

## INTRODUCTION

**Goal of the Study:** Examine the limits of syntactic adaptation by testing a structure, i.e., filler-gap dependencies, in which probabilistic information & other cognitive constraints (i.e., memory demands) are put in conflict.

### Syntactic Adaptation

- Manipulating the input distribution can alter biases in ambiguity resolution → favor an *a priori* unlikely structure, processing difficulty of this structure diminished [1-3]

(1) The experienced soldiers **warned** ... about the dangers before the midnight raid. *main verb*  
 about the dangers conducted the midnight raid. *reduced relative*

### Memory constraints on filler-gap dependency processing

(2) **The book** that the author wrote the article about \_\_\_\_ ...  
 filler gap

- Active completion of filler-gap dependencies → gap predicted in first possible syntactic position (i.e., the direct object position) without bottom-up evidence [e.g., 4]
  - Argued that fillers are stored in memory until integration → parser biased to complete dependencies early to reduce burden on memory [e.g., 5]

**Main Question:** Do participants adapt when the input is skewed toward later dependencies (i.e., PP-gaps) despite the bias to complete dependencies early imposed by memory?

## CORPUS ANALYSIS OF POST-VERBAL ARGUMENT GAP POSITIONS

Corpus	# Lines	Object Gaps	Preposition Gaps	Total
CallHome [6]	28,967	1,790	612	2,402
Switchboard [7]	44,696	1,159	226	1,385
	73,663	2,949 (77.9%)	838 (22.1%)	3,787

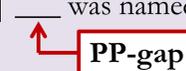
- Both corpora of naturalistic conversations between adults
- Includes argument *wh*-questions (*who*, *what*, *which*, *whose*) & relative clauses

## EYE-TRACKING EXPERIMENT

**Participants:** 40 native English speakers from the JHU community

**Eye-tracking:** Eyelink 1000 tower mount eye-tracker (SR Research, Toronto, ON)

**Stimuli:** Filled gap sentence pairs [4,8]

- (3) a. **NP-fronting:** The book that the famous non-fiction author |<sub>Verb</sub> wrote |<sub>Filled Gap</sub> **the article** |<sub>Spillover</sub>  
 about | \_\_\_\_ was named for an explorer.  

- b. **PP-fronting:** The book about which the famous non-fiction author |<sub>Verb</sub> wrote |<sub>Filled Gap</sub> **the article** \_\_\_\_ |<sub>Spillover</sub> was | named for an explorer.

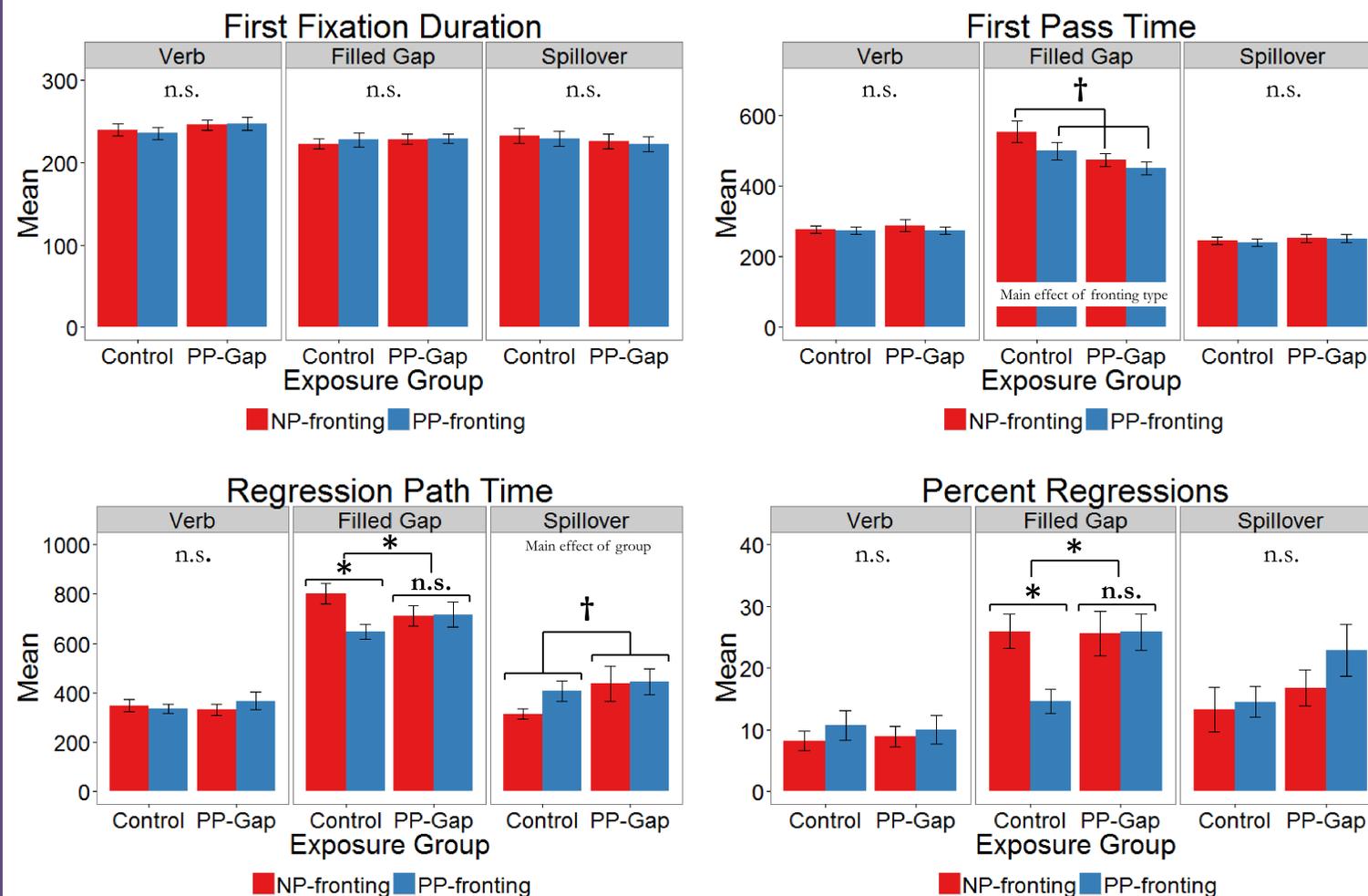
### Two Block Design:

Group	Exposure Block	Test Block
PP-gap exposure	24 <b>NP-fronting</b> filled gap sentences	24 target pairs + 48 fillers
Control	24 fillers	

### Predictions:

- If syntactic adaptation effects > memory driven bias toward shorter dependencies...
  - PP-gap exposure group = **reduced or eliminated** filled gap effect during test
  - Control group = filled gap effect during test
- If memory driven bias toward shorter dependencies > input statistics...
  - Both groups = filled gap effect during test

## RESULTS: TEST BLOCK



## DISCUSSION & CONCLUSION

**Main Findings:** As in ambiguity resolution, predictions for *a priori* likely gap positions (i.e., object gaps) can be diminished by an input favoring a later gap (i.e., PP gaps).

### Significance

- Syntactic adaptation effects extend outside ambiguity resolution to gap predictions
- At least in this case, probabilistic information in the input can override memory constraints favoring shorter dependencies
- Because structural probabilities as derived from the input statistics can affect gap predictions, memory constraints cannot be the sole explanation for the preference for early completion of filler-gap dependencies

### Future work

Experiment 1: Are participants actively prediction a gap in the prepositional phrase?

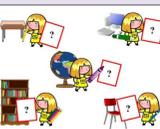
*Filled Preposition Gap Sentences*

(4) The carcass that the male lion ate \_\_\_\_ by the water's edge was attracting scavengers.

Experiment 2: Do participants adapt to the input distribution when it is presented during a separate experiment?

Group	Exposure Block = Narratives	Test Block
PP-gap Exposure	48 NP-fronting filled gap sentences	24 target pairs ( <i>plausibility mismatch</i> ) + 48 fillers
Obj-gap Exposure	48 NP-fronting object gap sentences	

Experiment 3: Can children (5yos) use the distribution of gap positions in their productions to strengthen their object gap predictions during comprehension?



[1] Fine, A. B., Jaeger, T. F., Farmer, T. A., & Qian, T. (2013). Rapid expectation adaptation during syntactic comprehension. *PLoS One*, 8(10), 1-18. [2] Jaeger, T. F. & Snider, N. E. (2013). Alignment as a consequence of expectation adaptation: Syntactic priming is affected by the prime's prediction error given both prior and recent experience. *Cognition*, 127(1), 57-83. [3] Fine, A. B. & Jaeger, T. F. (2013). Evidence for implicit learning in syntactic comprehension. *Cognitive Science*, 1-14. [4] Stowe, L. E. (1986). Parsing WH-constructions: Evidence for on-line gap location. *Language and Cognitive Processes*, 1(3), 227-245. [5] Gibson, E. (1998). Linguistic Complexity: Locality of syntactic dependencies. *Cognition*, 68, 1-76. [6] Kingsbury, P., Strassel, S., McEmore, C., & McIntyre, R. (1997). *CALLHOME American English Transcripts LDC97T14*. Philadelphia: Linguistic Data Consortium. [7] Marcus, M. Santorini, B., Marcinkiewicz, M. A., & Taylor, A. (1999). *Treebank-3 LDC99T42*. Philadelphia: Linguistic Data Consortium. [8] Wagers, M. W. & Phillips, C. (2014). Going the distance: Memory and control processes in active dependency construction. *The Quarterly Journal of Experimental Psychology*, 67(7), 1274-1304.