Compression vs. Partition: Memory domains and the processing of appositives

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Memory Domains & Linguistic Structure

Previous research suggests that some units of linguistic structure correspond to *memory domains*, units that influence storage and access during on-line processing [3, 6, 11].

How (if at all) is retrieval of linguistic content affected by segmentation of that content into memory domains?

A test case: Appositive relative clauses (ARCs).

- Sub-sentential units that are semantically, pragmatically, and prosodically demarcated from their host clauses [10].
- Argued to be **less impactful on later processing than restrictive relative clauses** (RRCs) [2, 3, 7, 9].

ARC: The cat, who loves to eat tuna in the morning, came running into the kitchen.

RRC: The cat that loves to eat tuna in the morning came running into the kitchen.

Two explanations: Appositives are stored in separate domains that are...

- less accessible in memory due to loss/compression of structure [3, 11], or
- easier to target directly and/or bypass during memory retrieval [8].

Two views of segmentation effects

- Prosodic and semantic/pragmatic segmentation sometimes reduces the accessibility of previous content, because crossing domain boundaries induces memory decay [3, 11].
- Prosodic segmentation enhances memory for utterances and their segments [6], because domains lessen the burden on working memory and reduce potential of interference [8].

Hypotheses & Predictions

Compression: Following processing of the RC, appositives are compressed in memory due to their semantic/pragmatic status [3].

- Predicts worse memory for ARCs compared to RRCs.
- Predicts difficulty accessing ARC-internal content, post-RC.

Partition: Appositives create a structural division in the memory representation of a sentence that makes all the sentence's content more easily accessible.

- Predicts better memory for ARCs compared to RRCs.
- Predicts easier access to all content in a sentence with an ARC.

Experiment 1: Recognition Memory ($n = 48$)

Q: Are ARCs remembered worse or better than RRCs?
A: Numerically better, but not significantly. Crucially, not worse.

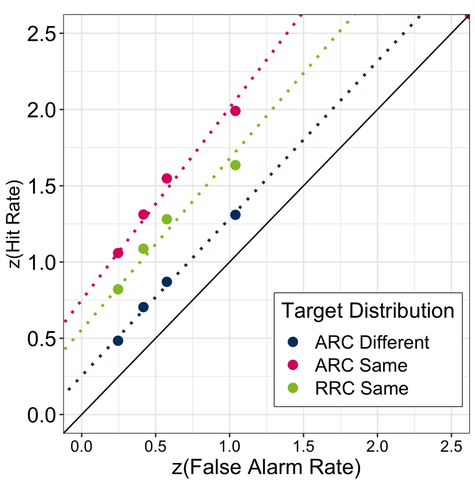
2×2 Recognition Memory paradigm crossing RC Type (ARC, RRC) and recognition probe Structure (Same, Different) across 48 items (+ 108 fillers of varied structure).

Structure levels manipulated the syntactic structure of the RC (Dative vs. Double Object).

	ARC	RRC
Same	The father, who cooked the kids a meal after the orchestra performance, was grateful for instant noodles.	The father that cooked the kids a meal after the orchestra performance was grateful for instant noodles.
Different	The father, who cooked a meal for the kids after the orchestra performance, was grateful for instant noodles.	The father that cooked a meal for the kids after the orchestra performance was grateful for instant noodles.

d_a and 95% CIs from `pROC` model:

	d_a	AUC	2.5%	97.5%
ARC Same	0.84	0.67	0.64	0.7
RRC Same	0.64	0.63	0.6	0.66
	$D_{boot} = 1.76$		$p = 0.08$	



✗ **Compression** hypothesis: Sensitivity to ARCs is not lower than sensitivity to RRCs.

? **Partition** hypothesis: Numerically higher sensitivity to ARCs.

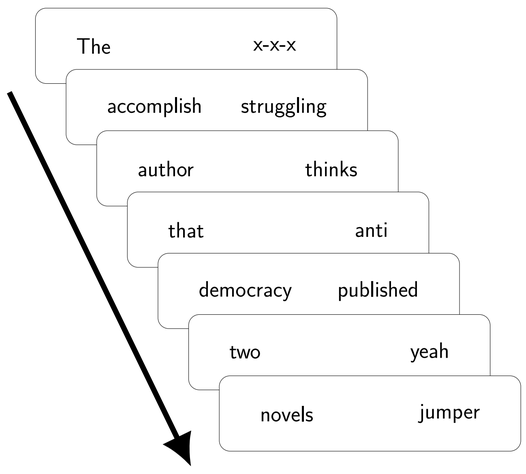
Experiment 2: Maze ($n = 72$)

Q: Are ARCs less accessible than RRCs, or do they make content more accessible?
A: Tentatively, more accessible - ellipsis resolution is faster in sentences with ARCs.

1×3 Maze task manipulating ellipsis site Position across 36 items (+ 164 fillers):

- **Control**: Both the ellipsis site and antecedent occupy RRCs.
- **ARC-1**: An ellipsis site in an RRC targets an ARC-internal antecedent.
- **ARC-2**: An ellipsis site within an ARC targets an RRC antecedent.

Control	The struggling author that published **two novels** resented the successful hack that published **forty _** over the past three decades.
ARC-1	The struggling author, who published **two novels**, resented the successful hack that published **forty _** over the past three decades.
ARC-2	The struggling author that published **two novels** resented the successful hack, who published **forty _** over the past three decades.



The Maze Task [1, 5]

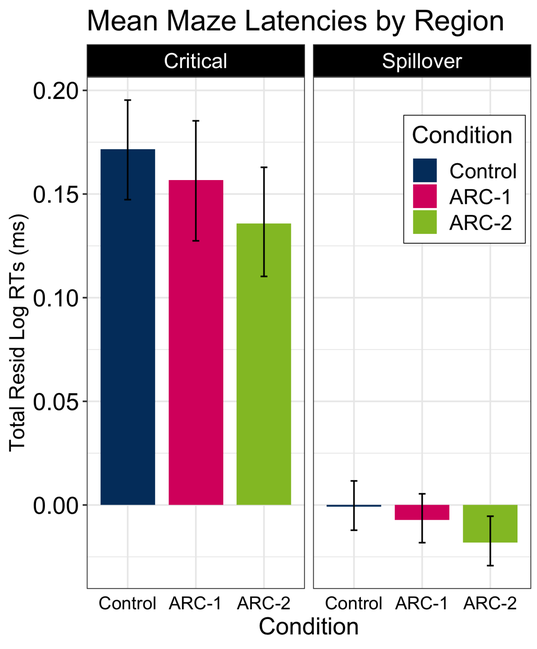
- 2AFC decisions between grammatical continuations vs. high-surprisal foils.
- Choosing a foil terminates the trial.
- Success requires representation of structural and conceptual context.
- Response latency (RT) assumed to index lexical access, integration, and decision making.

`brms` linear m/e model for ln(RT):

Critical (*over*)	$\hat{\beta}$	95% CrI
C vs. ARC-1	-0.01	(-0.05,0.02)
C, ARC-1 vs. ARC-2	-0.03	(-0.08,0.02)
Spillover (*the past*)	$\hat{\beta}$	95% CrI
C vs. ARC-1	-0.01	(-0.02, 0.01)
***C, ARC-1 vs. ARC-2**	-0.02	(-0.05,-0.0008)

✓ **Partition**: Retrieval in ARC-2 is faster than in Control.

? **Compression**: Numerically, retrieval in ARC-1 is faster than in the Control but also slower than in ARC-2.



Discussion

- We find evidence that segmentation facilitates memory retrieval: support for Partition.
- Are domains also compressed?
  - The two hypotheses aren't mutually exclusive.
  - Alternatively: an avoidance of ellipsis antecedents in ARCs?
- Some large linguistic constituents constitute domains in memory.
  - These domains serve to restrict the search space for retrieval, and so can reduce potential sources of similarity-based interference.
  - But what large linguistic constituents? Syntactic? Pragmatic? Prosodic? All of the above? (see [4])

Conclusions

- We do not find evidence in support of Compression:
  - ARCs are not less accessible in memory than RRCs.
- We find tentative evidence in favor of Partition:
  - ARCs (through segmentation) make utterance content *more* accessible in memory than RRCs.

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Preregistration: https://osf.io/u56np/?view_only=db2033be34a845fe9fbe414e3a2d569f
PCIbex demos for E1: https://farm.pcibex.net/r/YddJID/ and E2: https://farm.pcibex.net/r/gjbibw/

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