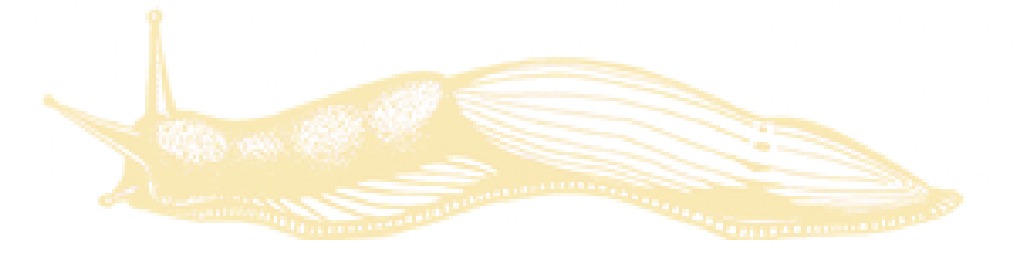


# Domain-sensitivity of sentence memory and (lack of) temporal contiguity effects

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## Background: Contiguity in Memory

**Temporal Context Model:** Items are associated with shared *encoding contexts*, which affect the maintenance and retrieval of items in memory. Retrieval of items leads to reactivation of their contexts [4].

- **Temporal contiguity** in free recall of unstructured word lists: temporally proximal items within some group influence one another's accessibility [3].
- **Contiguity Effect:** Correct recall of word  $w_i \rightarrow w_{i+1}$  or  $w_{i-1}$
- **Forward Asymmetry (FA):**  $w_{i+1}$  is more likely than  $w_{i-1}$ .
- In word list experiments, contiguity effects also extend to chunks/groups, which delineate encoding contexts [6].

### In search of temporal contiguity effects in sentential contexts

- Do linguistic groupings within a sentence correspond to encoding contexts in memory?
- Suggestive evidence comes from syntactic [5] and prosodic [2] memory literature.

## Hypotheses & Predictions

**Linguistic Sensitivity (LS):** Contextual reactivation is bounded by linguistic groupings.

- Linguistic cues to contextual grouping (e.g. syntactic or prosodic boundaries) delineate contexts in sentential memory.
- Predicts contiguity effects remain within linguistic chunks: no recall advantage for  $w_{i+1}$  following reactivation of  $w_i$  if  $w_i$  and  $w_{i+1}$  are separated by a linguistic boundary.

**Temporal Contiguity (TC):** Contextual reactivation renders temporally contiguous content more active, even across linguistic boundaries.

- Temporal contiguity affects memory representations, even within linguistic structures.
- Predicts contiguity effects cross linguistic chunks: recall advantage for  $w_{i+1}$  following reactivation of  $w_i$  even if  $w_i$  and  $w_{i+1}$  are separated by a linguistic boundary.

## Experiment: Sentence recall (n = 48)

- Items consisted of **chunks:** list constructions containing 4 comma-separated SVO clauses.
- Task: chunk-by-chunk cumulative self-paced reading
- Comprehension question followed by free sentence recall.

Manipulated whether participants responded to a reactivating QUESTION (Chunk 2 Question, Chunk 3 Question, No Question) between presentation and recall.

### Example Item

CHUNK1 The guest<sub>Ch1-Subj</sub> loved the voter<sub>Ch1-Obj</sub>,

CHUNK2 the miner<sub>Ch2-Subj</sub> loved the guide<sub>Ch2-Obj</sub>,

CHUNK3 the enemy<sub>Ch3-Subj</sub> loved the groom<sub>Ch3-Obj</sub>,

CHUNK4 and the boxer<sub>Ch4-Subj</sub> loved the artist<sub>Ch4-Obj</sub>.

### Cond Reactivation Question

NoQ —

Ch2Q Who did the miner love?

Ch3Q Who did the enemy love?

## Results: Recall Accuracy

Q-Corr	$\beta$	95% CrI	$\beta$	95% CrI	Q-Incorr		$\beta$	95% CrI	
					Ch2Q	Ch3Q			
Ch2-Subj	1.8	(1.2,2.5)	0.1	(-0.3,0.5)	Ch2-Subj	-0.7	(-1.4,0.02)	-1.2	(-1.8,-0.7)
Ch2-Obj	2.3	(1.6,3.2)	0.1	(-0.3,0.5)	Ch2-Obj	-3.2	(-5.8,-1.8)	-1.0	(-1.6,-0.4)
Ch3-Subj	-0.09	(-0.4,0.2)	1.6	(1.1,2.2)	Ch3-Subj	-1.7	(-2.3,-1.2)	-0.5	(-1.3,0.4)
Ch3-Obj	-0.2	(-0.5,0.08)	1.6	(1.2,2.1)	Ch3-Obj	-1.1	(-1.7,-0.5)	-3.4	(-5.1,-2.3)

Table 1. brms [1] m/e model results for Question-Correct and Question-Incorrect trials.

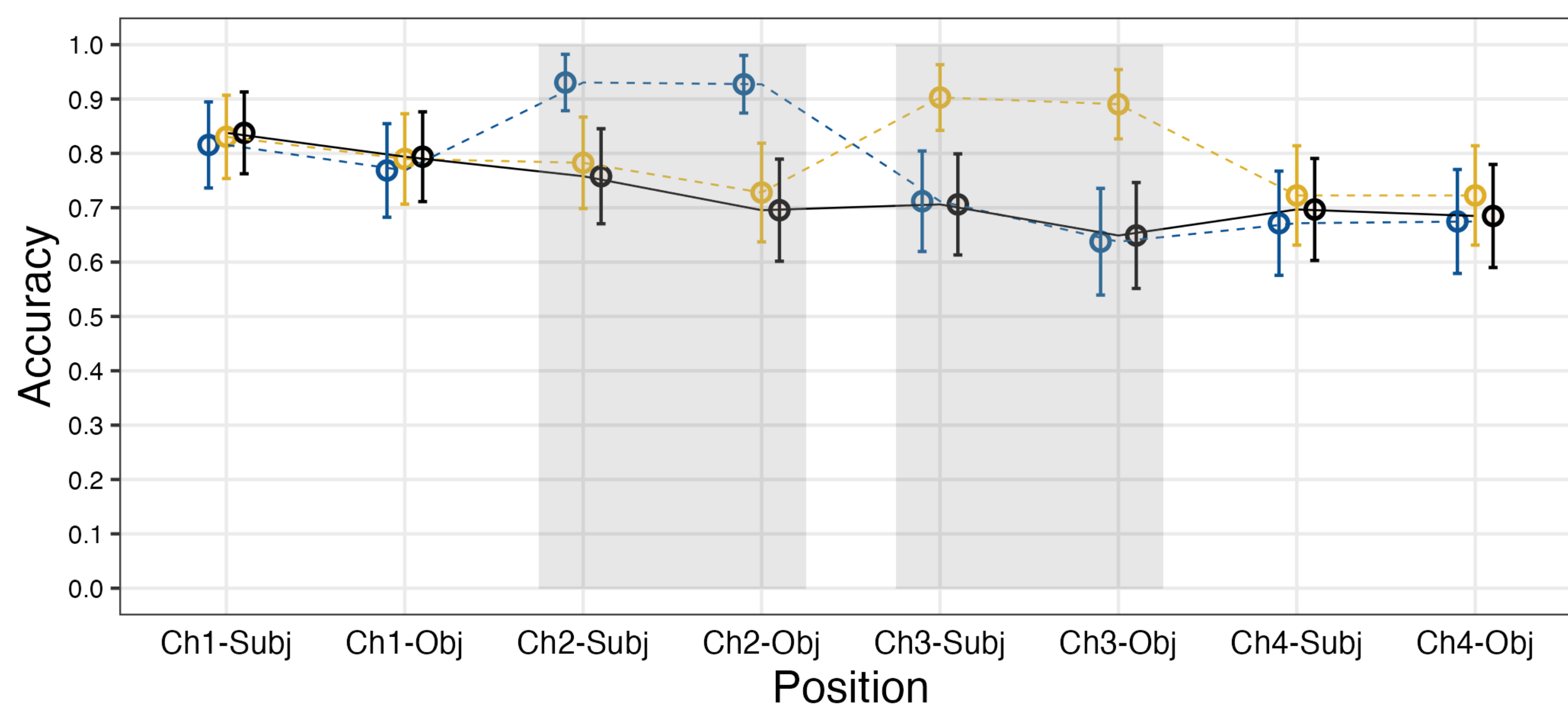
✓ **LS:** Reactivation is bounded by chunk boundaries.

? **TC:** Correct trials - reactivation benefit does not extend to temporally contiguous positions. Incorrect trials - recall failure does extend to TC positions.

## Generalization 1: Chunk reactivation does not lead to across-chunk contiguity effects.

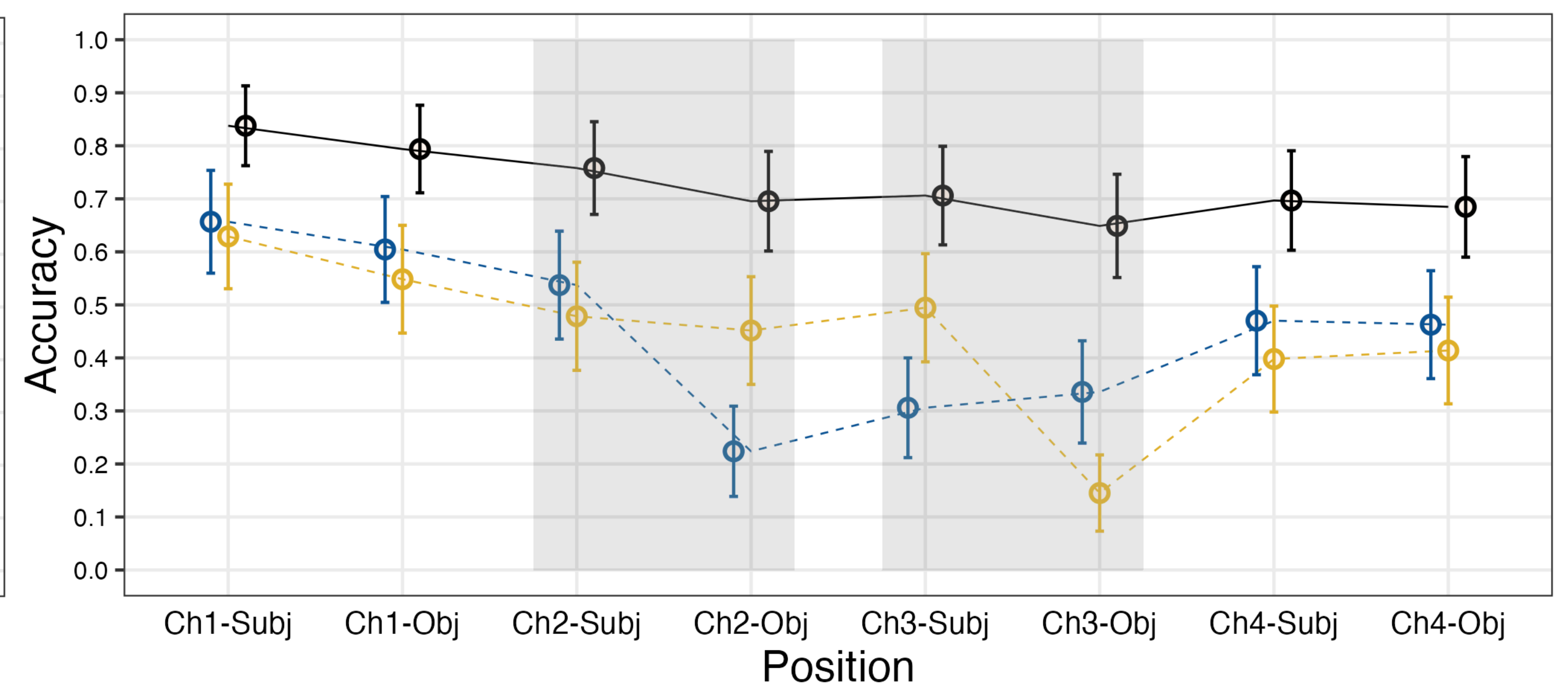
**Q:** Does chunk reactivation lead to contiguity effects across linguistic boundaries? **A:** No – the benefit for reactivated chunks does not spill over to subsequent positions.

### Recall Accuracy by Position – Question Correct Trials



Condition —●— Comp. Q targets Chunk 2 —●— Comp. Q targets Chunk 3 —●— No Comp. Q

### Recall Accuracy by Position – Question Incorrect Trials



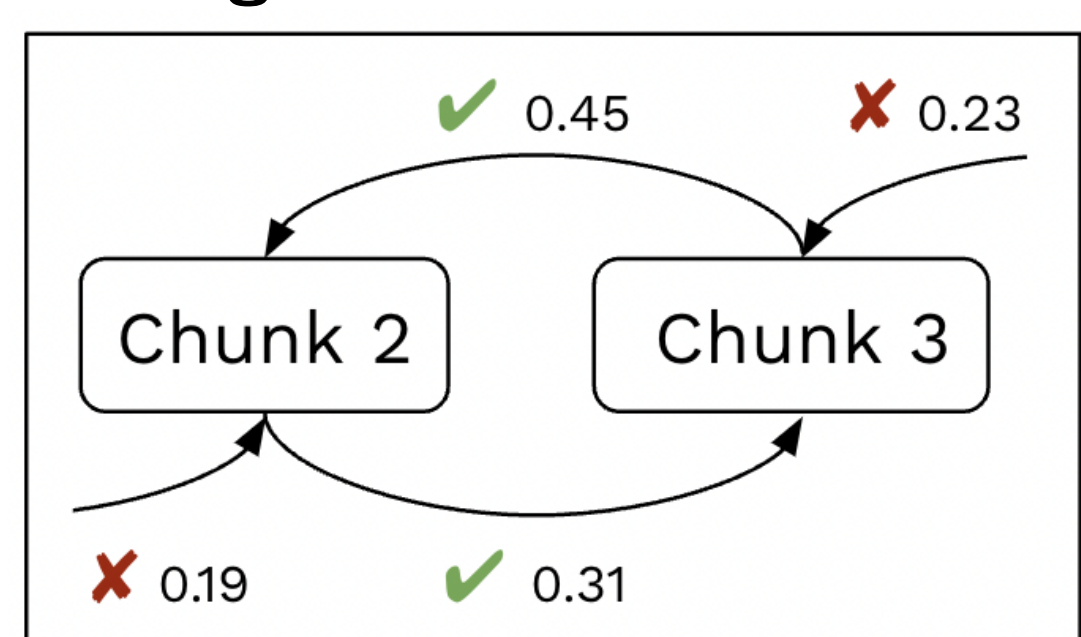
## Generalization 2: Intrusions evidence chunk-to-chunk contiguity.

**Q:** Do intrusion rates reveal contiguity effects?

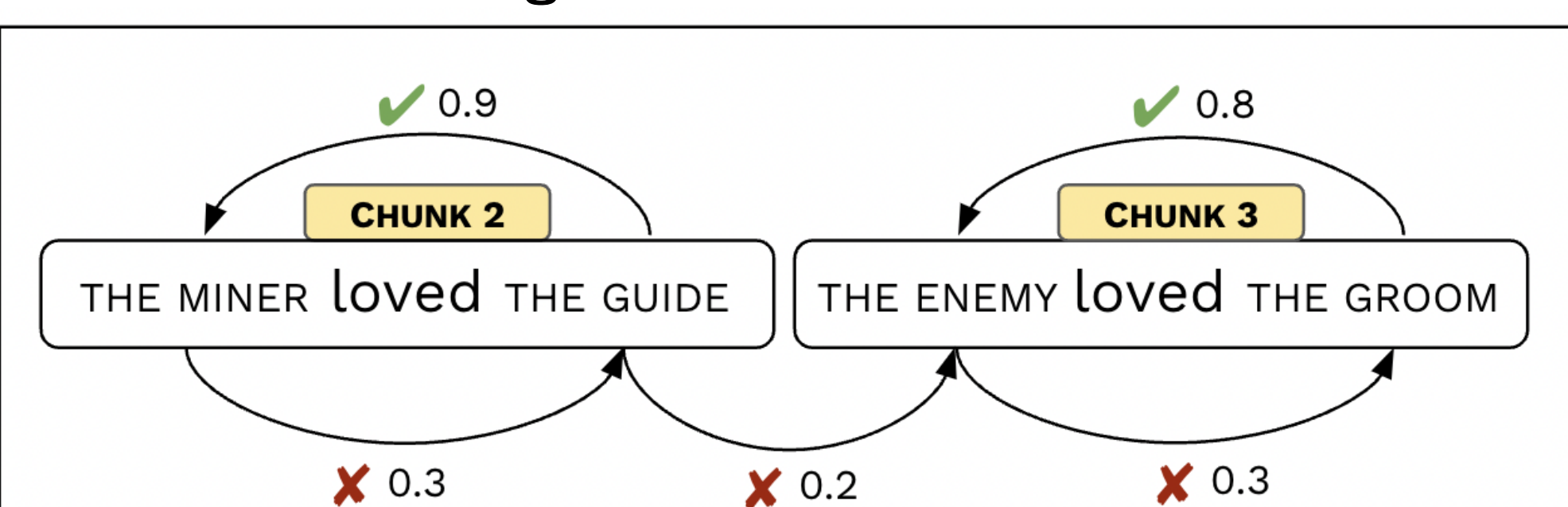
**A:** Yes, but at the level of the chunk, maintaining congruence of syntactic roles.

- Overall intrusion rates by position in Chunk 2 and Chunk 3: 7-10%
- Most intrusions (63-72%) came from the same item.
- Across-chunk intrusions:
  - Typically from contiguous chunks (Chunks 2 and 3 replaced)
  - Subjects most often replaced with subjects, objects with objects.
- Within-chunk intrusions: objects were likely to intrude in the subject position, not vice versa.

### Contiguous Chunk Intrusions



### Contiguous Position Intrusions



## Discussion

- Reactivation questions successfully boosted accuracy for recall, but very selectively.
- Linguistic boundaries block associations between temporally contiguous words, but may facilitate associations between temporally contiguous chunks.
- Syntactic role information outweighs similarity from temporal contiguity in intrusion data.

## Conclusions

- We find evidence for **Linguistic Sensitivity**
  - Recall advantage does not extend across chunk boundaries following reactivation question
  - Intrusions are more likely from the same structural position (e.g. subjects intrude subjects), and not from temporally contiguous list positions
- Evidence for Temporal Contiguity at the level of linguistic chunks, not individual words

## References

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