Event plausibility influences language comprehension in reversal anomalies: Evidence from ERPs and comprehension data

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Can our knowledge of the world shape how we understand language? Indeed it seems that sometimes it can override syntactic cues. For example, readers frequently misinterpret role-reversed sentences such as *"The dog was bitten by the man"* as the dog biting the man, effectively ignoring the syntax in favour of what is more plausible [2]. However, recent post-interpretive accounts have argued that these errors do not reflect plausibility-based language processing, but instead result from faulty memory retrieval [1, 3]. On this view, role-reversed sentences are processed strictly veridically, in accordance with the syntax, and comprehension errors arise later, induced by task demands and memory processes. Here, we examined whether misinterpretations arise online or post-interpretively by combining ERP and comprehension measures. If misinterpretations take place online, we predicted that correctly interpreted role-reversed sentences should elicit a P600—an ERP component associated with online reanalysis—relative to a plausible baseline, whereas misinterpreted sentences should not.

Method. Participants (N = 159) read plausible and role-reversed German sentences presented word-by-word in the centre of the screen, while we recorded their EEGs. Each experimental sentence was followed by a comprehension question probing the agent or the patient (see sample stimuli 1a-b and comprehension questions on the last page), to which participants responded with a button press.

Analysis. We examined ERPs in the P600 time-window (550-800 ms time-locked to the presentation of the critical word, averaged across a posterior ROI for each trial), binning the trials by condition and response correctness. The data were analysed using Bayesian hierarchical mixed effects models and hypothesis testing was carried out using Bayes factors (BF). We report estimates and credible intervals (CrI).

Results and Discussion. Our analyses revealed that the P600 was increased in response to role-reversed sentences that were interpreted correctly, relative to the plausible baseline, $\hat{\beta} = 0.86,\ CrI = [0.30,\ 1.40]$. The evidence for this effect was strong ($BF_{10} = 24.03$). Importantly, the same role-reversed condition yielded no P600 increase when the sentences were misinterpreted based on plausibility ($\hat{\beta} = 0.19,\ CrI = [-0.37,\ 0.73]$, $BF_{10} = 0.34$). This ERP pattern suggests that syntactically correct interpretation of role reversed sentences was accompanied by incremental reanalysis, while misinterpreted role-reversed sentences were processed as though they were plausible. Our results are difficult to reconcile with strictly post-interpretive accounts of misinterpretations, as they do not predict any variation in processing related to comprehension accuracy before the comprehension probe. Instead, our data are better accommodated by models of sentence comprehension that permit plausibility-based processing.

References

[1] Markus Bader and Michael Meng. The misinterpretation of noncanonical sentences revisited. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 2018.

[2] Fernanda Ferreira. The misinterpretation of noncanonical sentences. *Cognitive Psychology*, 2003.

[3] Michael Meng and Markus Bader. Does comprehension (sometimes) go wrong for noncanonical sentences? *Quarterly Journal of Experimental Psychology*, 2021.

Figures

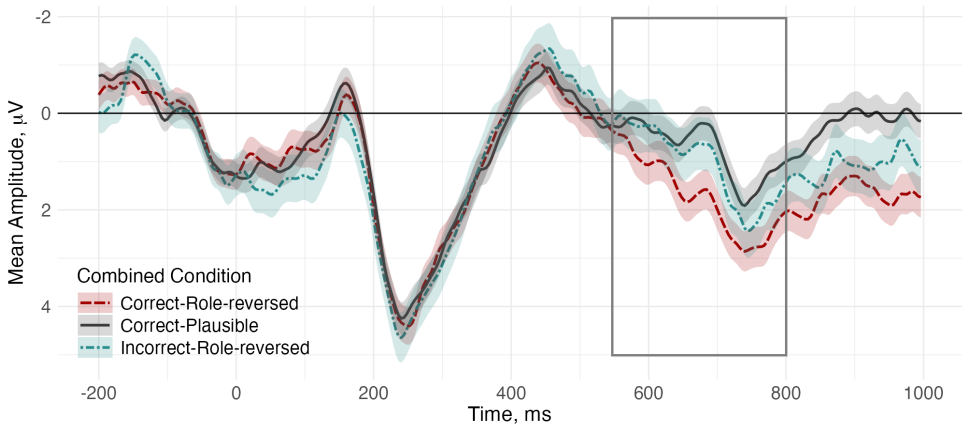

Figure 1: Event-related potentials time-locked to the critical word, binned by condition and response correctness. Negativity is plotted upwards. The grey box indicates the P600 window. The ERPs were pooled across electrodes in posterior ROI: CP1/2, Cz, P3/4, Pz. Ribbons indicate 95% confidence intervals.

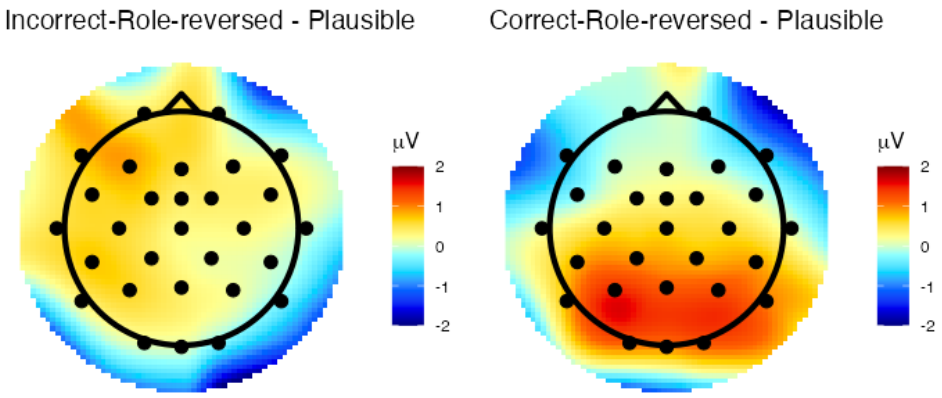

Figure 2: Topographical voltage maps of the ERP effects in the 550-800ms window. Left: *Incorrect-Role-reversed* minus *Plausible*; Right: *Correct-Role-reversed* minus *Plausible*.

A sample of German experimental sentences in both conditions

The example sentences below show the German stimuli in plausible [1a] and role-reversed [1b] conditions, with the English gloss directly below each sentence. The OSV (Object-Subject-Verb) order has been previously shown to elicit the most amount of misinterpretations [1], which were the focus of the current study.

[1a] Die Menschen am Strand konnten sehen, *plausible*
welchen Surfer der Hai angegriffen hatte.
The people on the beach could see,
which$_{ACC}$ surfer the$_{NOM}$ shark attacked has.

[1b] Die Menschen am Strand konnten sehen, *role-reversed*
welchen Hai der Surfer angegriffen hatte.
The people on the beach could see,
which$_{ACC}$ shark the$_{NOM}$ surfer attacked has.

Each plausible sentence contained a relative clause introduced by *welchen* (the accusative form of *which* in German), followed by the patient, the agent, and the critical verb (underlined). The relative clause makes the OSV order less marked, since *which* can license OSV even in English. For the role-reversed version, we swapped the agent and patient roles, making necessary morphological adjustments to maintain grammaticality (in German, some nouns take an additional suffix in the accusative case, e.g. *Polizist* becomes *Polizisten*). All argument nouns were masculine.

Each experimental sentence was always followed by a comprehension question, probing either the agent, e.g. *"Was/Wer hat jemanden angegriffen?"* (Who/What attacked someone?), or the patient, e.g. *"Was/Wer wurde angegriffen?"* (Who/what was attacked?) of the action. Both question words (Was/Wer) were always present in the question separated by a slash to avoid animacy bias.

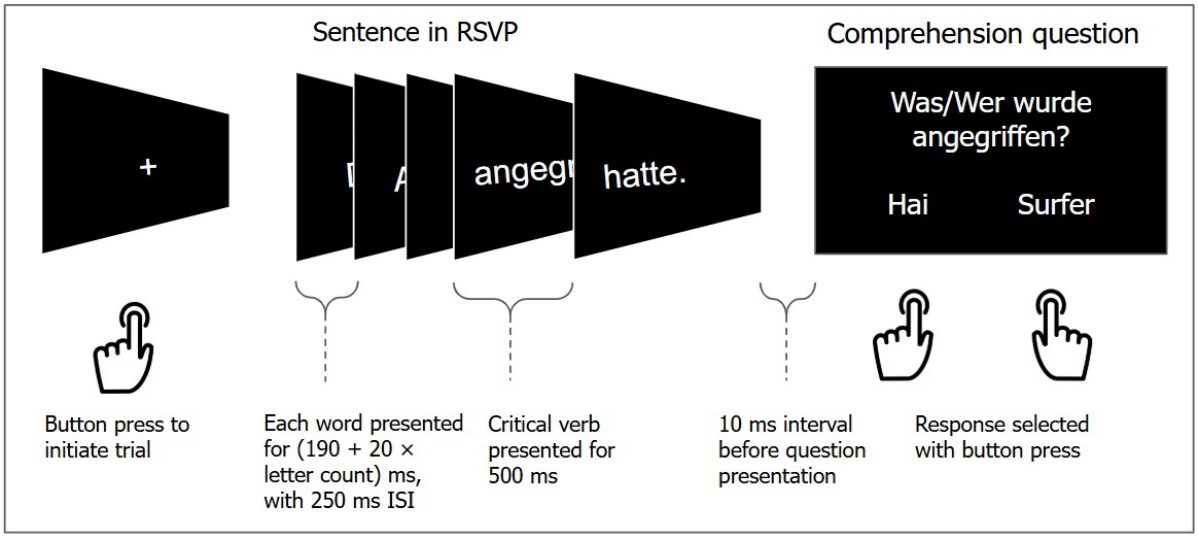

Figure 3: Trial structure