

# Processing of Verb-Phrase Ellipsis: Evidence for Preserved Processing Reflexes in Aphasia

Josée Poirier<sup>a</sup>, Lewis Shapiro<sup>b</sup>, Tracy Love<sup>b,c</sup>, David Swinney<sup>c</sup>

<sup>a</sup> SDSU/ UCSD Joint Doctoral Program in Language and Communicative Disorders

<sup>b</sup> San Diego State University

<sup>c</sup> University of California, San Diego

## INTRODUCTION

Certain complex linguistic constructions, such as object relatives, require linking the verb and an earlier part of the sentence to be interpreted:

*The man saw the boy that the crowd accused of the crime.*

Interpretation:

*The crowd accused [the boy] of the crime. The man saw [the boy].*

Unimpaired listeners readily and unambiguously understand these constructions. Adults with anterior lesions to the left hemisphere show difficulties comprehending relatives.

Verb-Phrase Ellipsis (VPE) is another type of construction that requires a similar coreference between elements of the sentence:

*The pharmacist bought a house and the teacher did too.*

Interpretation:

*The pharmacist [bought a house] and the teacher [bought a house].*

Due to the different nature of its internal linking, VPE may help shed light on the impairment of anterior-lesioned patients.

## REACTIVATION PATTERNS IN PROCESSING

### Object Relative Constructions

*The man saw the boy that the crowd at the <sup>1</sup> party accused 2 of the crime <sup>3</sup>.*

Priming Effect (msec)	Position 1	Position 2	Position 3
Unimpaired Adults	✗	✓	✗
Anterior-Lesioned Patients	✗	✗	✓

### Verb Phrase Ellipsis

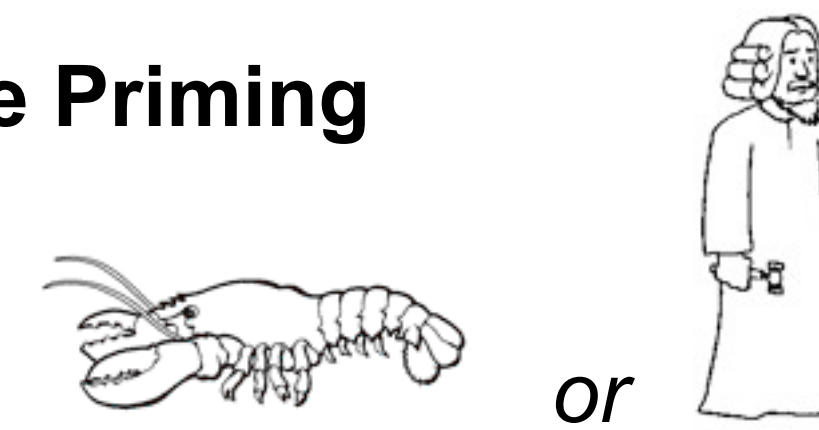
*The otter followed the lobster, and the funny <sup>1</sup> architect did <sup>2</sup> too, according <sup>3</sup> to the anxious housekeeper.*

Priming Effect (msec)	Position 1	Position 2	Position 3
Unimpaired Adults	✗	✓	✗
Anterior-Lesioned Patients	✗	✗	✓
Anterior-Lesioned Patients	✗	✓	✗

Predictions {

## METHODS

### Cross-Modal Picture Priming



*The otter followed the lobster, and the funny PPO architect did PP1 too, according PP2 to the anxious housekeeper.*

- Uninterrupted, auditory presentation of sentences
- Presentation of a picture (= probe), related or not to 'lobster'
- Binary decision about pictures: Is it alive?
- Reaction times and accuracy recorded

### Design

- Within-subject design
- 40 test items, 80 fillers (30 of similar complexity to VPE)
- 54 comprehension questions, 30 about test items

### Participants

★ All participants were pre-morbidly right-handed.

Patient	Gender	Age	Post-Onset (Yrs)	Education	Lesion	BDAE	WAB AQ
LHDCE	F	62	20	2 yrs College	Left basal ganglia, internal capsule, lenticular nucleus	4	88.2
LHDFT	M	69	8	8th Grade	Left frontal extending to basal ganglia, internal capsule, lenticular nucleus	4	92.4
LHDSH	M	60	1.5	Ph.D.	Left MCA infarct involving basal ganglia and extending to temporal cortex	4.5	93.8
LHDPY	M	52	4	Junior College	Left frontal cortical regions and basal ganglia (ACA)	4	91.9
LHDTL	M	48	3	1.5 yrs College	Large left parietofrontal CVA involving MCA	3.5	83.8
LHDTM	M	64	2	13 yrs	Large left MCA infarction involving temporal and parietal lobes	3	75.3
LHDHB	M	67	7.5	MBA	Extensive left hemisphere damage extending posteriorly to parietal lobe with sparing of STG and insula (MCA infarct)	1	18
LHDCS	M	60	1	Bachelor's	Large left MCA infarct with basal ganglia involvement	4	85.2
LHDST	F	52	6	High School	Large left MCA infarction, midline shift and sulci effacement	2	52.7

## REFERENCES

Shapiro, L.P., Hestvik, A., Lesan, L., and Garcia, A.R. (2003) Charting the time-course of sentence processing: Evidence for an initial and independent structural analysis. *Journal of Memory and Language*, 49: 1-19.

Swinney, D., Love, T., Nicol, J., Bouck, V., Hald, L. A. (2000). Neuroanatomical Organization of Sentential Processing Operations: Evidence from aphasia on the (modular) processing of discontinuous dependencies (chapter 3, pp 51-66). In R. Bastianse & Y. Grodzinsky (Eds.) *Grammatical disorders in aphasia: a neurolinguistic perspective*. London: Whurr Publishers.

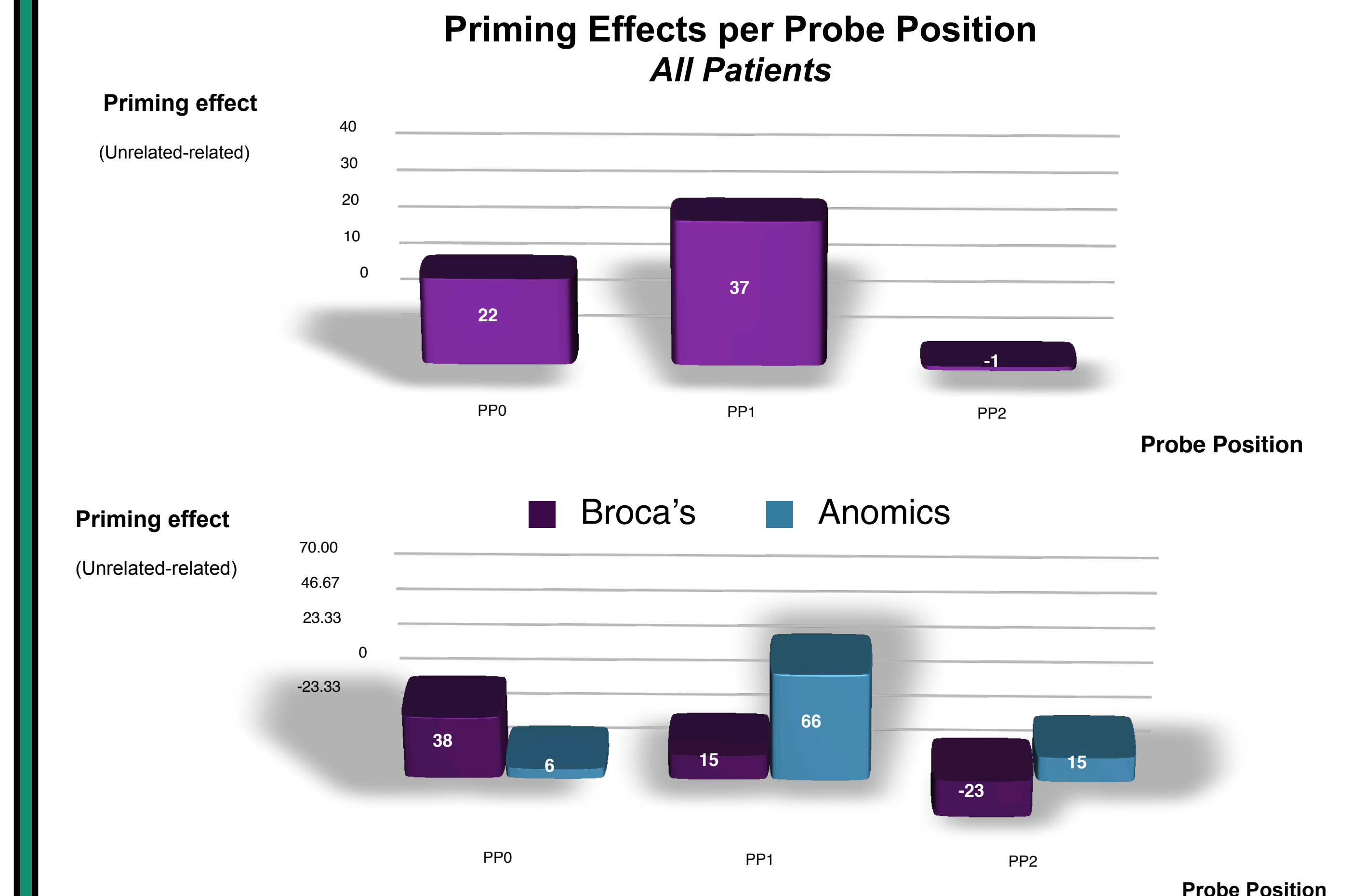
Prather, P., Zurif, E., Love, T., and Brownell, H. (1997). Speed of lexical activation in non-fluent Broca's aphasia and fluent Wernicke's aphasia. *Brain and Language*, 59, 391-411

## ACKNOWLEDGEMENTS

We would like to thank the patients for participating in this study. We are also grateful to the assistants, Chelsea Sera, Lynsey Gebelin, Rebecca Rothman, Elisabeth Vance-Trup, Nicola Bettino, Vickie Koehly, Danielle Durham and Lauren Hollingsworth, and to Dr. Andrew Kehler for his valuable help and comments.

This research was supported by the NIH (DC00494 to Drs. Shapiro & Swinney), and the Lipinsky Family Fellowship awarded to Josée Poirier.

## RESULTS (PRELIMINARY ANALYSES)



## DISCUSSION

Priming effects seem to obtain at pre- and at the elision site (PP0 and PP1). Offline VPE comprehension overall better than for relatives.

Interestingly, if patients are grouped based on behavioral performance on assessment tests (i.e. following clinical diagnostic) and not lesion site, differential patterns emerge:

- Anomic patients appear to show immediate, on time priming for the antecedent of the VPE (normal pattern).
- Broca's aphasics appear to show early (pre-elision) priming that decays by the elision site.
  - This early priming effect may reflect the protracted access to the overt direct object (lobster; 'Slow-Rise Hypothesis', see Prather et al, 1997)

The interpretation of VPE seems unlikely to rely on the same processes that underlie the on-line processing of relatives. These results suggest the disruption of online processes following anterior lesions may only pertain to specific syntactic constructions and/ or that VPE is more 'temporally forgiving', perhaps because of a reliance more on semantics and/ or discourse.

## FUTURE DIRECTIONS

Examine individual variability by correlating online performance with factors such as offline performance, lesion site and extent, perfusion data.

Investigate the processing of other ellipsis types (gapping, sluicing) to better understand the processes involved in VPE and/ or in relative constructions.