Agreement attraction in grammatical sentences does arise, but only in the good-enough processing mode

In comprehension, agreement attraction errors are known to facilitate the processing of ungrammatical sentences, such as The key to the cabinets are rusty. However, there is only scarce evidence suggesting that agreement attraction can also increase processing difficulty in grammatical sentences. The Marking & Morphing account predicts a slowdown at the verb in sentences such as The key to the cabinets is rusty, due to erroneous representation of the subject number (the illusion of ungrammaticality). The majority of studies haven’t found any evidence for this effect, and most of those that did had design confounds. However, recently evidence in favor of the predicted effect has begun to accumulate: [2] reported the expected effect in grammaticality judgments, and here we report consistent illusions of ungrammaticality in reading times across three experiments. Moreover, in an additional experiment we show that the illusion was rarely observed before because it is likely to arise only in the good-enough processing mode.

All experiments were conducted in English using 16 items in a 2x2 design manipulating semantic and number match/mismatch between the verb and the attractor noun (see example items). Participants each read a single experimental sentence (thus preventing adaptation to the stimuli and strategic effects) in an online self-paced reading paradigm. Bayesian LMMs were used for the analysis. Spill-over from the attractor noun was statistically controlled in Exp. 1 by adding the RTs on the pre-critical word as a covariate in the model for RTs on the critical word.

Exp. 1 (N=4,296) showed a slowdown in number mismatch conditions on the critical verb (26ms, CrI:[0.30, 50]ms). Exp. 2 (N=3,920) introduced long parentheticals with four to six words between the attractor noun and the verb. We found an interaction in the region following the verb: number mismatch conditions were read slower, but only within semantic match conditions (33ms, CrI: [4, 63]ms). In Exp. 3 (N=3,559), we used object relative clauses with three words intervening between the attractor noun and the verb. Again, we observed a slowdown in number mismatch conditions on the critical verb (59 ms, CrI:[12, 105]ms). Exp. 4 (N=3,702) had the same stimuli as Experiment 3. We manipulated only the practice sentences to induce deeper processing of the experimental sentence: instead of simple practice sentences from Exp. 1-3, we used three new, complex sentences accompanied by comprehension questions (see example sentence). No main effects or interactions were observed in Exp. 4. We pooled data from Exp. 3 and 4 to test for an interaction between the illusion of ungrammaticality and the depth of processing. It was found at the critical verb n and word n+1: as expected, it was driven by the slowdown in number mismatch conditions in Exp. 3 (the verb: 59ms, 95%-CrI:[15, 103]ms; n+1: 34ms, 95%-CrI:[9, 59]ms).

Across three experiments, we found the illusion of ungrammaticality in configurations where it has not been convincingly demonstrated in previous studies. These results suggest that the illusion of ungrammaticality does arise in normal sentence processing, and that attraction effects cannot be attributed to repair mechanisms alone. Furthermore, our results demonstrate that the illusion can be switched off when participants engage in deep processing. This finding sheds light on why the illusion was so rarely observed in previous studies: superficial processing mode is difficult to achieve in a repeated measures design, where experimental sentences are followed by comprehension questions. On a broader level, our findings add to the surprisingly sparse causal evidence supporting the existence of different processing modes (the only demonstration so far being the case of global ambiguity resolution [3,4]).
Example items:

(1)  
a. The admirer of the singer supposedly thinks that ...
b. The admirer of the singers supposedly thinks that ...
c. The admirer of the play supposedly thinks that ...
d. The admirer of the plays supposedly thinks that ...

...the show was a big success.

(2)  
a. The admirer of the singer, according to the Daily Mail, supposedly thinks that ...
b. The admirer of the singers, according to the Daily Mail, supposedly thinks that ...
c. The admirer of the play, according to the Daily Mail, supposedly thinks that ...
d. The admirer of the plays, according to the Daily Mail, supposedly thinks that ...

...the show was a big success.

(3)  
a. The singer that the actor openly admires apparently ...
b. The singers that the actor openly admires apparently ...
c. The play that the actor openly admires apparently ...
d. The plays that the actor openly admires apparently ...

...received some harsh criticism.

Example of a difficult practice sentence in Experiment 4:

(1)  
The priest who had privately advised the lawyer of the art dealer, is accused of withholding information. Who was accused? — The priest/The lawyer/The art dealer/The art dealers/I’m not sure.

Reading times in three experiments across regions of interest — estimated means and 95% confidence intervals.