Examination of a Distributional Account of Recency Effects in Comprehension

Neal J. Pearlmutter, Northeastern University

INTRODUCTION

Recency Effects

Many multi-site modification ambiguities display recency effects:

Relative clause and PP modification of NPs; PP modification of VPs
(Cuetos & Mitchell, 1988; Gibson et al., 1996; Thornton et al., 2000)

Adverbial and clausal modification of VPs
(MacDonald, 1999; Pearlmutter & Gibson, 2001)

Comprehenders prefer modification of the more recent site over less recent sites.

BUT the underlying source of the effects is unclear.

Activation Dynamics in Working Memory during Comprehension
(Gibson et al., 1996; Pearlmutter & Gibson, 2001)

Phrasal elements' activation levels change over time during processing.

Less recently-processed elements are less active.

More active elements are more accessible for modification/attachment.

Phrase Distribution Sensitivity, Coupled with a Gricean Mechanism
(MacDonald, 1999; Thornton et al., 2000)

Longer phrases tend to be produced later in utterances when possible.

Given alternative formulations, short phrases following long ones are more likely to be inter-preted as modifying a recent phrase (otherwise, they should have been produced earlier).

Long phrases following short phrases will display a weaker (or no) recency preference.

Basis for estimating attaching phrase length remains to be determined.

METHOD

Stimuli

24 sentence quadruples, varying in attachment recency and in attaching phrase length

Attaching phrase: Infinitval purpose clause containing an anaphor (-self); must agree with subject NP of VP to which purpose clause is attached

Short

The fireman$_i$ said that the arsonists$_j$ set the fire to get himself$_i$/themselves$_j$ into the day's news.

Long

The fireman$_i$ said that the arsonists$_j$ set the fire to make some money and get himself$_i$/themselves$_j$ into the day's news.

All items followed by Y/N comprehension question; Experiment 1 questions never asked about ambiguity; Experiment 2 & 3 questions always asked about ambiguity

66 miscellaneous filler sentences, similar in length and complexity

Procedure

Experiments 1 & 2: Standard self-paced reading (all non-space characters replaced by dashes)

Experiment 3: Reduced preview self-paced reading (all preceding words plus next word's dashes visible)

Analysis

Length-regressed residual reading times trimmed at 4 *SD*s; trials included regardless of comprehension question response (same patterns if trials excluded based on question)

Participants

Experiment 1: 91 Ss

Experiment 2: 98 Ss; 2 dropped for poor comprehension (at chance)

Experiment 3: 49 Ss (in progress); 2 dropped for poor comprehension (at/near chance)

PREDICTIONS

Comprehension Memory-Activation Account

Similar-sized ambiguity effects regardless of length of attaching phrase.

Similar-sized ambiguity effects regardless of amount of preview information.
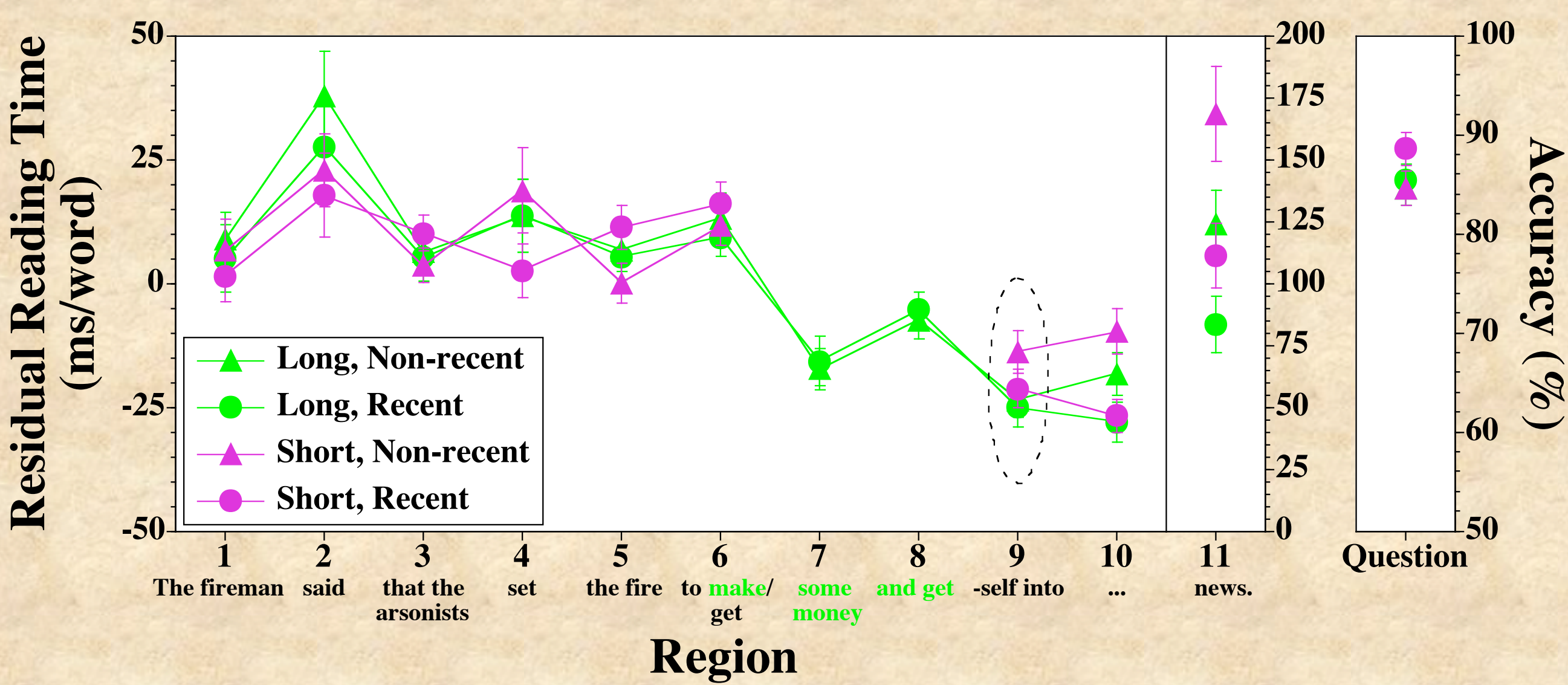
Distributional Account

Attaching purpose clauses can be sentence-initial if modifying non-recent VP:

To get himself$_i$ into the day's news, the fireman$_i$ said that the arsonists$_j$ set the fire.

Long purpose clauses are longer than preceding embedded clauses (e.g., *that the arsonists set the fire*), so likely to be produced late even if modifying non-recent VP.

Short purpose clauses likely to be produced early if modifying non-recent VP; thus production later suggests modification of recent VP.

If attaching phrase length estimate depends on specific phrase in current sentence:
Smaller ambiguity effect for **Long** than **Short**, at disambiguation or later.

If attaching phrase length estimate depends on visual preview:
Smaller amb. effect for **Long** than **Short** at disambiguation in Experments 1 & 2, but not Experiment 3.

RESULTS

### Experiment 1: Standard Self-Paced, Questions NOT about Ambiguity

Attachment x Length interaction at disambiguation: High > Low for **Short** but not **Long**.
Supports distributional account, but intuitions suggest a confound:
Anaphor may never be bound properly in **Long** cases, leaving recent attachment.

Experiment 2: Standard Self-Paced, Questions Ask about Ambiguity
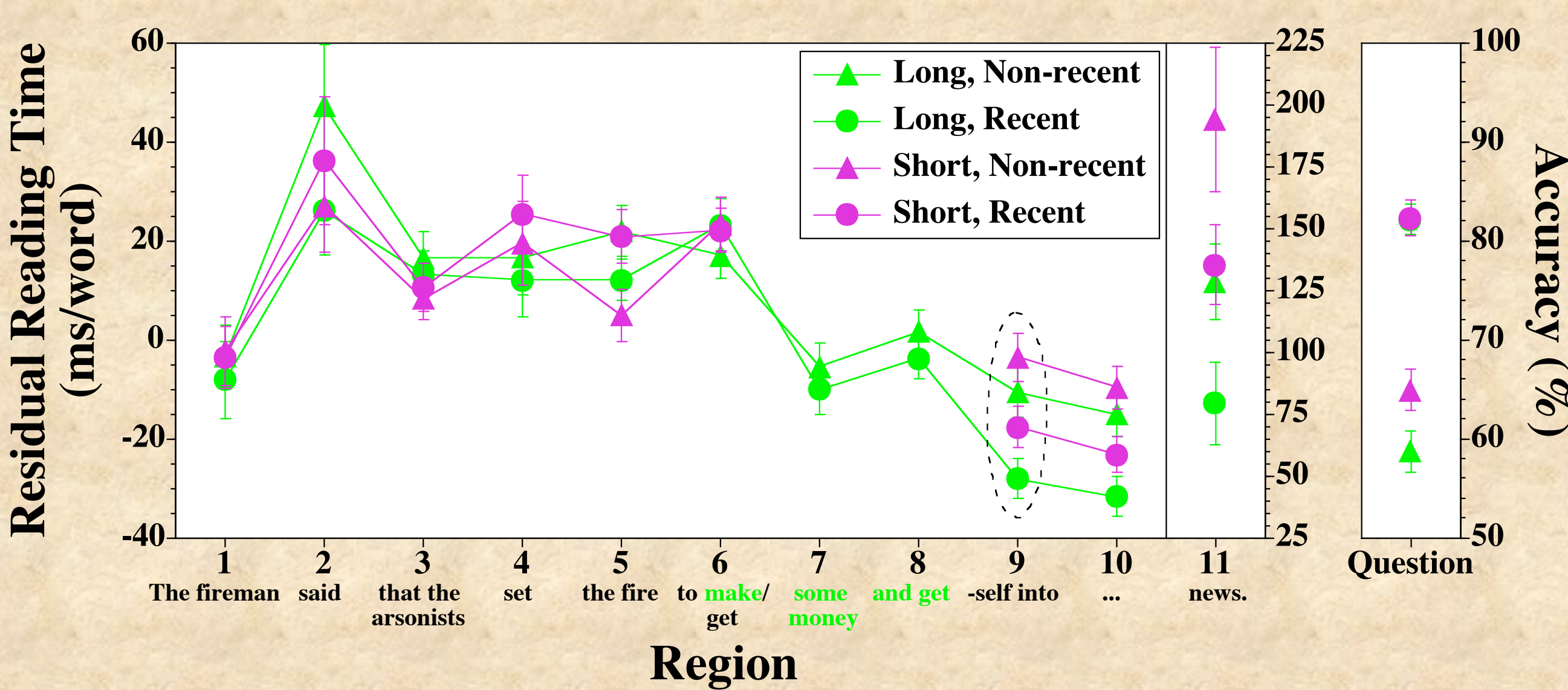
Main effect of Attachment (High > Low), but no interaction at any region.
Supports memory-activation account, suggests Exp. 1 distributional support was confounded.

Experiment 3: Reduced Preview, Questions Ask about Ambiguity
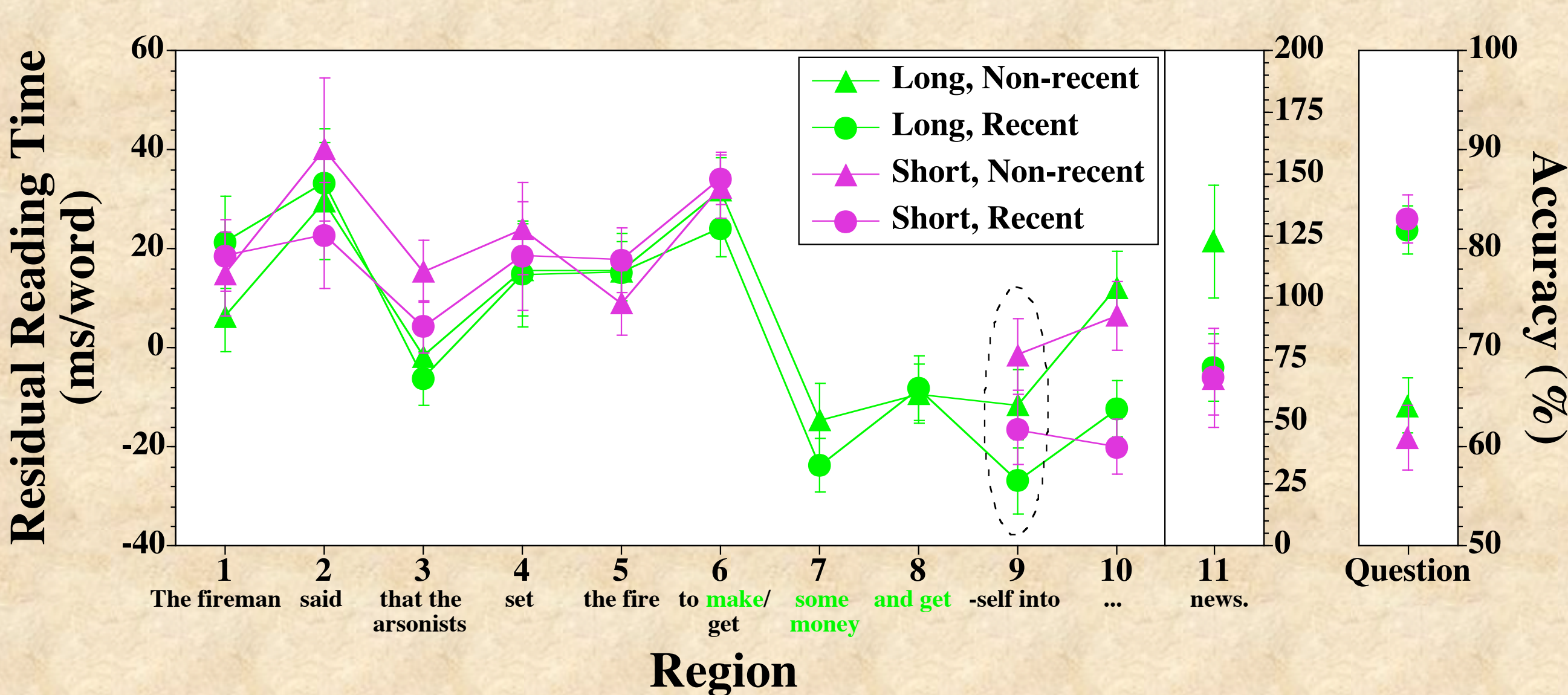
Main effect of Attachment (High > Low) but no interaction.
Supports memory-activation account; suggests distributional account not sensitive to preview.

CONCLUSIONS

No evidence for Attachment x Length interactions, except in Experiment 1, where comprehension questions did not force resolution of the ambiguity. Lack of resolution of anaphor seems more likely when antecedent is more distant (non-recent conditions).

Experiments 2 & 3 suggest distributional account sensitive to estimated length of specific material being attached, or to estimated length based on visual preview, is not sufficient.

Memory-activation account can explain full pattern (with add'l assumptions for Experiment 1).

REFERENCES & ACKNOWLEDGMENTS

Cuetos, F., & Mitchell, D. C. (1988). Cross-linguistic differences in parsing: Restrictions on the use of the Late Closure strategy in Spanish. *Cognition*, **30**, 73-105.

Gibson, E., Pearlmutter, N. J., Canseco-Gonzalez, E., & Hickok, G. (1996). Recency preference in the human sentence processing mechanism. *Cognition*, **59**, 23-59.

MacDonald, M. C. (1999). Distributional information in language comprehension, production, and acquisition: Three puzzles and a moral. In B. MacWhinney (Ed.), *The emergence of language* (pp. 177-196). Mahwah, NJ: Erlbaum.

Pearlmutter, N. J., & Gibson, E. (2001). Recency in verb phrase attachment. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **27**, 574-590.

Thornton, R., MacDonald M. C., & Arnold, J. E. (2000). The concomitant effects of phrase length and informational content in sentence comprehension. *Journal of Psycholinguistic Research*, **29**, 195-203.