Agreement Attraction (but No Interference) in Grammatical Sentences

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Contradicting predictions

Several theoretical accounts make contradicting predictions about the processing of subject-verb dependencies in structures as:

1. The computer installed in the missile *is* ...
2. The computer installed in the missiles *is* ...
3. *The computer installed in the missiles *are* ...

→ Feature percolation / Marking & morphing: The plural feature of the intervening noun (*missiles*) accidentally percolates to the root node of the NP / affects computation of subject number ⇒ agreement attraction effect in grammatical sentences (**2**), manifested in slower reading time on the singular verb (ungrammaticality illusion).

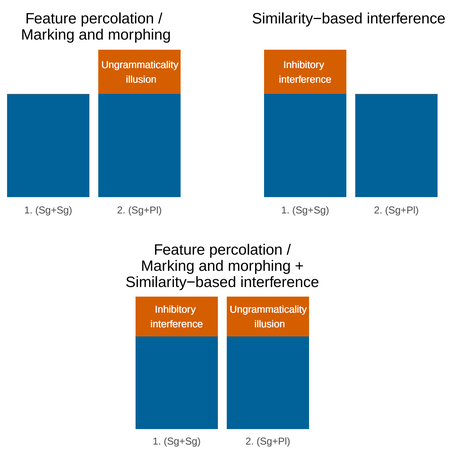
→ Reanalysis interference: Wagers, Lau & Phillips (2009) proposed that attraction only occurs in ungrammatical sentences (**3**): number mismatch between the subject and the verb triggers reanalysis, during which the interfering noun may occasionally be misretrieved. In grammatical sentences, reanalysis is not triggered.

→ Similarity-based interference: The singular intervening noun (*missile*) matching the number marking of the verb should create inhibitory interference (slowdown) in (**1**) as compared to (**2**).

The majority of studies found no differences in reading times between conditions (**1**) and (**2**), which is problematic for both similarity-based interference and feature percolation / marking & morphing.

Confounds in previous designs

Hypothesis: Attraction effects are present in grammatical sentences (**2**), but masked by interference effects in (**1**). If the interference and the attraction effects are similar in size, they might cancel each other out:



Design

Reduce similarity-based interference in **Semantic mismatch** conditions by making the intervening noun inanimate and therefore semantically incompatible with the verb ⇒ Attraction is expected in (**b**), but not (**a**), the typically tested configuration.

We manipulated semantic and number match/mismatch between the verb and the interfering noun. Experiment 1 (without parenthetical) had an unusually long-lasting plural complexity effect (spill-over). Experiment 2 mitigated spill-over using parentheticals between the intervening noun and the verb. Experiment 3 used an object relative clause construction and should elicit agreement attraction under Marking & Morphing but not feature percolation:

Experiments 1 (without parenthetical) and 2 (with parenthetical)

a. **Semantic match**
{The admirer of the singer / The admirer of the **singers**} (according to the Daily Mail) supposedly thinks that the show ....

b. **Semantic mismatch**
{The admirer of the play / The admirer of the **plays**} (according to the Daily Mail) supposedly thinks that the show ....

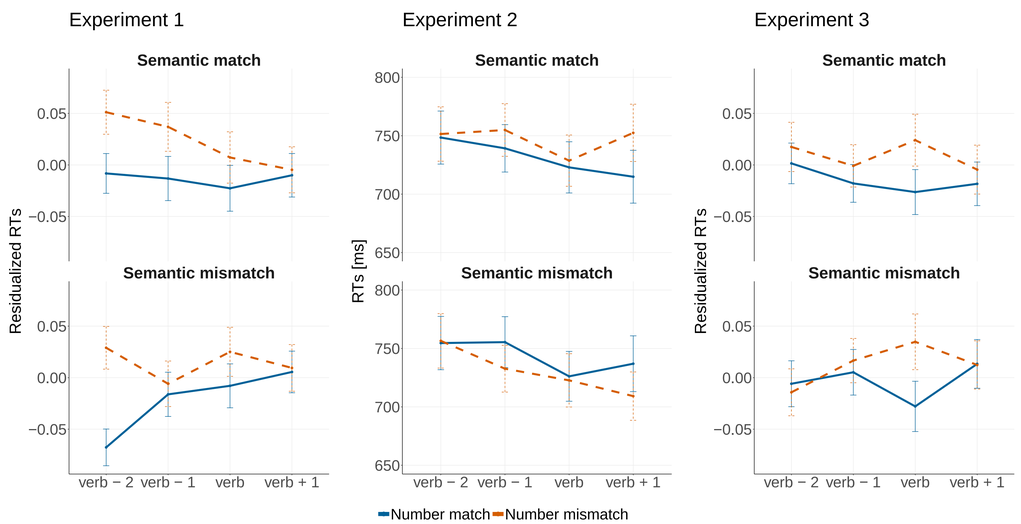
Experiment 3

a. **Semantic match**
The {singer / **singers**} that the actor openly admires apparently received some harsh criticism.

b. **Semantic mismatch**
The {play / **plays**} that the actor openly admires apparently received some harsh criticism.

→ Self-paced reading, sentence acceptability judgments and comprehension questions
→ 16 items (in each experiment) used in a single trial design to avoid adaptation effects
→ Online presentation programmed in Ibex, participants were self-reported native English speakers (N = 4296 for Experiment 1, N = 3920 for Experiment 2, N = 3600 for Experiment 3)
→ Studies were pre-registered on OSF: Experiment 1 – https://osf.io/pd8ky/, Experiments 2 & 3 – https://osf.io/vm5bw/.

Results



Bayesian LMM analysis

Plural complexity effect:

- Experiments 1 and 3 showed unusually long-lasting plural complexity effects (longer RTs after the plural interfering noun). Statistical control: RT on the n-1th word as a covariate in the model for the nth word (deviation from the pre-registration). This eliminated the number mismatch (attraction) effect on the pre-critical region, meaning that any slowdown on the critical verb cannot be attributed to spillover effect.

Reading times:

- **Experiment 1**: A main effect of attraction on the critical verb (95% CrI: 0.3 ms – 54 ms), but no evidence for semantic interference or interaction.
- **Experiment 2**: An interaction in the region following the verb: There was a slowdown due to plural interfering noun in semantic match conditions (**a**, 95% CrI: 4 ms – 63 ms), but not in semantic mismatch conditions (contrary to our prediction).
- **Experiment 3**: A main effect of attraction on the critical verb (95% CrI: 8 ms – 70 ms, consistent with Marking & Morphing but not feature percolation), but no evidence for semantic interference or interaction.

⇒ All three experiments provide evidence for agreement attraction (ungrammaticality illusion) in grammatical sentences, and no evidence for semantic or number interference.

Discussion

→ Our hypothesis that attraction effects may be concealed by similarity-based interference did not receive any support.

→ Reanalysis interference cannot account for any of the effects in grammatical sentences.

→ Similarity-based interference (either semantic or number) was not observed in any of the experiments. Privative number marking (only plural nouns having the number feature) could explain lack of number interference, but no explanation is readily available for the lack of semantic interference.

→ In sum, *any* plural non-subject noun present in the sentence seems to slow down processing at the verb, which is only compatible with Marking and Morphing account, but not memory-based retrieval accounts and feature percolation.

Do you have feedback for us?

Drop us a line via e-mail ({laurinavichy\malsburg}@uni-potsdam.de), or on Twitter @annlaurin, @tmalsburg.