

The Posterior P600 reflects Reanalysis but not Repair

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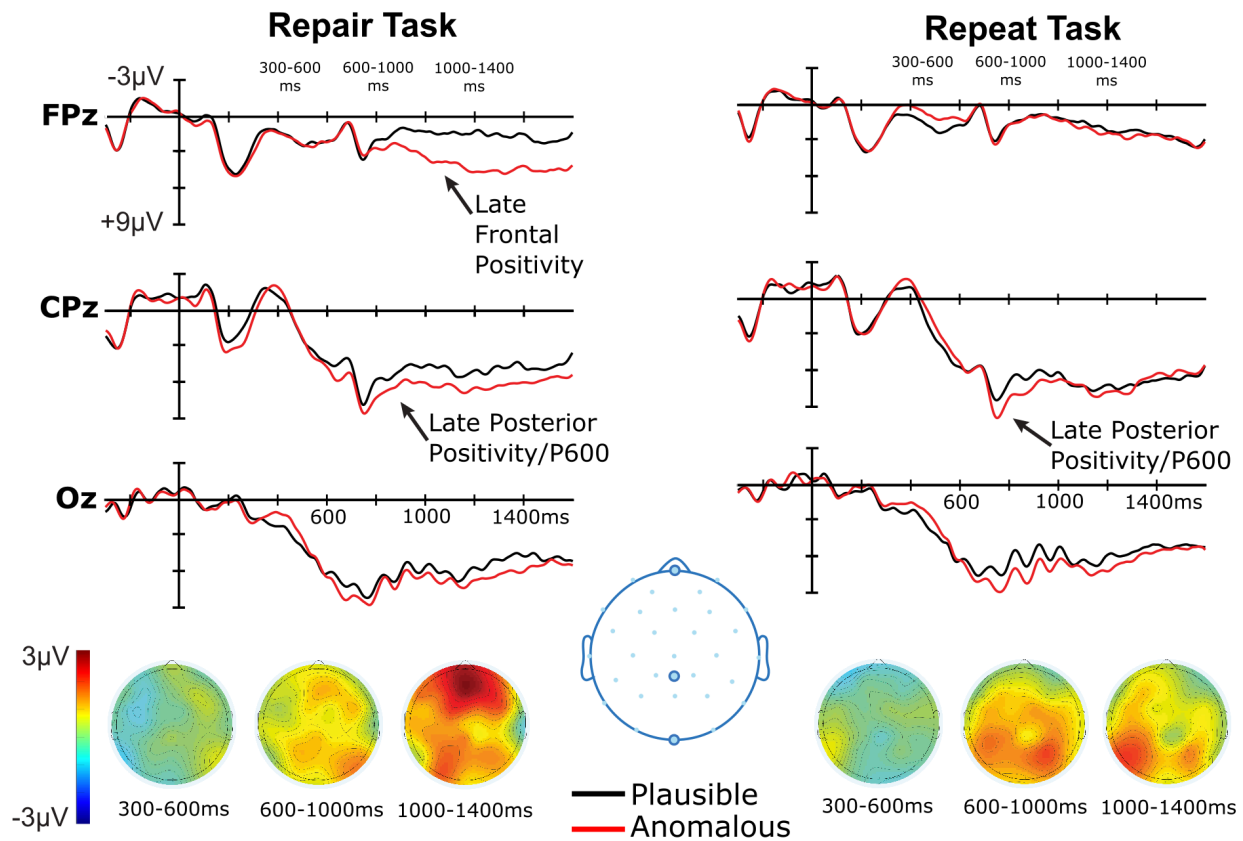
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Language comprehension requires us to infer the underlying message being communicated. However, this message can be complicated by the presence of errors, ambiguities and misperceptions. Rather than passively accepting these errors, comprehenders sometimes engage in additional analysis of the input, which manifests as a late posteriorly distributed positive-going waveform, known as the P600 [1,2]. However, it has been unclear whether the late posterior positivity/P600 simply reflects a re-analysis of the input (reprocessing in attempt to gather more information), or whether it additionally reflects attempts to actively repair the input (i.e. actively change its surface features) to re-establish coherence. To distinguish between these accounts, we manipulated task requirements as participants read sentences, which were either plausible or anomalous (*The judge's gavel was banged/*pardonned*). Based on the prior literature, these semantically attracted anomalies were likely to elicit a late posterior positivity/P600 effect [2,3]. In both tasks, participants indicated after each sentence whether it was plausible or anomalous. In the 'Repeat' task, they then repeated the sentence exactly as it was presented, making repair difficult. In the 'Repair' task, they repaired any errors (if present) and spoke the corrected versions of the sentences aloud. This resulted in a 2 x 2 within-participants design that crossed Task (Repeat or Repair; blocked with order counterbalanced) and Plausibility (Plausible or Anomalous). If the late posterior positivity/P600 effect only reflects detection of conflict and re-analysis, then its magnitude should be the same in both the Repeat and the Repair tasks. Conversely, if it is only elicited when participants engage in linguistic repair, then it should be seen in the Repair but not in the Repeat task. Finally, if linguistic re-analysis and repair processes involve distinct cognitive operations, we may observe two separate neural components across tasks, potentially with different time-courses or scalp topographies.

Methods: 21 participants read 192 scenarios (96 anomalous and 96 plausible) while EEG was recorded. All sentences followed the form “[article/pronoun] [adjective] [noun] [was/were/had been] [verb]”, and all nouns were semantically attracted to the preceding verb. To assess differences across conditions, we extracted ERPs to the critical verbs, and carried out 2x2 repeated measures cluster mass univariate ANOVAs across all scalp electrodes within a common P600 time window (600-1000ms) as well as within a later 1000-1400ms window. We also examined effects within an earlier N400 time window (300-600ms).

ERP Results: Between 600-1000ms, we observed a main effect of Plausibility due to a larger P600 to anomalous than plausible completions (spatial mass peak: P4, extent: 627-1000ms, $p < 0.001$). However, there was no main effect of Task, or Task x Plausibility interaction. This positive-going effect continued into the later 1000-1400ms time window in both the Repeat and the Repair tasks (a main effect of Plausibility, Spatial mass peak: AF3, extent: 1000-1400ms, $p < 0.001$). At frontal sites, however, the effect appeared to be much more robust in the Repair than the Repeat task. Statistically, this was reflected by a cluster that showed an interaction between Plausibility and Task, which was limited to frontal sites (Spatial mass peak: AF4, extent: 1000-1400ms, $p = .03$). Follow-up analyses confirmed that the cluster showing a main effect of Plausibility extended to all these frontal sites in the Repair task, but not the Repeat task. No significant clusters were observed within the 300-600ms time window.

Discussion: The presence of a late posterior positivity/P600 between 600-1000ms in both the Repeat and Repair tasks suggest that this component does not reflect repair processes, but instead reflects the diagnosis of a comprehension error and re-analysis of the input [4]. In contrast, in the current paradigm, linguistic repair processes were associated with a still later frontally distributed positivity (1000-1400ms). We suggest that this reflected the re-establishment of coherence after comprehenders successfully repaired the anomalies, following previous work linking late frontal positivities to successful shifts in the discourse model [5,6].



References:

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