Effect of Plausibility on Analysis of Garden Paths

A Gaze-Tracking Study

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Abstract
Research on the cognitive science of sentence processing has been driven largely by the study of resolution of syntactic ambiguity in Garden Path sentences. Recent work has shown that apart from syntax, semantics is another essential component that affects the analysis of sentences. In this study, we analyze the role of semantic plausibility in resolution of syntactically ambiguous Garden Path Sentences.

Theory of Incremental Evaluation

- Sentences processed sequentially, most “probable” parse tree selected at every word.
- Probability predominantly defined by the syntactical role of words, rather than semantic meaning.

Protagonists 
Garden Path sentences: The most likely parse in incremental evaluation will be incorrect.
→ The criminal confessed his sins which upset kids harmed too many people.
→ As the woman edited the magazine about fishing amused all the reporters.
Impossible to parse sentences!

Resolution through reanalysis

Proposed Theory

- Syntactic role of elements in a sentence predominantly controls its parsing, BUT semantic plausibility of the parse defines the extent of attachment towards the sentence.
- Greater semantic plausibility of initial parse → Greater attachment → Larger time in reanalysis →↑ Regressions, ↑ First pass time

Experimental setup

Two related experiments conducted simultaneously.
- Experiment 1: Subordinate Clause Ambiguities
  A clause dependent on a main clause.
  → When the ambassador negotiated the treaty about arms upset
  many of the civilians.
- Experiment 2: Complement Clause Ambiguities
  A clause introduced by a complementizer such as that or whether.
  → The sailor reads the chart from London described new routes around the world.

Methodology

1. Gaze Tracking apparatus and software designed by SensoMotoric Instruments (SMI) used.
2. 8 test sentences + 18 fillers. No two test sentences consecutive.
3. 4 sentences for each of the two experiments → types I, II, III, or IV.
4. All sentences written over two lines, sufficient distance (1") between the two lines.

Instructions
- Do not waiver focus from the sentence. Read sentence sequentially, word by word.
- You can go to a previous word to understand the meaning, but always focus on the current word you are reading.
- Close your eyes once you are done reading the sentence. (This is an indicator for the experimenter to move to the next sentence)
- Understanding the meaning of the sentence is essential to the experiment. Close your eyes only after understanding the meaning.

Discussion and Conclusion

1. It was clear that readers commit to a more plausible initial analysis. Often, the implausible sentences did not even show regressions. This validates our primary hypothesis, indicating an essential role of semantics in parsing.
2. Effects of disambiguation were delayed, appearing as regressions from posterior words. Often no local effects were present, only overall increase in total pass time.

Possible improvements in setup

- Issue: The apparatus required the head to be kept stationary. Violation drastically affected calibration.
- Solution: An adjustable chin-rest could be provided.
- Issue: The gaze of subjects often diverted from the sentence despite clear instructions.
- Solution: A dark background around the sentence, with the sentence embedded over a white background could be used to make sure that subjects focus on the sentence.

References