The Time Course of Meaning Construction with Varying Expectations

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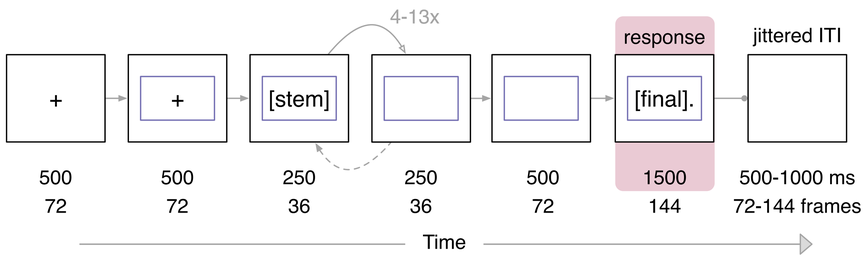
Introduction

- The N400 ERP is a neural correlate indexing semantic processing in the brain [1]
- Mechanistic theories of the N400 implicate the roles of prediction, priming, and bottom-up sensory integration in language comprehension
- However, mechanisms explaining volitional aspects of semantic meaning construction are not fully understood

Method

- Participants were presented 400 sentences one word at a time and were instructed to determine whether the sentence made sense at the final word via button press
- Stimulus creation was based on a normed stimulus set of 200 sentences with the highest cloze probabilities [2]
- Sentence endings were either sensibly connected (SC) or unconnected (UC) to the sentence stem and were presented in equal proportions (50/50 split)

cued Sentence Verification Task (cSVT)



- Words were surrounded by three different colored boxes that cued participants' expectations:

[final.]

Sentence will make sense

- SC - Valid - Vic asked her to repeat what she had said.
- UC - Invalid - The baby bird was ready to learn to said.

[final.]

Sentence will not make sense

- SC - Invalid - The kids fed the ducks some stale bread.
- UC - Valid - The athlete enjoyed lifting weights at the bread.

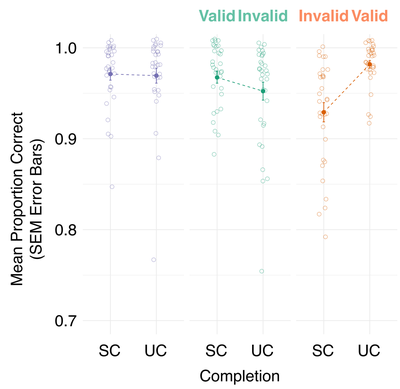
[final.]

Sentence will either make or not make sense

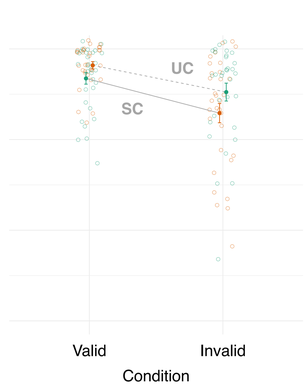
- SC - Neutral - Jesse ran the race at a slower pace.
- UC - Neutral - He had a long day and was in a bad pace.

- Trial presentations were weighted such that sentences were validly, invalidly, and neutrally cued 60/20/20% of the time, respectively, incentivizing participants to utilize the cues
- N400 comparisons were optimized by counterbalancing final words within-subjects, while sentence stems and button presses were counterbalanced between-subjects
- Behavioral performance and N400 mean amplitudes were analyzed using a model comparison approach to within-subjects regression (i.e., multilevel modeling) [3]
- Orthogonal contrasts for completion type (SC vs. UC) and condition (Neutral vs. Valid + Invalid; Valid vs. Invalid) and their interactions were used to calculate within-subjects dependent variable composites
- Data were collected from 32 right-handed native English speakers (age $M = 24.1$, $SD = 5.17$ years; education $M = 15.50$, $SD = 2.23$ years; 19 females)

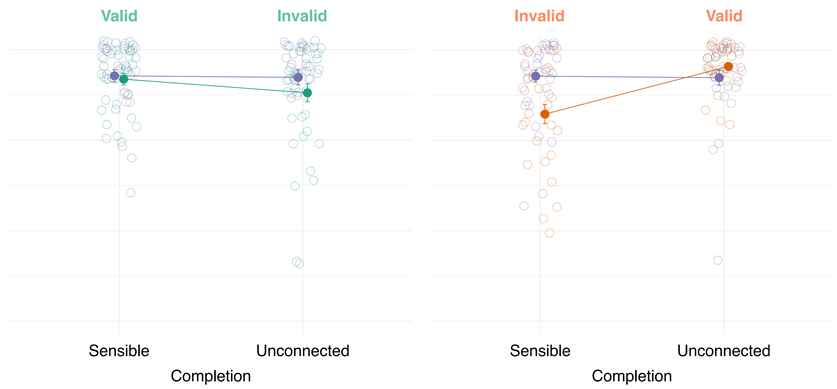
Proportion Correct Results



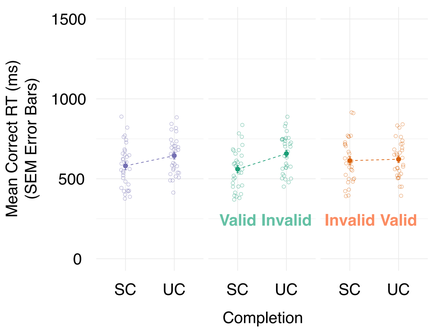
a priori



post-hoc Neutral Comparisons



Correct RT Results



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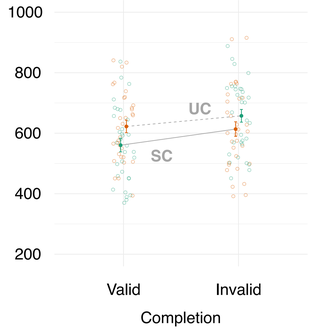
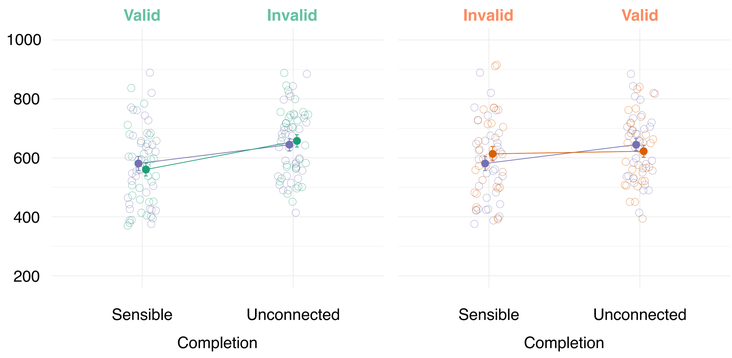
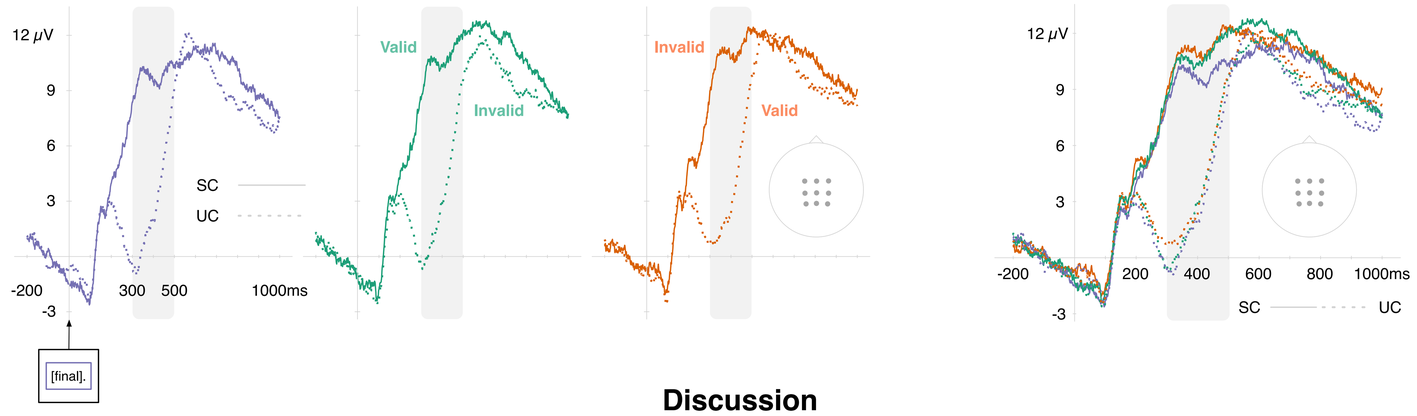


post-hoc Neutral Comparisons



Grandaveraged N400 Results



Discussion

- Colored cues modulated participant expectations by improving performance (better accuracy and faster reaction times) for valid vs. invalid conditions
- Despite the cues' ability to modulate performance, N400 mean amplitudes were affected only by completion type and not by condition (validity)
- These results suggest that volitionally generated expectancies do not dramatically affect neural signatures of semantic access, but ultimately lead to additional processing responsible for resolving discrepancies between semantic congruency and expectancy

References

[1] Kutas, M., & Federmeier, K. D. (2011). Thirty years and counting: finding meaning in the N400 component of the event-related brain potential (ERP). Annu Rev Psychol, 62, 621-647.

[2] Block, C. K., & Baldwin, C. L. (2010). Cloze probability and completion norms for 498 sentences: behavioral and neural validation using event-related potentials. Behav Res Methods, 42(3), 665-670.

[3] Judd, C. M., McClelland, G. H., & Ryan, C. S. (2017). Data Analysis: A Model Comparison Approach to Regression, ANOVA, and Beyond (Third ed.). New York, NY: Routledge.

Acknowledgements

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