Using grammatical features to forecast incoming structure: The processing of Across-the-board extraction

Citation for published version:
Sturt, P & Martin, AE 2016, 'Using grammatical features to forecast incoming structure: The processing of Across-the-board extraction' 29th CUNY Human Sentence Processing Conference, Gainesville, Florida, United States, 3/03/16.

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Background: Across the board (ATB) extraction

- A filler (e.g., wh-phrase) is linked to multiple gaps, each in a different conjunct.
- ATB extraction is degraded when two gaps have different syntactic functions (Williams (1978); LI):
  
  (a) Parallel syntactic functions (good)
  The surgeon who James tricked G1 and Richard annoyed G2 scrubbed up for surgery

  (b) Non-parallel syntactic functions (bad)
  * The surgeon who G1 tricked James and Richard annoyed G2 scrubbed up for surgery

- Is this contrast due to a grammatical constraint?
  - e.g., (b) is ungrammatical because the operator who is not allowed to be linked to nominative and accusative case simultaneously
  - Or is it due to processing differences?
    - Parallelism preference (Frazier et al., 2000, JPR):
      - 2nd conjunct in (b) is hard because its internal structure differs from 1st conjunct

Analysis measures

- **Go-Past time**
  - The time taken to "go past" a region: sum of fixation durations from the first entry into the region from the left, to the first exit to the right
- **Proportion of First-pass regressions**
  - Proportion of trials where the first exit from the region is a regression.
- **Total Time**
  - Summed durations of all fixations in the region.

Experiment 1: Results (critical region)

- Main effect of parallelism in all measures (all p's < .01): Reading times shorter, and fewer regressions, in Parallel relative to non-parallel
- Interaction of Parallelism × ATB in Total time (p < .05), and marginal in Go-Past (p < .06; p < .05).
- Larger parallelism effect in ATB than in non-ATB

Experiment 2 design

- Same conditions as Exp1, but with extra embedding
- Each relative clause was 2 clauses deep
- Gap inside the most deeply embedded clause

(a) Parallel: ATB
The surgeon who I think James tricked G1, and you think Richard annoyed G2, scrubbed up for surgery

(b) Non-Parallel: ATB
The surgeon who G1 tricked James, and Richard annoyed G2, scrubbed up for surgery.

(c) Parallel: Non-ATB
The surgeon who James tricked G1, and who Richard annoyed G2, scrubbed up for surgery.

(d) Non-Parallel: Non-ATB
The surgeon who G1 tricked James, and who Richard annoyed G2, scrubbed up for surgery.

- Non-ATB conditions included as a control:
  - Non-ATB conditions include operator for each conjunct
  - If (a) vs. (b) contrast is due to grammatical constraint, there should be no comparable contrast (c) vs. (d), since each who is linked to just one gap (so no case clash)
  - However, parallelism effects should be similar whether ATB or not

Experimental set-up (both Exp1 and Exp2)

- 40 participants
- Eye-tracking during reading (Eyelink 1000)
- 30 sentences

Summary

- Parallelism clearly plays a role in subject vs. object relative clause extraction.
- Some evidence for the grammatical account (extra parallelism effect in Exp1, over and above baseline parallelism effect) leads to interaction.
- However, no evidence of the interaction in Exp2, and Parallelism also significantly reduced.
- If the contrast in (a) vs. (b) is related to passing of case features, then structural distance introduced by embedding may have degraded this process.
- Extra embedding also reduces parallelism