The processing of VP ellipsis

Adam Szczegielniak (Harvard University), Evelina Fedorenko (MIT) & Ted Gibson (MIT)

The question: What types of information are processed during VP ellipsis comprehension?

The answer: Only the types of information that are relevant - we do not need to process Phonological *and* Semantic information in elided structures.

Previous Work (Shapiro et al. 2003)

Shapiro et al. claim to have shown that in processing of VP ellipsis every possible semantic interpretation is entertained by the listener, even the ungrammatical ones.

Cross-modal lexical priming was used to investigate whether in structures like (1) there is semantic priming for items related to the antecedent of the elided verb-phrase (VP) at the ellipsis site and at an earlier control location.

1. The zookeeper pushed the donkey out of the truck, and a visitor, who was {**MULE / MUSE**} sunburned all over his arms, did {**MULE / MUSE**} too, according to others at the park.

Semantic priming was observed at both locations, with a numerically larger effect at the ellipsis site.

So why do another experiment?

- The target-type (semantic / unrelated) by target-location (critical / control) interaction did not reach significance in Shapiro et al.'s study.
- The fact that priming was observed at the control-location suggests that subjects may have been:
  (1) consciously aware of the relationship between the target and the prime, and
  (2) developed a strategy of paying attention to the prime (the direct-object of the VP), which is consistent with a low filler-to-target ratio.

These issues make Shapiro et al.'s results difficult to interpret.

Experiment: Examining lexical activation during the comprehension of VP ellipsis

Design and procedure:
Within-modal lexical priming paradigm.
Design: 2 x 3 x 2

Hence, three factors were manipulated:

1. **Structure** (with / without VP-ellipsis)
2. **LD (lexical-decision) target-type** (semantically-related to the antecedent / phonologically-related to the antecedent / unrelated)
3. **LD target-location** (critical / control)

We used fixed-rate (350 ms/word) word-by-word visual sentence presentation with the intervening LD-task presented for 300 ms at the critical or control location:

Sample Item:

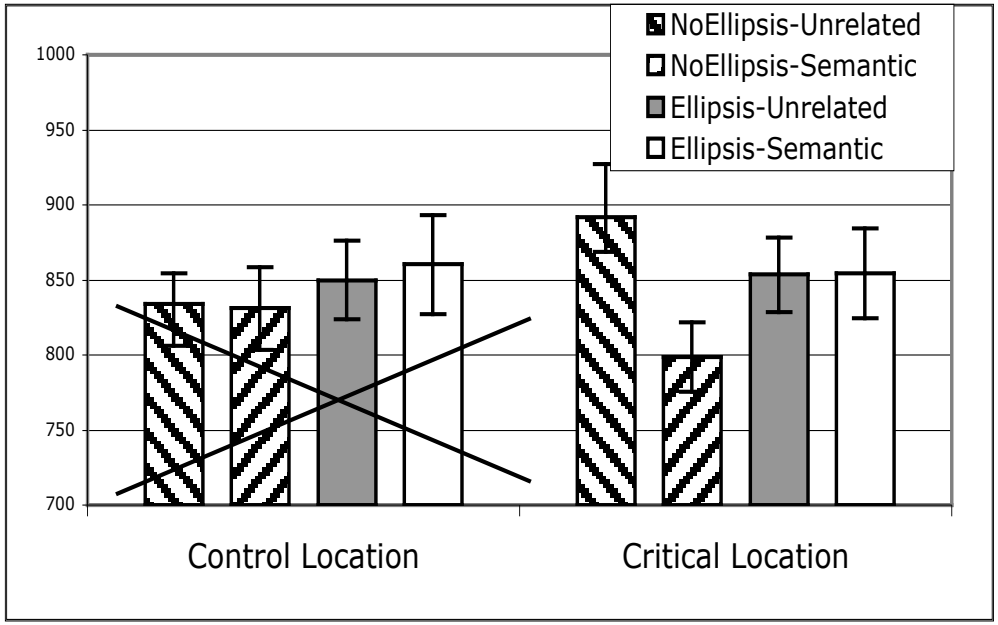
Ellipsis: Karen gave a speech which was long and boring {**TALK / BEACH / BRICK**} *and so did* Tyler {**TALK / BEACH / BRICK**} during the morning meeting.

No Ellipsis: Karen gave a speech which was long and boring {**TALK / BEACH / BRICK**} *while* Tyler {**TALK / BEACH / BRICK**} prepared a report.

Results

40 subjects, 48 items

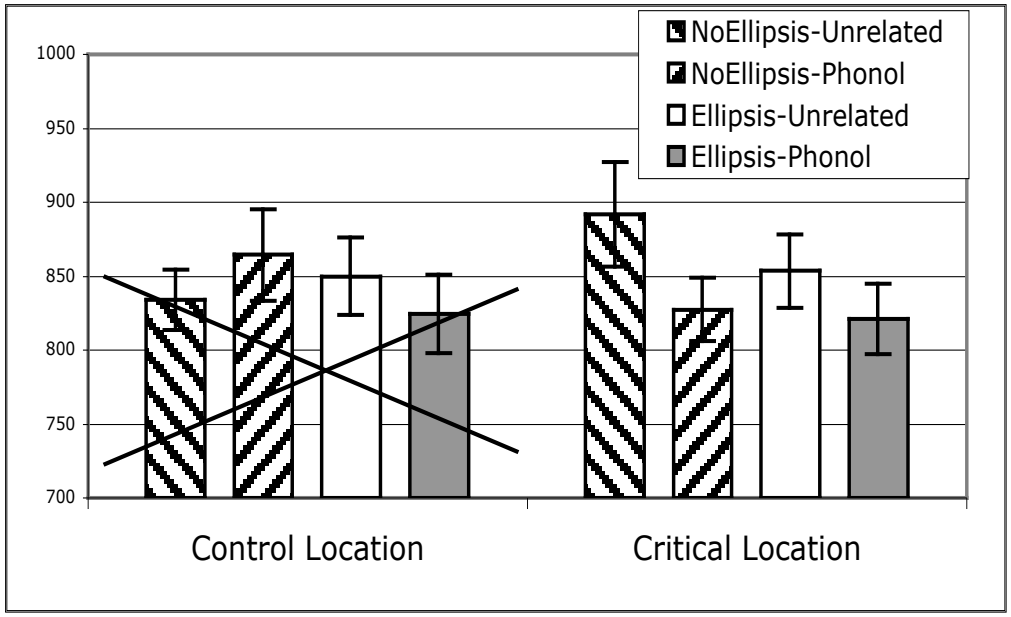
No priming effects at the control-location (Fs<1.5), suggesting that subjects were not aware of the experimental manipulation



Semantically-related LD-targets

- Main effect of target (Semantic faster than Unrelated) in the participants analysis only:
  $F1(1,39) = 9.45$, $MSE=84839$, $p<.005$
  $F2(1,47) = 2.64$, $MSE=104514$. $p=.11$

- Interaction between target (Semantic / Unrelated) and structure (Ellipsis / No Ellipsis):
  $F1(1,39) = 6.26$, $MSE=88321$, $p<.02$
  $F2(1,47) = 4.93$, $MSE=88892$, $p<.05$



Phonologically-related LD-targets:

- Main effect of target (Phonological faster than Unrelated), marginal in the items analysis:
  F1(1,39) = 5.018, MSE=93827, p<.05
  F2(1,47) = 3.16, MSE=103134. p=.08

- No interaction, Fs<1

Pairwise comparisons

Semantic and Unrelated conditions:

- Ellipsis Semantic vs. Ellipsis Unrelated
  NS (Fs<1)
- No Ellipsis Semantic vs. No Ellipsis Unrelated: No Ellipsis Semantic condition is faster
  $F1(1,39) = 14.7$, $MSE=173143$, $p<.001$
  $F2(1,47) = 5.98$, $MSE=193089$, $p<.02$

Phonological and Unrelated conditions:

- Ellipsis Phonological vs. Ellipsis Unrelated: a trend for the Phonological condition to be faster
  $F1(1,39) = 1.77$, $MSE=20922$, $p=.19$
  $F2(1,47) = 1.38$, $MSE=31230$, $p=.25$
- No Ellipsis Phonological vs. No Ellipsis Unrelated: No Ellipsis Phonological condition is significantly (marginally in the items analysis) faster
  $F1(1,39) = 4.19$, $MSE=83259$, $p<.05$
  $F2(1,47) = 2.98$, $MSE=76977$, $p=.09$

Accuracy data

- Main effect of structure (marginal in the items analysis): No Ellipsis conditions are more accurate than Ellipsis conditions
  $F1(1,39) = 5.88$, $MSE=.0689$, $p<.05$
  $F2(1,47) = 3.69$, $MSE=.0811$, $p=.06$
- Main effect of target:
  $F1(2.78) = 4.53$, $MSE=.0767$, $p<.02$
  $F2(2,94) = 3.78$, $MSE=.0700$, $p<.05$

No other effects/interactions.

Interpretation of results

We find an asymmetry between phonological and semantic priming in elided structures as compared to the control (No Ellipsis) condition, where there is semantic and phonological priming.

We explain priming in control conditions as resulting from the need to establish coherence relationships.

There are **two hypotheses** that can account for the pattern of priming in ellipsis structures:

1. Processing of elided structures involves only semantic processing:
   When we process elided structures, lexical access due to reactivation of the antecedent VP for *coherence* interpretation and for *ellipsis* interpretation compete. This competition results in the lack of priming at the semantic level.

2. Processing of elided structures involves only phonological processing:
   Ellipsis involves de-stressing and deletion, a phonological process.
   There is phonological priming because phonological information of the antecedent VP is activated.

Current experiment cannot provide empirical evidence to exclude (1) or (2). Additional research is being carried out to examine the interaction between coherence and ellipsis.