Maze Correlates of N400 Responses in English Argument Structure Processing

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Can a behavioral tasks like **maze** provide insight into whether apparent 'delays' in argument structure processing are due to timing or the presence of intervening linguistic material? YES!

Background

Chow et al. (2016) proposal: **slow prediction** for structurally-sensitive argument structure predictions such as predicting the **verb** based on **specific argument roles**.

Empirical support: No N400 observed for low cloze verb in structurally-sensitive argument reversal stimuli (1-2), vs. lexically-biased argument substitution (3-4).

Chow et al. (2018): N400 with more intervening words (time?).

Stimuli

Table 1: Chow et al (2016) Exp 1 Stimuli. 120 pairs, 60 per type.

Ex	Sentence	Type	Cloze	N400
1	...which **customer** the **waitress** had **served** ...	rev	high	
2	...which **waitress** the **customer** had **served** ...	rev	low	N
3	...which **tenant** the **landlord** had **evicted** ...	sub	high	
4	...which **realtor** the **landlord** had **evicted** ...	sub	low	Y

Table 2: Kutas (1993) Stimuli. 60 pair subset.

Ex	Sentence	Type
5	She put on her high heeled **shoes**.	Highest cloze
6	She put on her high heeled **boots**.	Related to highest cloze
7	They went as far as they **dared**.	Highest cloze
8	They went as far as they **could**.	Unrelated to highest cloze

Current Study

Goal: test slow prediction hypothesis by lengthening argument-verb SOA via the maze task (see right).

Prediction: RTs will be longer for low cloze verbs in both substitution AND reversal stimuli.

Stimuli from Kutas (1993) to confirm "classic" N400-associated effect (Table 2).

Results

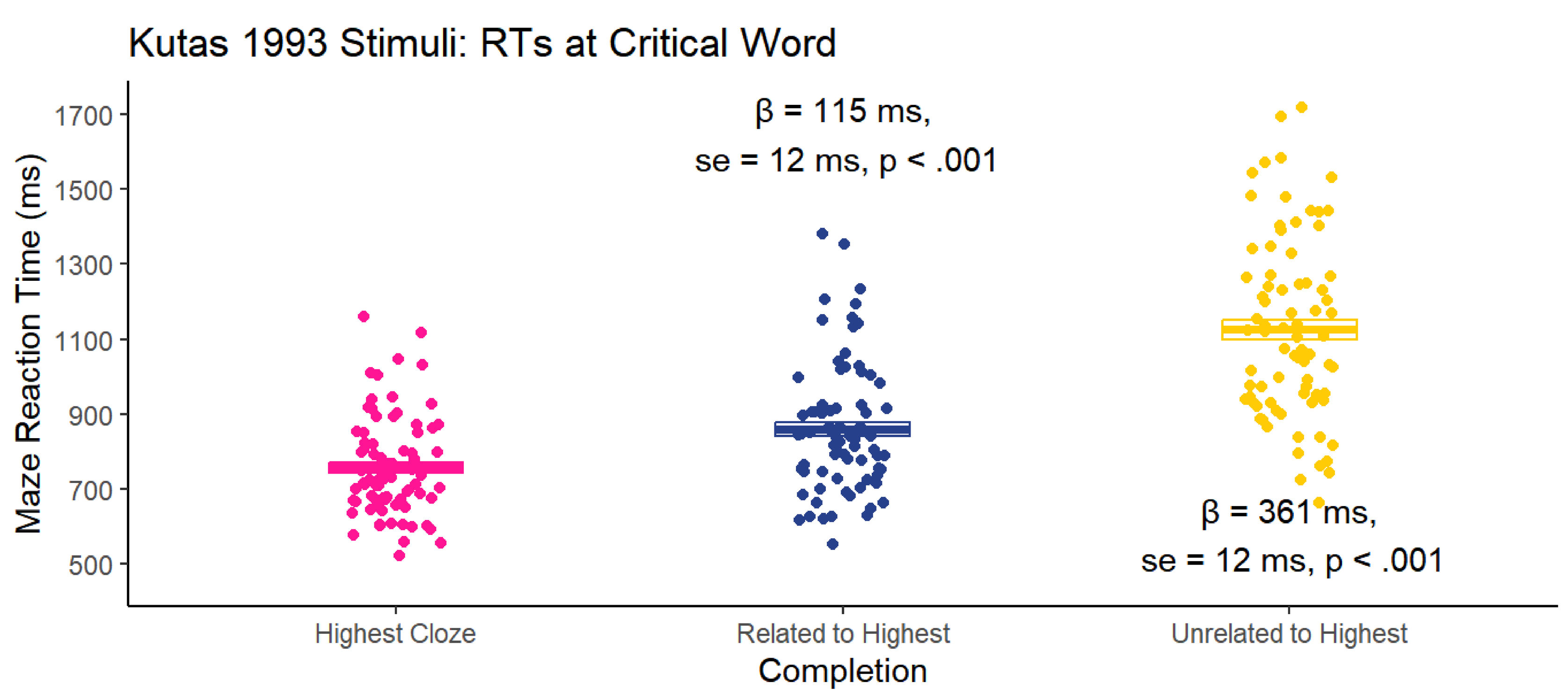


Figure 1: Points represent participant means. Crossbars represent mean and standard error. lmer(log(rt) ~ relatedness + (1|part) + (1|item))

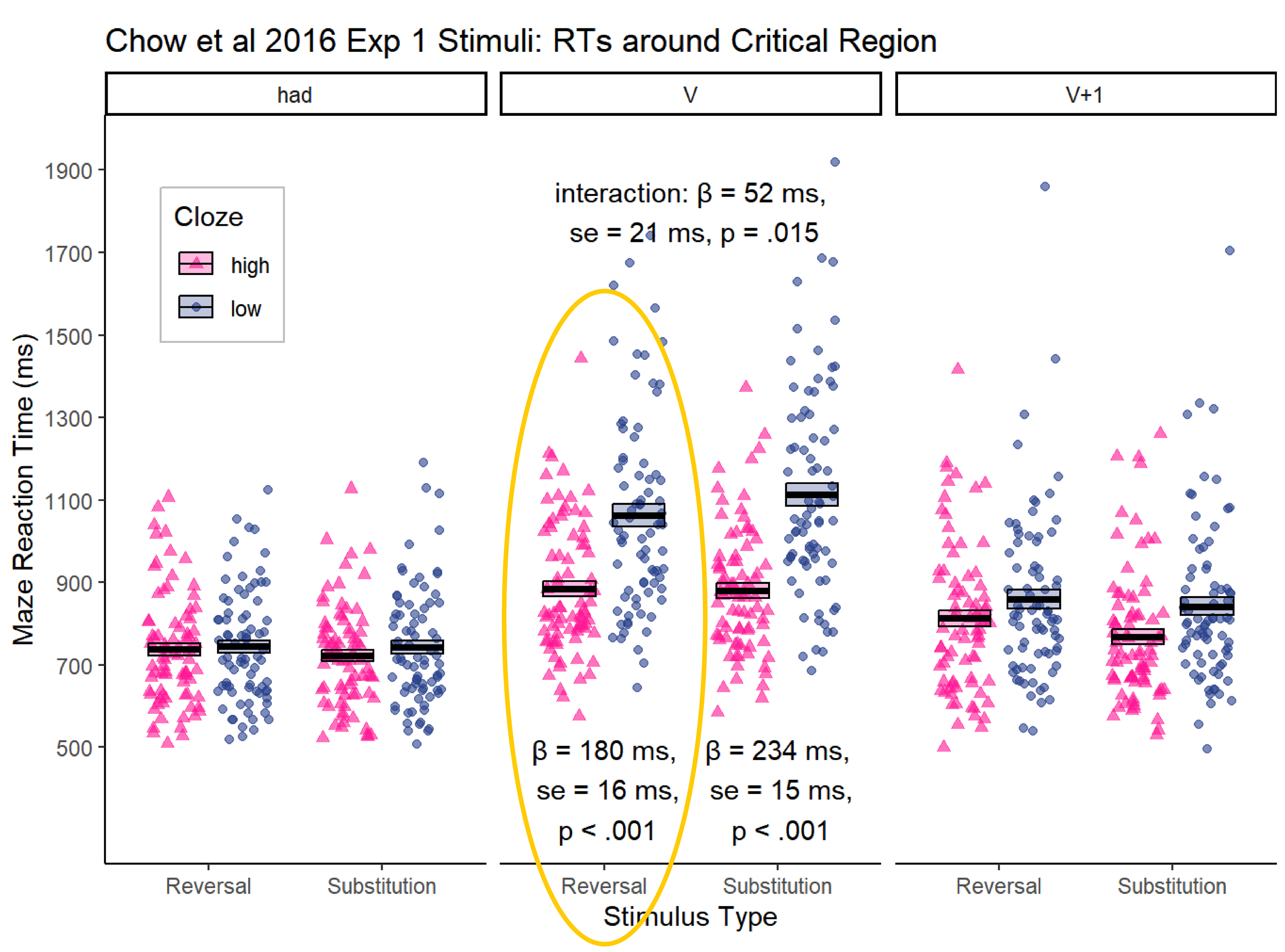
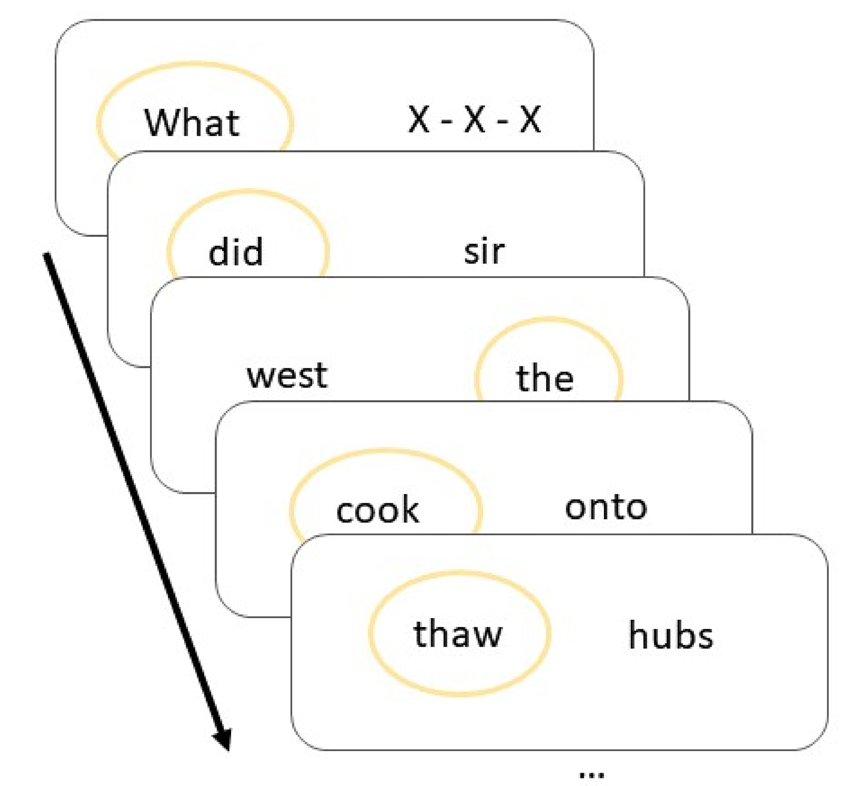


Figure 2: Points represent participant means. Crossbars represent mean and standard error. For interaction: lmer(log(rt) ~ cloze * type + (1 + cloze | participant) + (1|item))

LME models fit with maximal converging random slopes. Estimates in figures from inferentially-equivalent models of non-logged RTs for ease of interpretation.

https://umwordlab.github.io/output/HSP2023_maze_slow_prediction/

Maze Task and Methods



Highly **incremental**, focalized task. Long RTs, no spillover. (Forster, Guerrera, and Elliot 2009)

SOA from last argument to critical verb > 1600ms (compare 1050 ms in Chow et al. (2016), 1800 ms in Chow et al. (2018)).

Husband (2022): slower SOAs in maze reveal stronger effects of morphosyntactic pre-activation.

79 US-based English-reading participants recruited with Prolific completed an online Ibex- and PCIbex-based Zehr and Schwarz (2018) A-maze (Boyce, Futrell, and Levy 2020) task. The experimental (120 pairs, 60 each stimulus type) and control comparison (60 pairs) stimuli were split into 4 counterbalanced lists.

Discussion & Conclusion

Slower RTs in the argument reversal condition, where N400s are absent, are **consistent with the slow prediction hypothesis**.

Suggests that the **maze task allows slower argument-related predictive processes to emerge**.

Is argument reversal effect from P600 (present in EEG)? Small 50ms interaction doesn't seem "to scale" as P600 only for reversal vs P600 + N400 for subsitution. Compare effect size in Kutas 1993 stimuli.

Additional analyses of **continuous** variables for cloze, GPT-2 surprisal, and plausibility are in progress to further explore the correlations between stimuli variables and the characteristics of associated maze and EEG responses.

References

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