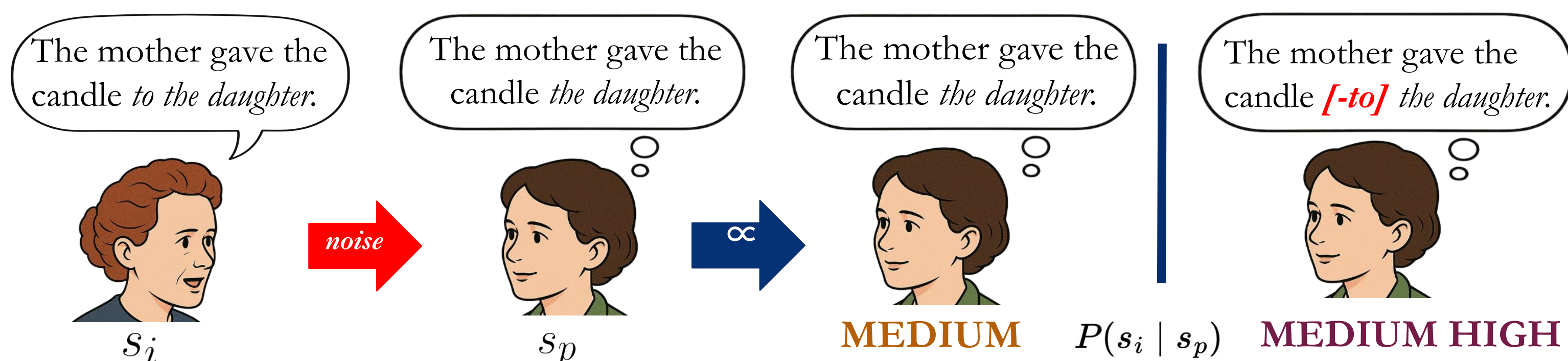


Motivation

- Robust comprehension under noise: listeners infer intended meaning even when input is noisy via **Bayesian inference**:

$$P(s_i | s_p) \propto P(s_p | s_i) P(s_i)$$

Probable Interpretation Noise Model Language/World Prior



- More inferences made for **deletions** > **insertions** (Gibson et al., 2013).
- Higher probability of inference in **supportive** > **unsupportive context** (Chen et al., 2023).
- Production Noise**: Readers model specific error types and infer speaker intentions (Ryskin et al., 2018).
- Memory Noise**: Interpretation may rely on inferences over lossy memory representations of preceding context (Hahn et al., 2022).

Question

How does memory affect the *prior* and the *noise model* during noisy-channel inference?

Methods

- E1: Direct Replication of Chen et al. (2023) (comprehension)**
N = 181
- E2: High Memory Load (RSVP + comprehension + reconstruction)**
N = 176
- E3: Moderate Memory Load (comprehension + reconstruction)**
N = 187

Discourse Context

Supportive

The mother found a candle in the kitchen cabinet...

Unsupportive

Watching the Super Bowl is exciting...

Critical Sentences

Direct Object (DO: 1 Deletion)

The mother gave the candle *[-to]* the daughter.

Prepositional Object (PO: 1 Insertion)

The mother gave the daughter *[+to]* the candle.

Active (2 Deletions)

The ball *[-was]* kicked *[-by]* the girl.

Passive (2 Insertions)

The girl *[+was]* kicked *[+by]* the ball.

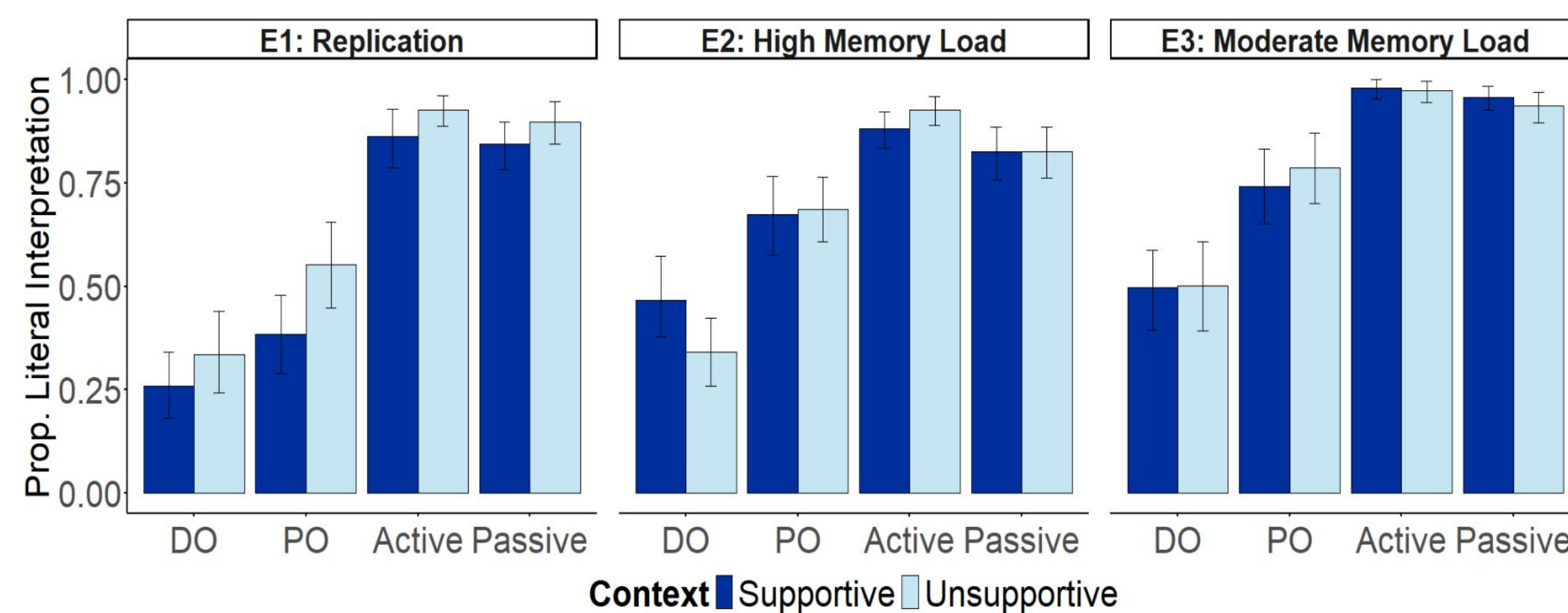
Comprehension Question

Did the candle receive something/someone?

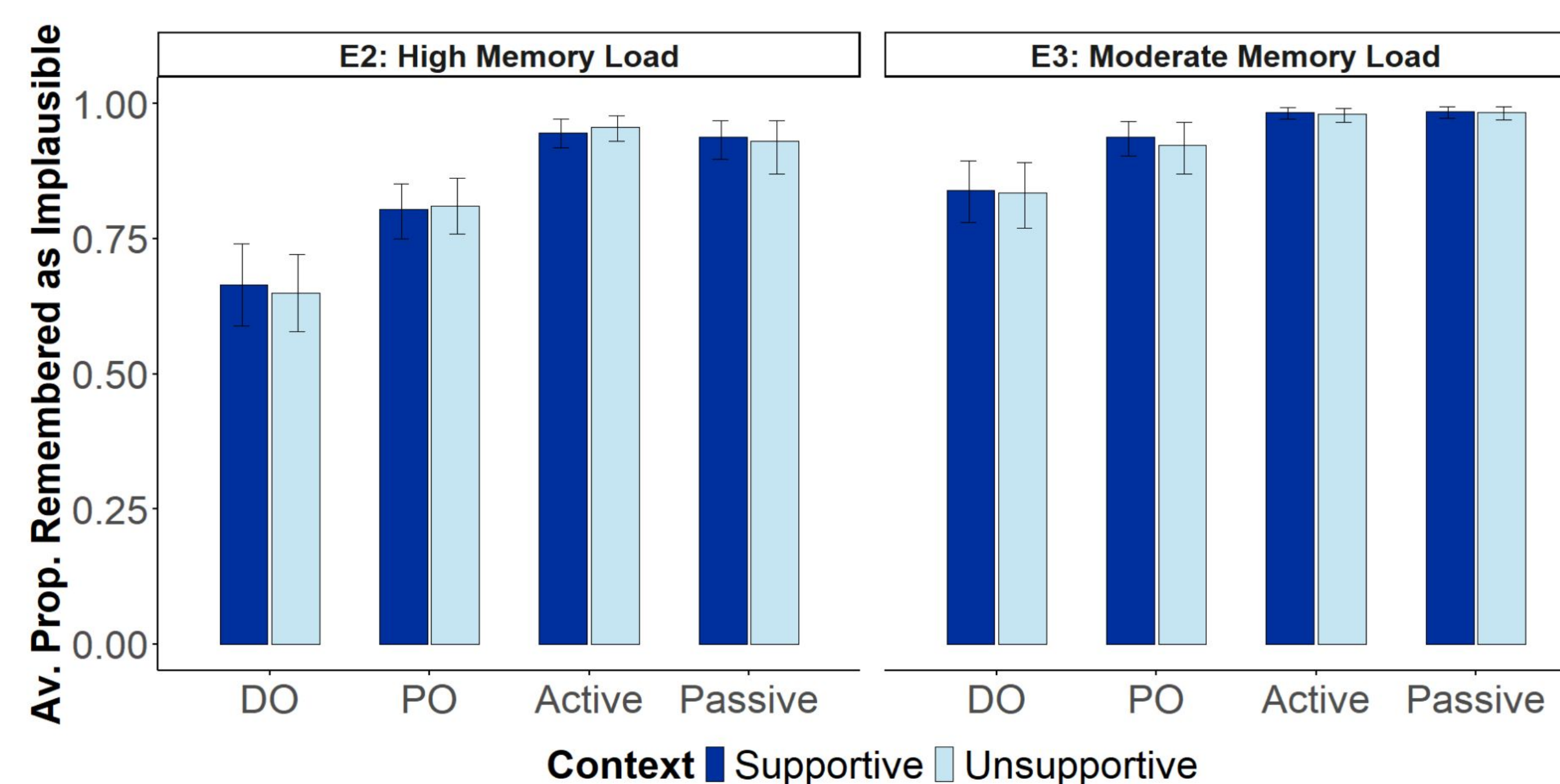
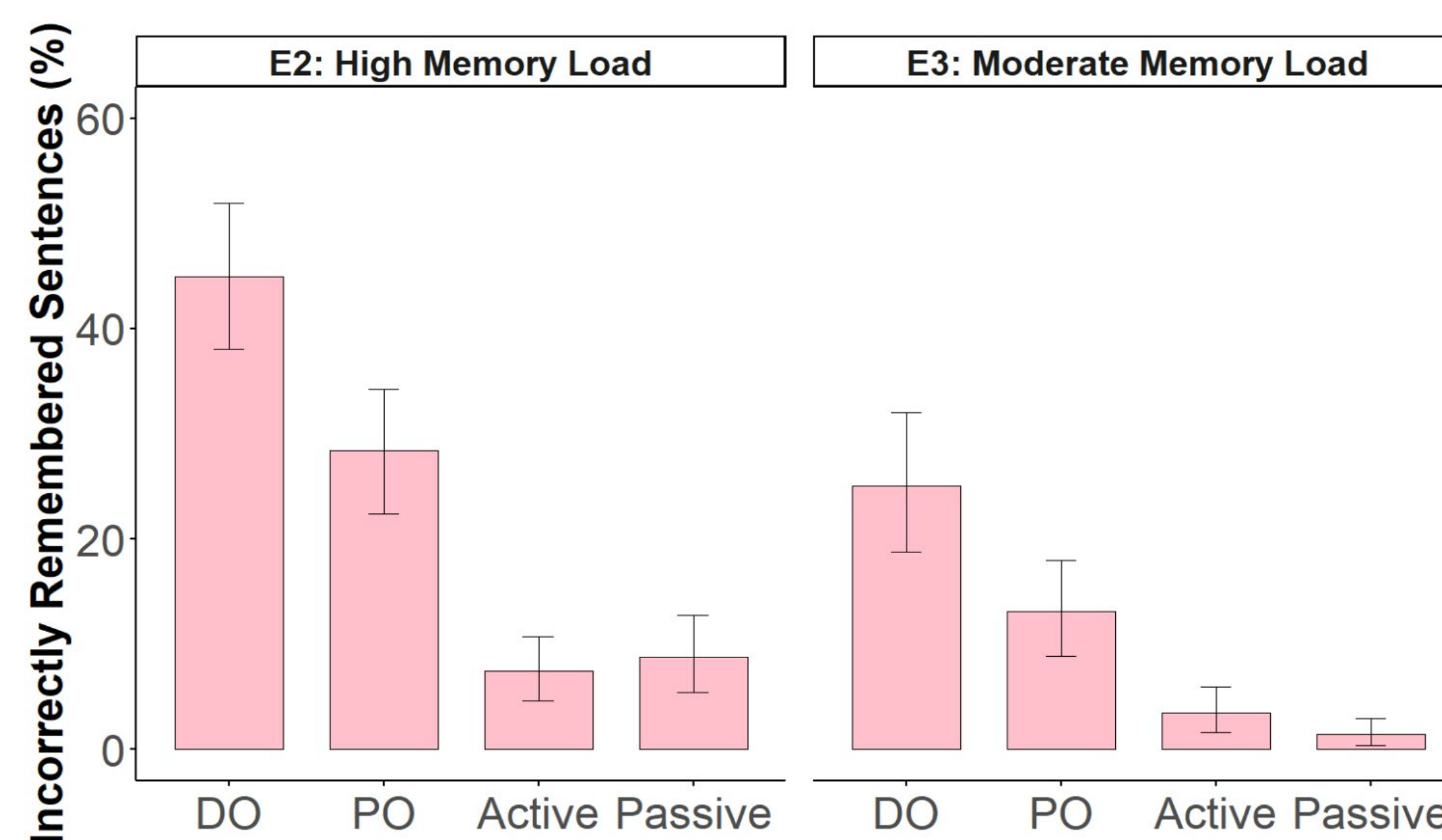
Reconstruction Prompt*

Retype the last sentence before the question.

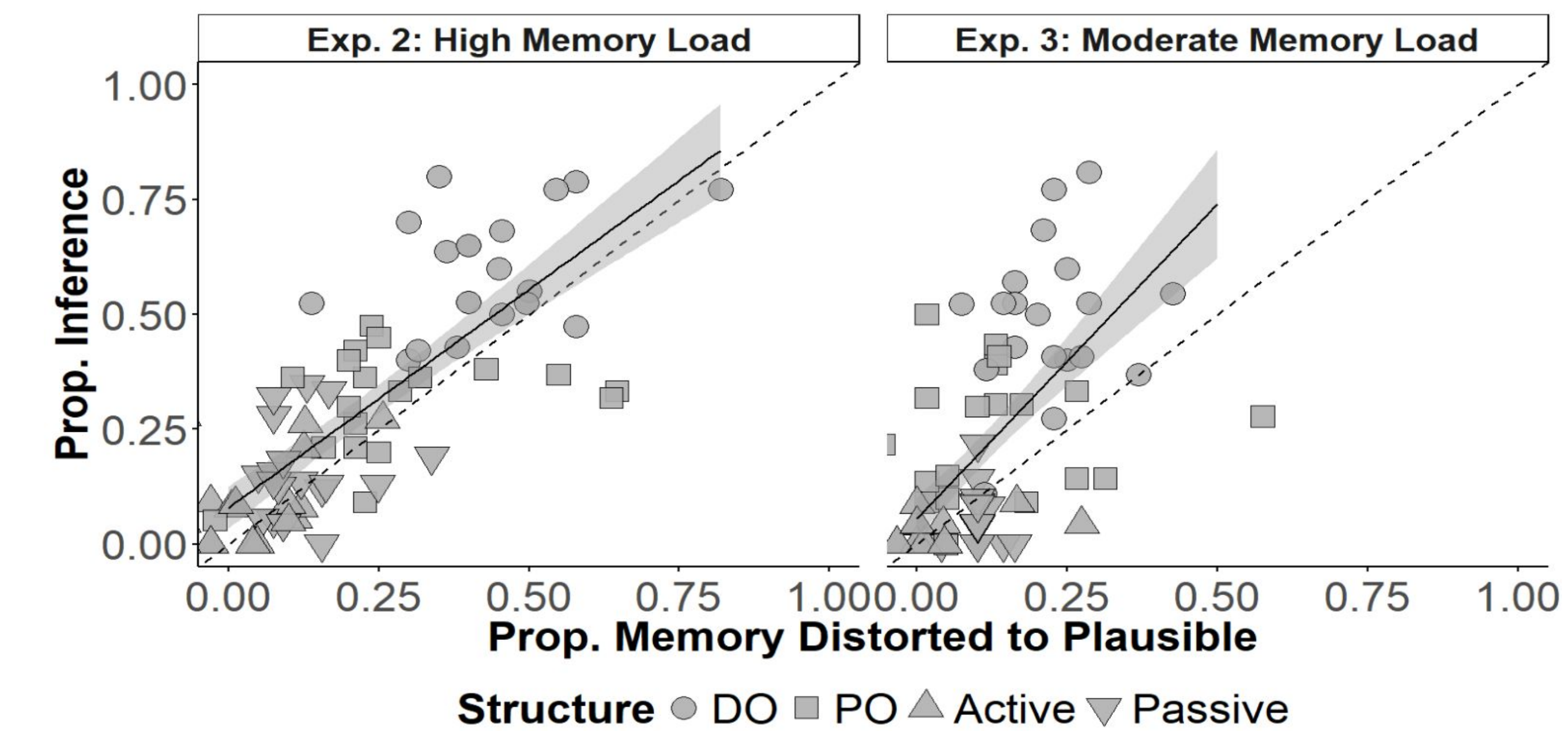
Results



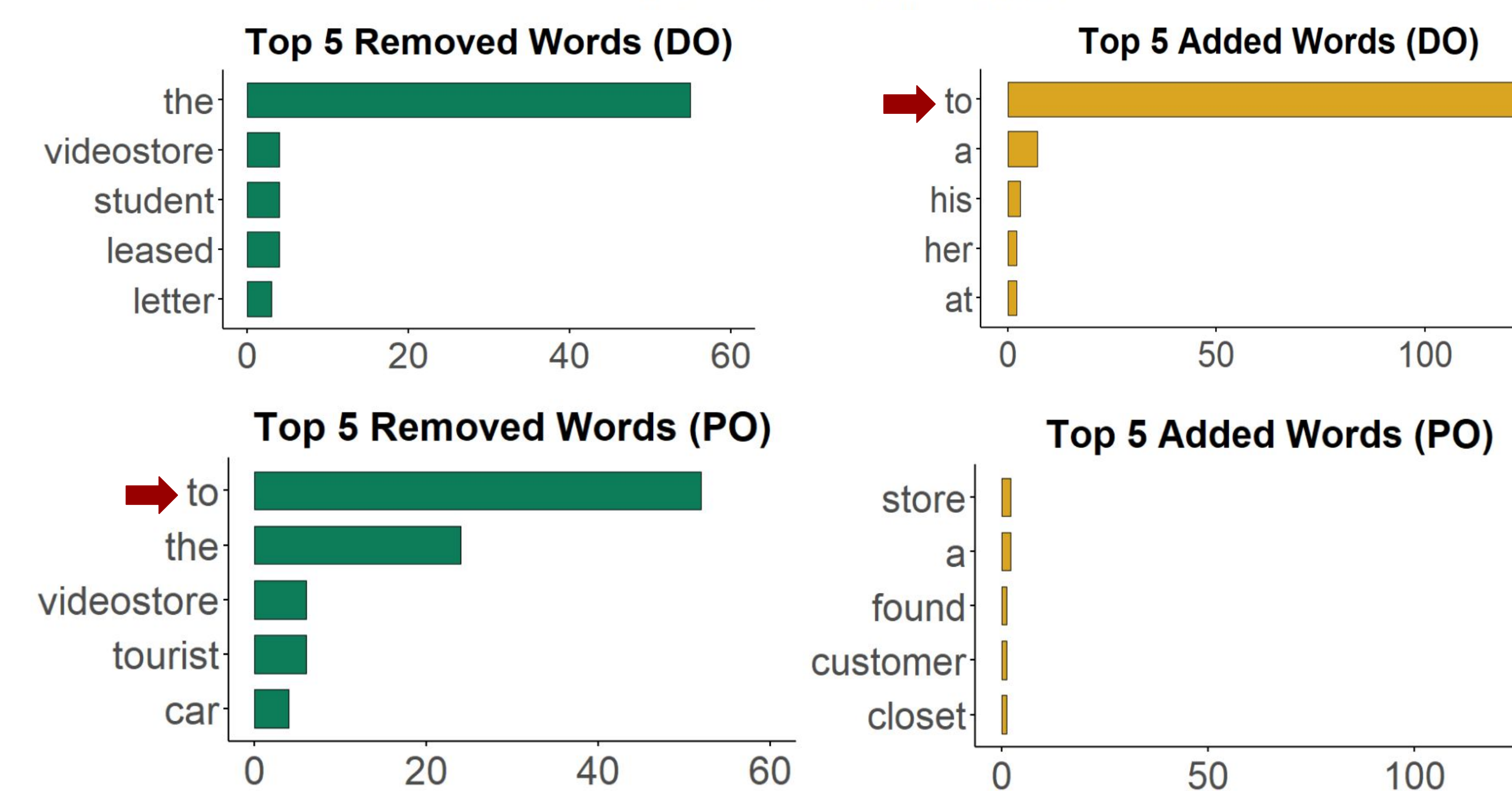
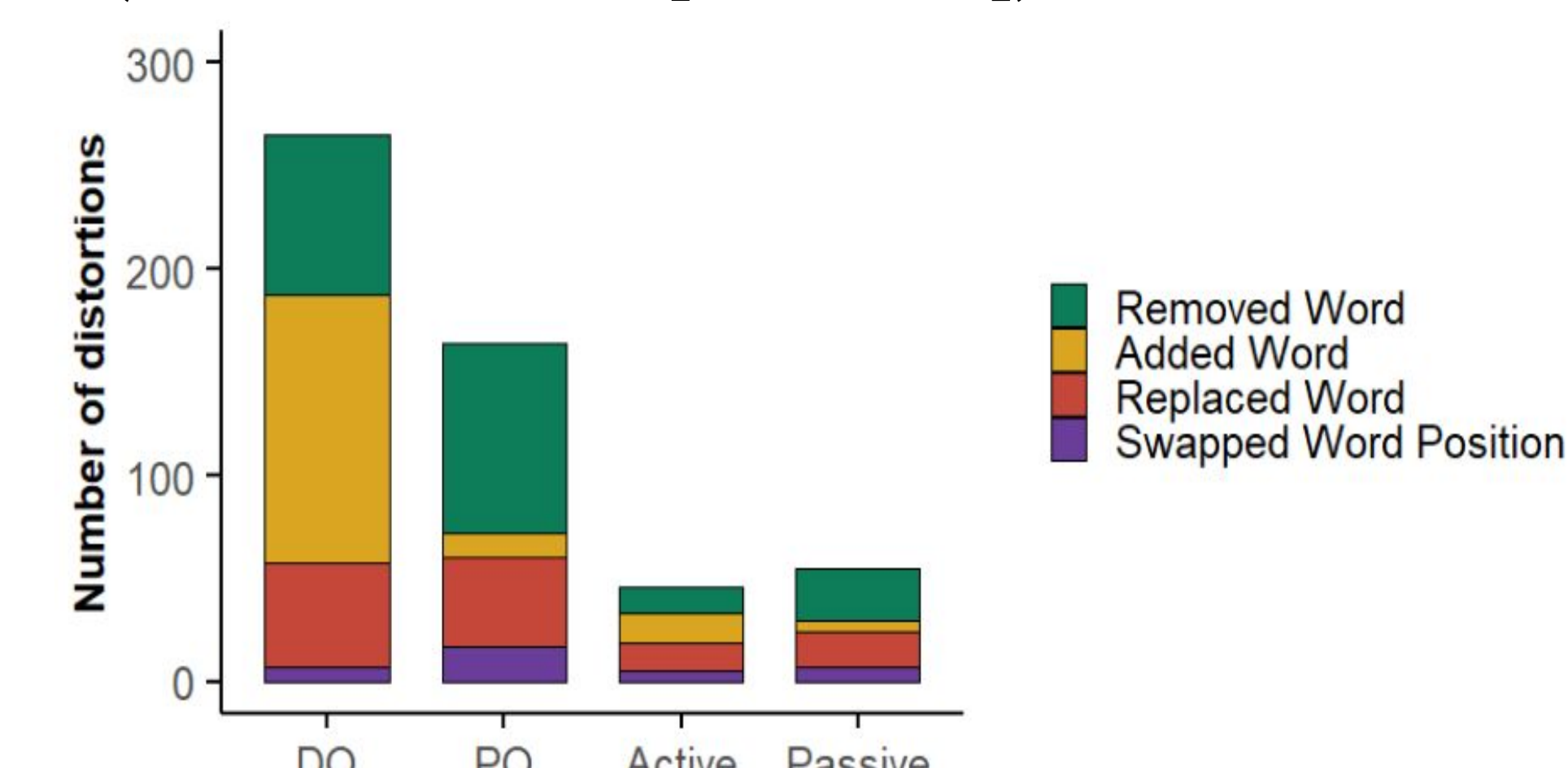
- Implausible sentences are more likely to be interpreted non-literally when noise is likely**: DO > PO > Active > Passive (E1: ΔPO -passive = -1.91 [-2.34, -1.47] & E3: ΔDO -passive = -2.38 [-2.88, -1.93]).
- Unsupportive context increased literal interpretations** under no memory load (E1: ΔUS -S = 0.45 [0.05, 0.83]) but **not high** (E2) and moderate (E3) memory load.



- Higher memory noise leads to more distortions** (1 deletion > 1 insertion > 2 edits) ($\Delta E2$ -E3 = 1.17 [0.82, 1.53]) and **switching to plausible alternative**.
- Sentences are **less likely to be distorted** to a more plausible alternative **during reconstruction than comprehension**.



- Sentences more often distorted to plausible forms in reconstruction **elicited more inferences in comprehension** ($\Delta E2$ -E3 1.32 [0.94, 1.7]).



- DO and PO sentences were most often distorted via adding/removing "to", reflecting the probability of memory noise involving a deletion/insertion of "to".

Conclusions

- Memory determines how much preceding context can affect the *prior*.
- Memory load increases the probability of *memory noise* but not *production noise*.
- Production and memory *noise models* have similar properties but their role depends on the target of inference (comprehension vs. reconstruction).