

Dissociating Effects of Predictability, Preview and Visual Contrast on Eye Movements and ERPs

**Jon Burnsky¹, Franziska Kretzschmar², Erika Mayer¹,
Lisa Sanders¹ and Adrian Staub¹**

`jburnsky@umass.edu`

Predictability Effects

Do the First Fixation Duration and the N400, measures that regularly show predictability effects, reflect the same process(es)?

Or do they reflect separate processes, both influenced by lexical predictability?

Coregistration

We used the “coregistration” paradigm to investigate the effects of 2 well-studied manipulations in the reading literature on the N400.

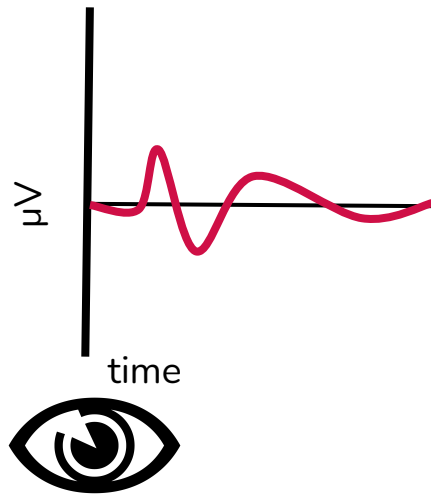
If the patterns in the data turned out to be the same between the First Fixation Duration and the N400, it might suggest they reflect (some of) the same process(es).

Dissociations more definitively suggest otherwise.

Coregistration

Fixation-Related Potentials (FRPs):

We timelock the raw EEG to the onset of fixations creating an FRP for each fixation

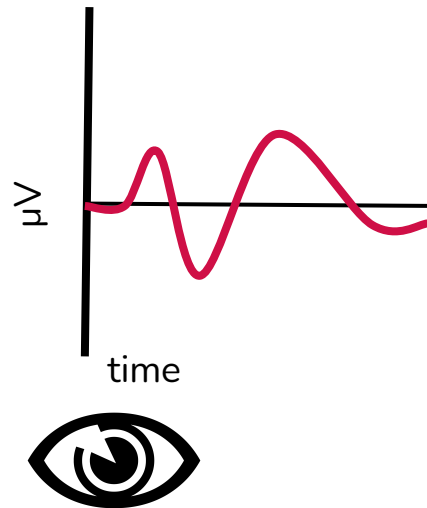


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Coregistration

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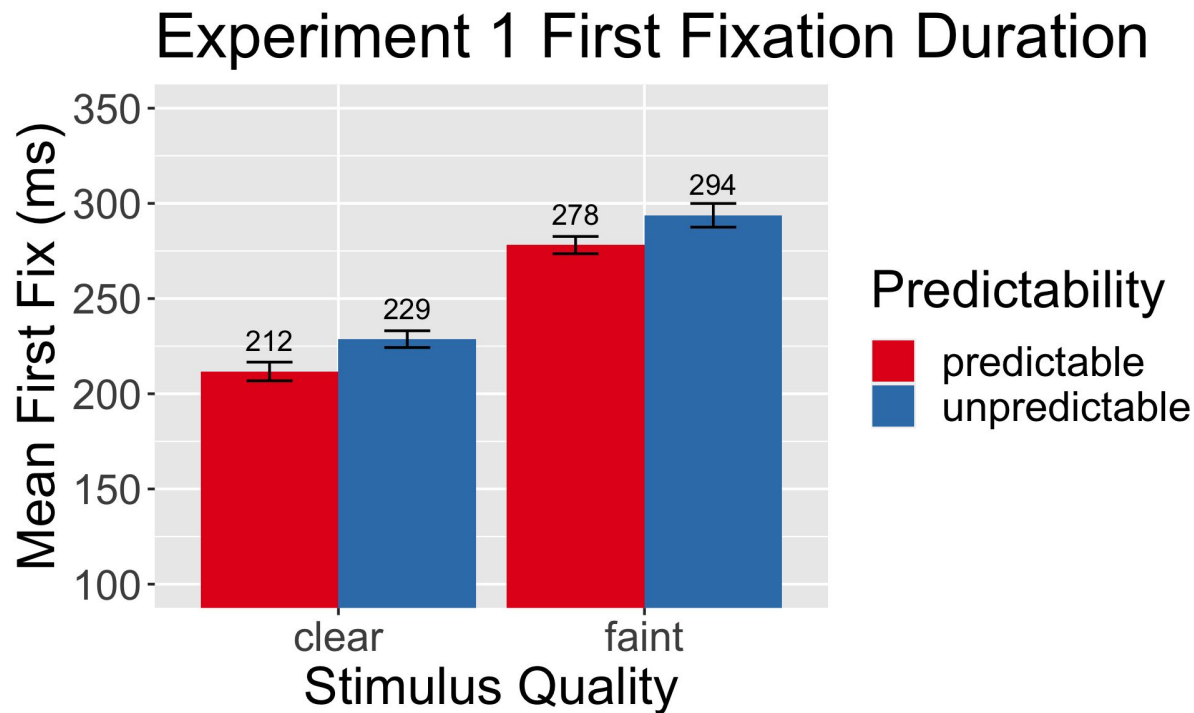
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Experiment 1: Predictability x Stimulus Quality

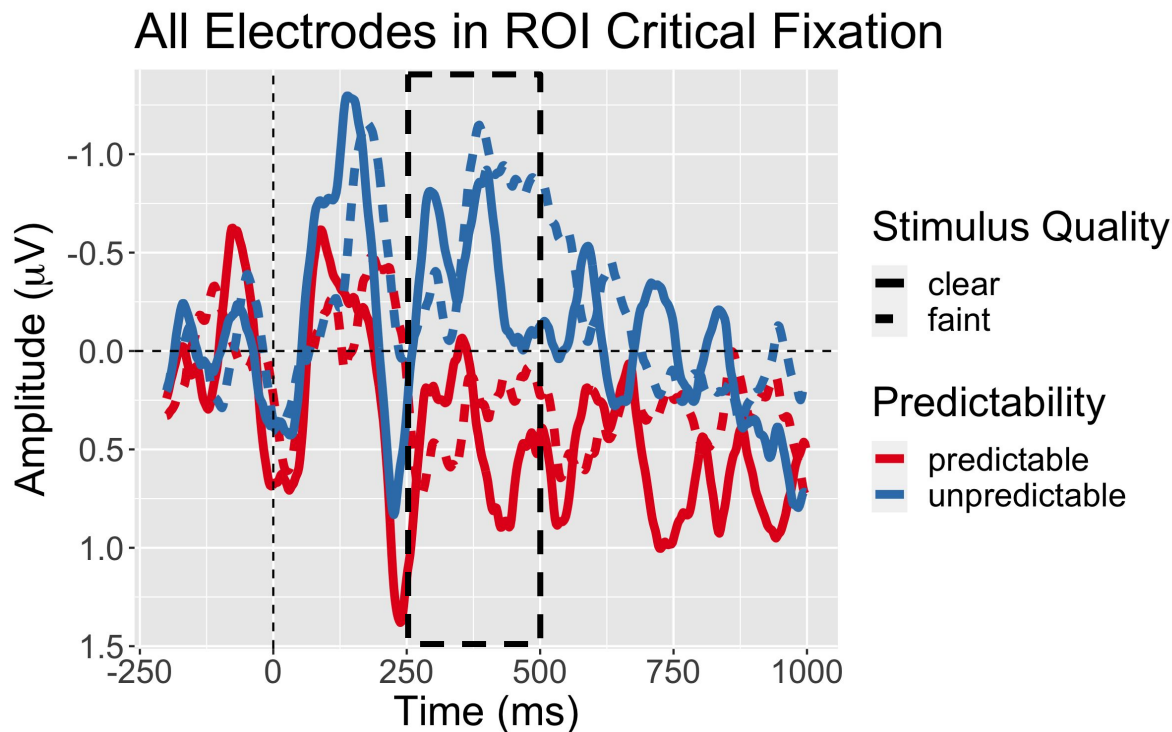
	Predictable Target	Unpredictable Target
Clear Text	The package was sent through the <u>mail</u> two weeks ago.	If in two weeks, nobody claims the <u>mail</u> it will be thrown out.
Faint Text	The package was sent through the <u>mail</u> two weeks ago.	If in two weeks, nobody claims the <u>mail</u> it will be thrown out.

$N_{\text{subjects}}=25$; $N_{\text{items}}=180$; blocked by Stimulus Quality

Experiment 1: Predictability x Stimulus Quality



Experiment I: Predictability x Stimulus Quality



Experiment I: Predictability x Stimulus Quality

The predictability effect was present in both measures.

The stimulus quality effect only surfaced in the eye tracking data; faint text led to neither an increase in the N400's amplitude nor a delay in the N400's onset.

The Predictability Effect in Reading Depends on Valid Preview

- Staub and Goddard (2019) demonstrated the predictability effect in reading disappears when the reader is denied valid parafoveal preview of the target word.



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* Parafoveally previewing “mail” *

The Predictability Effect in Reading Depends on Valid Preview

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✓ Predictability Effect

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* Parafoveally previewing “exit” *

The Predictability Effect in Reading Depends on Valid Preview

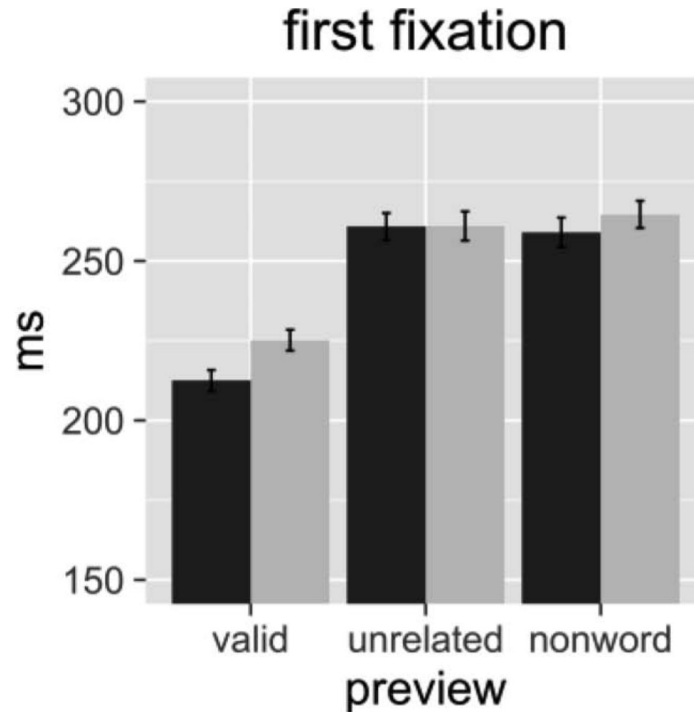
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✗ Predictability Effect

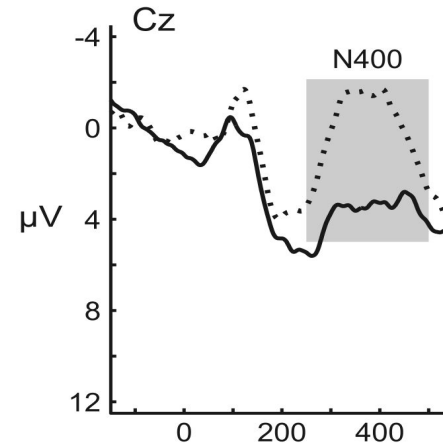
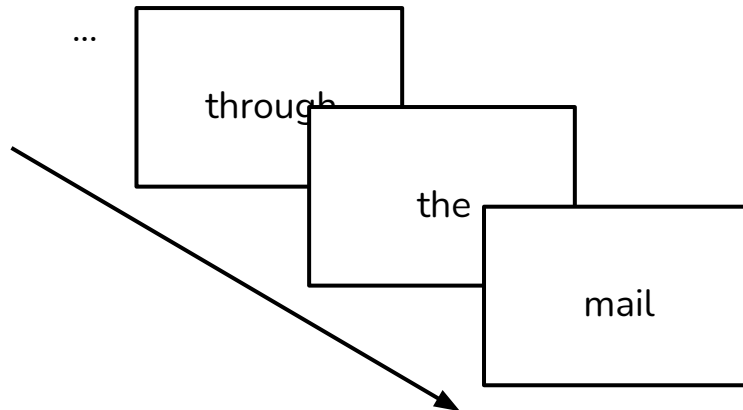
The Predictability Effect in Reading Depends on Valid Preview



Staub and Goddard (2019)

In RSVP ERP studies, there is no preview but still a predictability effect

- However, predictability effects are regularly observed in ERP studies which utilize RSVP which denies readers preview of the target word.

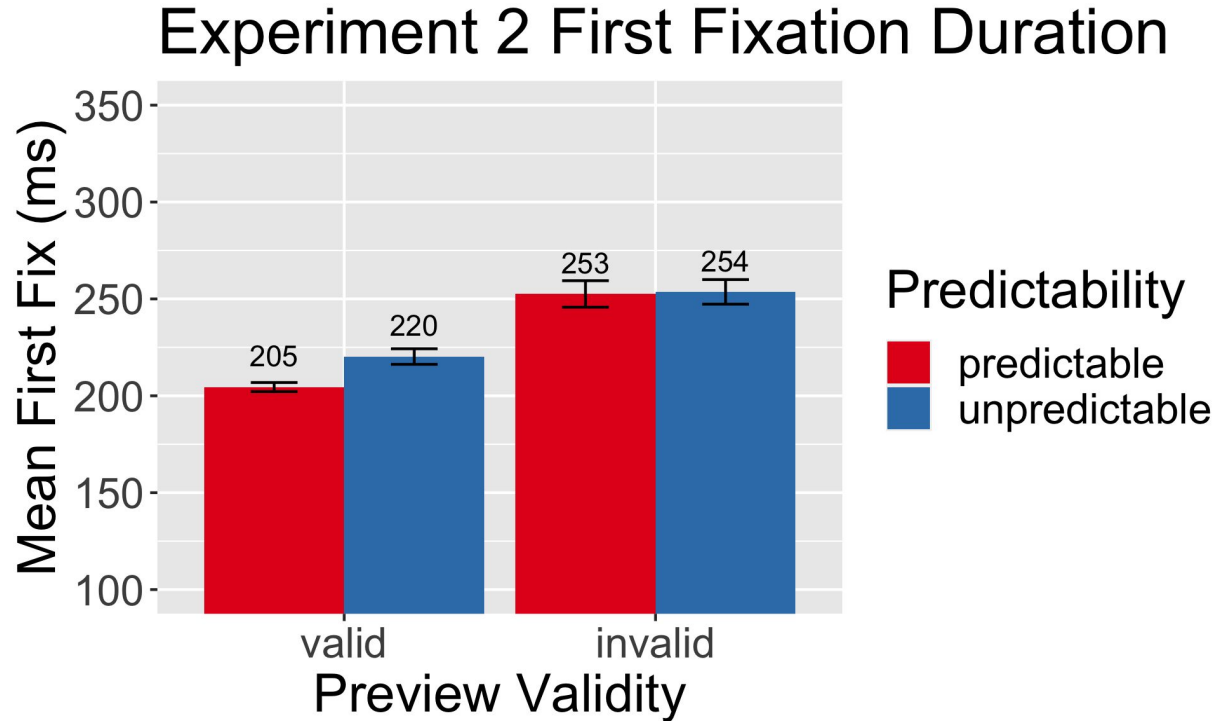


Experiment 2: Predictability x Preview Validity

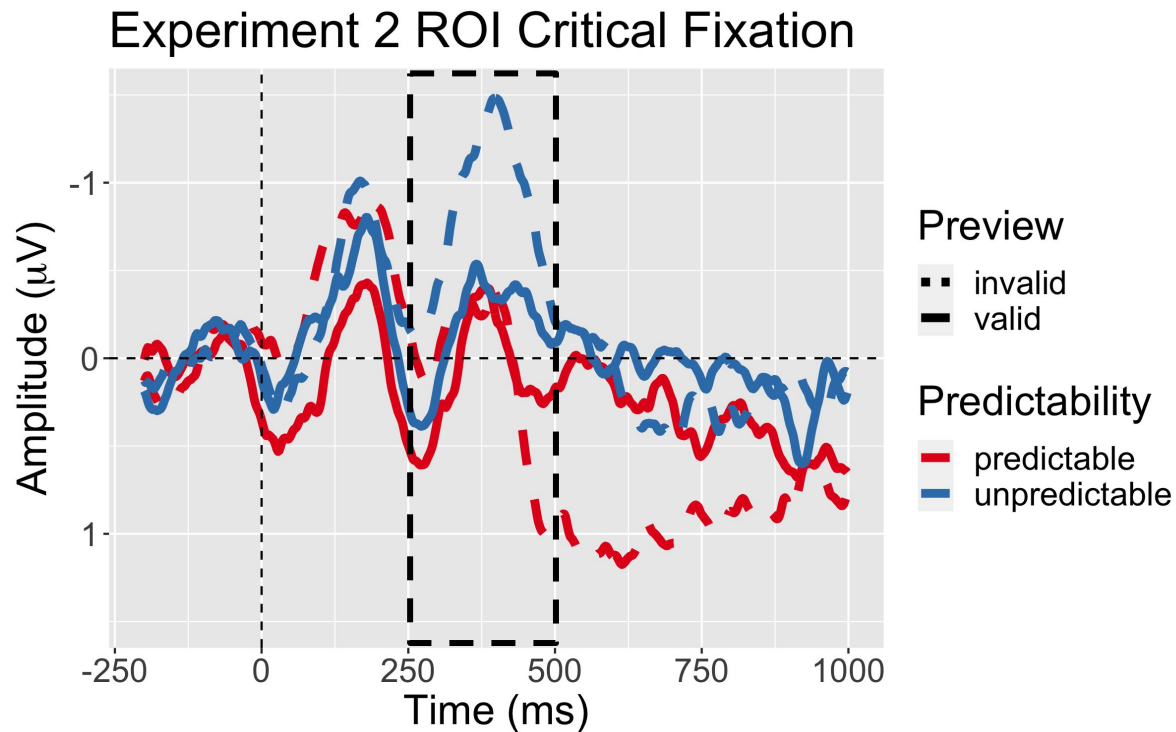
	Predictable Target	Unpredictable Target
Valid Preview	The package was sent through the <i>mail</i> <u>mail</u> two weeks ago.	If in two weeks, nobody claims the <i>mail</i> <u>mail</u> it will be thrown out.
Invalid Preview	The package was sent through the <i>exit</i> <u>mail</u> two weeks ago.	If in two weeks, nobody claims the <i>exit</i> <u>mail</u> it will be thrown out.

$N_{\text{subjects}}=33$; $N_{\text{items}}=180$; Randomized

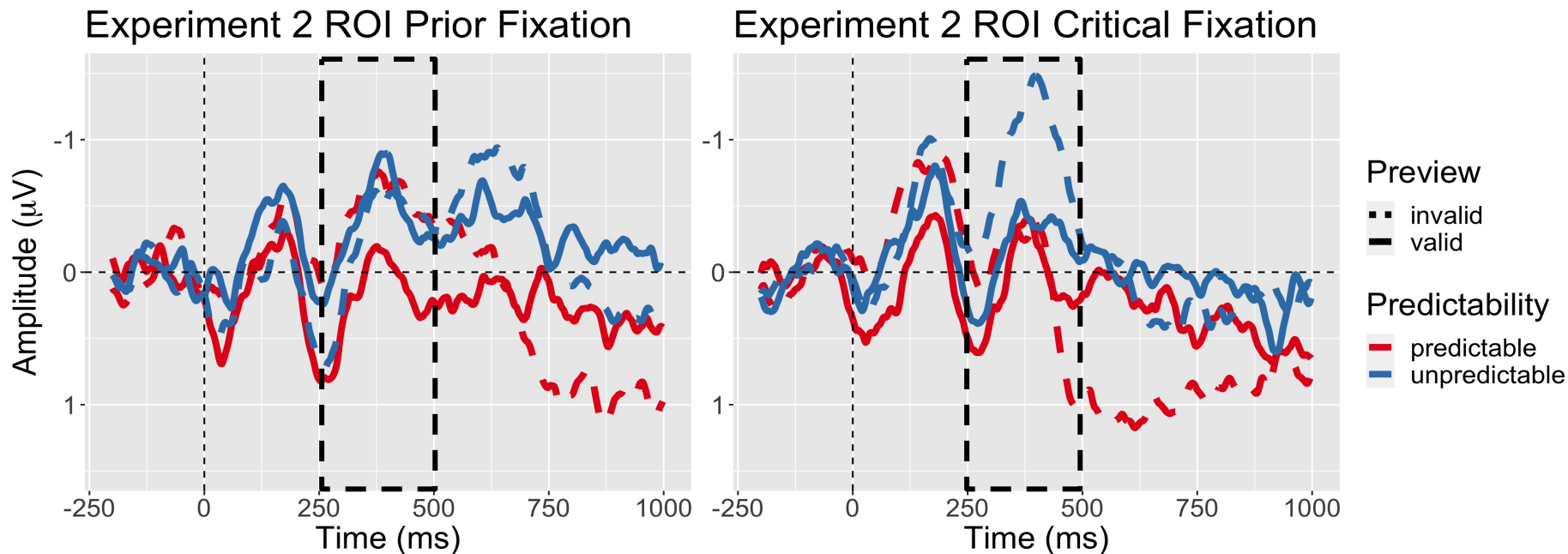
Experiment 2: Predictability x Preview Validity



Experiment 2: Predictability x Preview Validity



Experiment 2: Predictability x Preview Validity



Experiment 2: Predictability x Preview Validity

The predictability effect in the first fixation was absent in the invalid preview condition.

Preview validity also influenced the predictability effect in the FRPs.

- With valid preview, the predictability effect on the N400 was observed when the reader was fixating the previous word.
- With invalid preview, the predictability effect began only after fixation.

The FRPs showed the exact opposite pattern of the first fixation.

Conclusions

Lexical predictability influences these measures separately

The First Fixation appears to be sensitive to manipulations that affect early lexical processing

The N400 does not, suggesting it indexes something later (full lexical/conceptual access)

Thank you!!

Special Thanks to:

Brian Dillon in particular and the rest of the UMass Psycholinguistics community for helpful discussion.

Megan Agro, Dawn Bissessar, Eunji Choi, Serene Elbach, Alex Green, Amber Hughes, Subin Jung, Colin McDermott, Leo Stern, Robin Striar, Tiffini Tam, Cora Vitale & Tiffini Vo and Kuan-Jung Huang for assistance with data collection.

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Supplemental Materials

Analyses:

ERPLAB for EEG preprocessing and RoboDoc/EyeDry for Eye Movements.

N400 window ANOVA: Baseline corrected (-200-0ms); ANOVA over subject means for 250-500ms.

50ms bin ANOVAs: Baseline corrected (-200-0ms); Ran ANOVAs over subject means for 50ms bins from 0 to 600ms for timing differences.

Linear Mixed Effects Model: Average voltage in 250-500ms window predicted from baseline average and conditions:

`N400 ~ baseline * predictability * preview + (1 | subjects) + (1 | items)`

Supplemental Materials

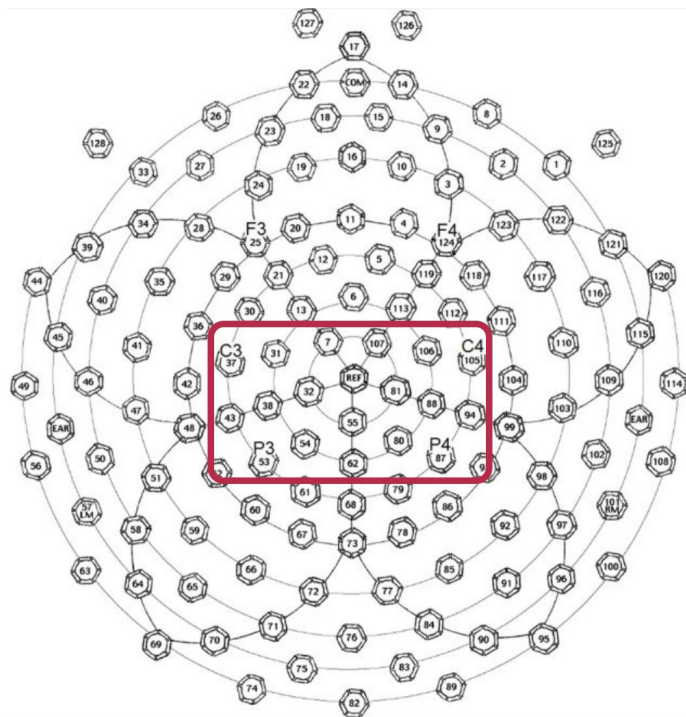
Exclusion Criteria:

- Trials with blinks on the critical word
- Trials with extreme voltages ($\pm 100\mu\text{V}$)
- Subjects with <10 remaining trials in at least 1 condition
- Subjects with electrode bridging

Experiment 1: 33 run: 25 analyzed and 8 removed

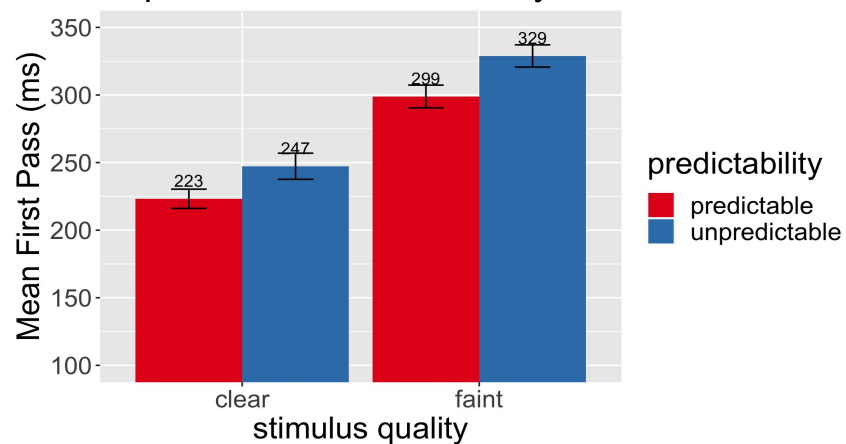
Experiment 2: 40 run: 33 analyzed and 7 removed

Supplemental Materials

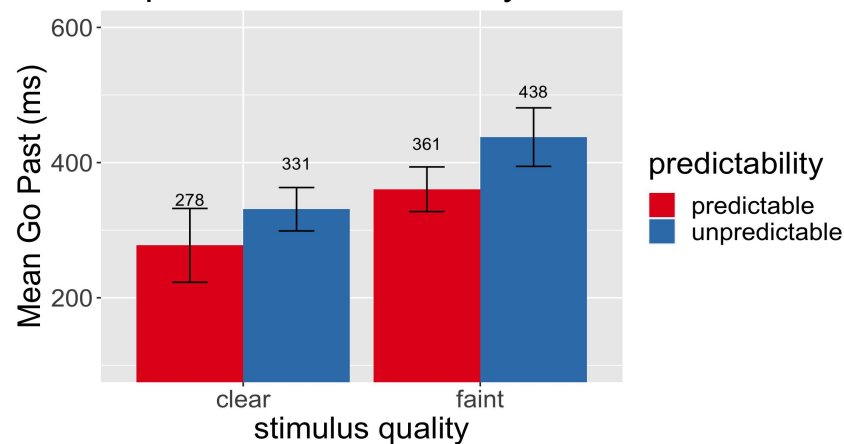


Supplemental Materials

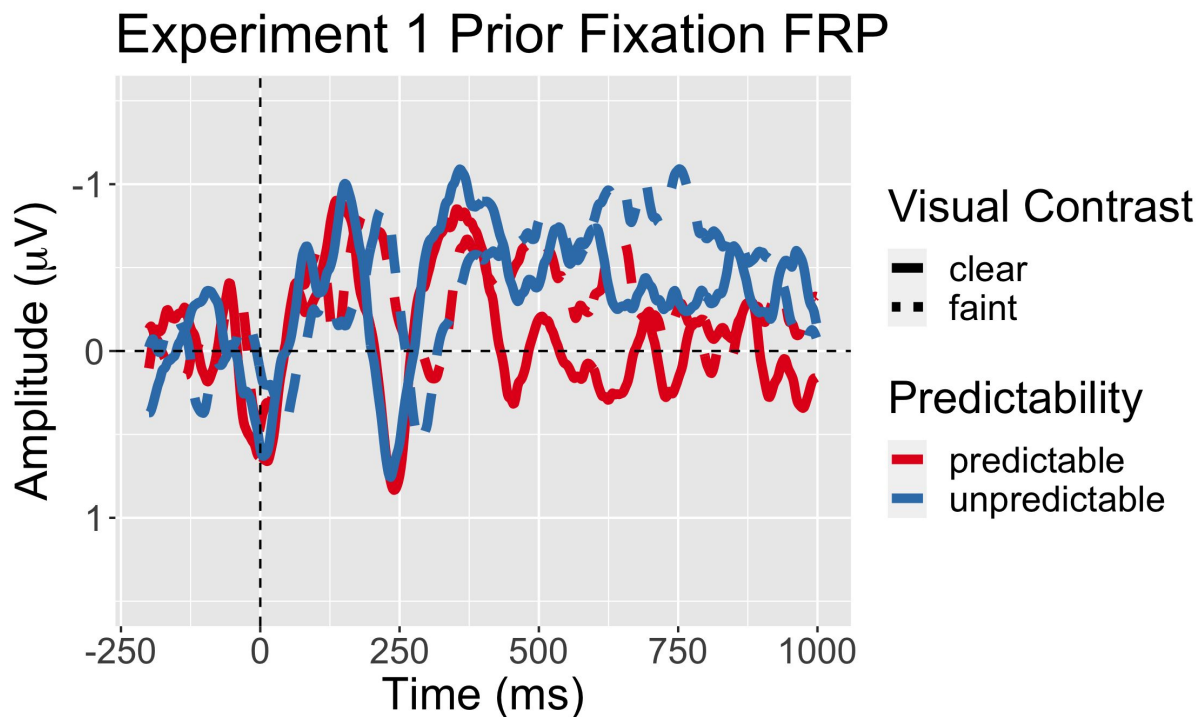
Experiment 1 First Pass by Condition



Experiment 1 Go Past by Condition



Supplemental Materials



Supplemental Materials

