighbors
- Mismatched & matched** processing time > identical processing time

References

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- Rayner, K. (1975). The perceptual span and peripheral cues in reading. *Cognitive Psychology*, 7(1), 65-81.

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