Agreement attraction in grammatical sentences arises only in the good-enough processing mode

Anna Laurinavichyute, Titus von der Malsburg (University of Potsdam)

In comprehension, agreement attraction errors are known to facilitate the processing of ungrammatical sentences, such as *The key to the cabinets are rusty*[1]. There is only scarce evidence suggesting that agreement attraction can also increase processing difficulty in grammatical sentences. The Marking & Morphing account [1] 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 ungrammaticality illusion). 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 [3] found an illusion of ungrammaticality in reading times in three self-paced reading experiments. It seems that the illusion is subject to some unknown constraints, and there is no explanation of why [3] detected the illusion absent in other studies. We hypothesized that the crucial factor might be good-enough processing: [3] presented participants with a single experimental sentence preceded by three simple training sentences without comprehension questions. We suggest that the training phase might have encouraged superficial processing of the experimental sentence. The superficial processing, in turn, may have allowed the illusion of ungrammaticality to appear. We test whether increasing the depth of processing would make the illusion of ungrammaticality disappear.

Methods. Participants were presented with the materials from Experiment 3 by [3], which were not changed in any way (see 1). Instead, we manipulated the training sentences that preceded the experimental sentence to induce deeper processing: we used three new, more complex training sentences, each of them accompanied by a difficult comprehension question (see 2). The original experiment had data from 3,559 participants. We aimed to collect at least as much data as in the original experiment and acquired data from 3,702 individuals. For the analysis, we used Bayesian LMMs.

Results. No main effects or interactions were detected at the verb or on the region following the verb. We pooled the data from the original Experiment 3 and the new experiment to test for an interaction between the illusion of ungrammaticality and the depth of processing. An interaction was found at the critical verb n, words n+1 and n+2. At the verb and word n+1, the interaction was driven by the the illusion of ungrammaticality in the superficial processing condition (the verb: 59ms, 95%-CrI:[15, 103]ms; the following region: 34ms, 95%-CrI:[9, 59]ms). At word n+2, nested comparisons showed the opposite effect: a slowdown in conditions with a number-matching interfering noun in the deep processing condition (-25ms, 95%-CrI:[-49, -2] ms), predicted by the cue-based retrieval accounts.

Discussion. Our results demonstrate that the illusion of ungrammaticality 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 and consistently found in Expts. 1 through 3 by [3]: superficial processing mode is difficult to achieve when using a repeated measures design, where experimental sentences are followed by comprehension questions. From the theoretical perspective, our findings are difficult to reconcile with the Marking & Morphing account: although it predicts the illusion, the postulated cause is not the misidentification of the subject noun or falsely assembled syntactic structure. Therefore, deeper processing and potentially more accurate memory encoding should not influence the rate of agreement attraction according to Marking & Morphing. Our findings are more compatible with a simple heuristic tracking the instances of plural features, a heuristic that might be initiated when deep parsing is not the main priority. 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 [4,5]).

Example experimental item:

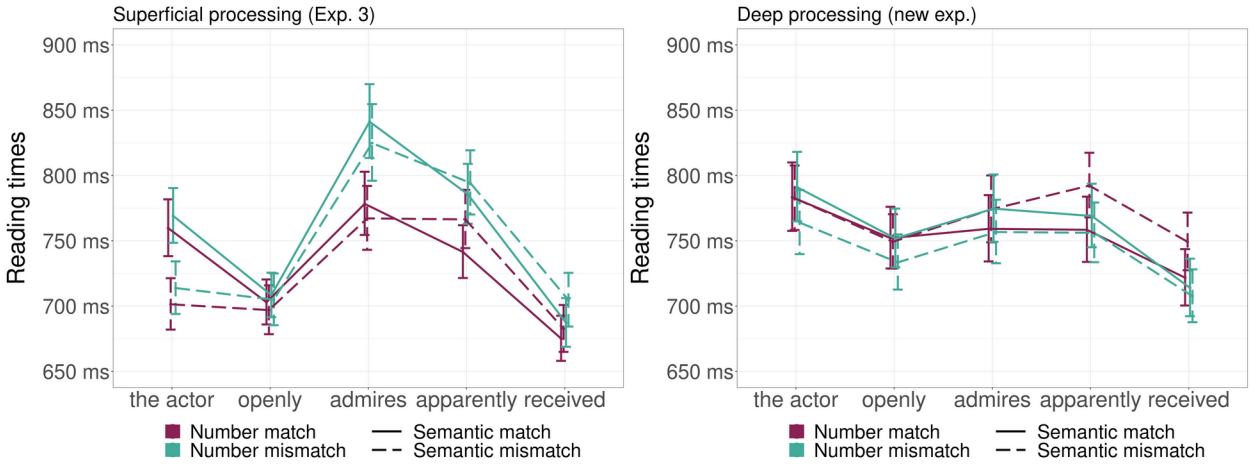
(1) a. The singer that the actor openly **admires** apparently …
b. The singers that the actor openly **admires** apparently …
c. The play that the actor openly **admires** apparently …
d. The plays that the actor openly **admires** apparently ...
...received some harsh criticism.

New practice sentences (response options were presented in random order):

(2) 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.

2. The personal assistant who the bodyguard of the delegate does not trust attracts great public attention.
Who attracted public attention? — The personal assistant/The bodyguard/The delegate/ The bodyguards/I'm not sure.

3. The philanthropist who had greeted the secretary of the director, later participated in the fundraising committee.
Who took part in the committee? — The philanthropist/The secretary/The director/The secretaries/I'm not sure.



Geometric mean reading times across conditions. Number match and Number mismatch refers to the match/mismatch between the interfering noun and the verb (since all experimental stimuli are grammatical, the subject noun always fully matches the verb).

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