

If the real world were irrelevant, so to speak: The role of propositional truth-value in counterfactual sentence comprehension

Mante S. Nieuwland and Andrea E. Martin

Basque Center on Cognition, Brain and Language

Contact: m.nieuwland@bcbl.eu

Propositional truth-value can be a defining feature of a sentence's relevance to the unfolding discourse, and establishing propositional truth-value in context key to successful interpretation. We investigated its role in comprehension of counterfactual conditionals, which describe imaginary consequences of hypothetical events, and are thought to require keeping in mind both what is true and what happens to be false (Byrne, 2002). Pre-stored real-world knowledge may therefore intrude upon and delay counterfactual comprehension, which is predicted by some accounts of discourse comprehension (e.g., Garrod & Terras, 2000), and has been observed during online comprehension in event-related potential (ERP) and eye-tracking measures (Ferguson & Sanford, 2008; Ferguson, Sanford & Leuthold, 2008). The impact of propositional truth-value may thus be delayed in counterfactual conditionals, as also claimed for sentences containing other types of logical operators (e.g., negation, scalar quantifiers). Yet, the validity of these earlier results stands or falls with the provision of a sufficiently constraining discourse context to 'overrule' real-world knowledge. In an ERP experiment, we investigated the impact of propositional truth-value when described consequences are both true and predictable given the counterfactual premise. Thirty participants read 120 negated counterfactual true/false statements in Spanish (approximate translation: "If N.A.S.A. had not developed its Apollo Project, the first country to land on the moon would have been Russia/America") and real-world true/false statements ("Because N.A.S.A. developed its Apollo Project, the first country to land on the moon was America/Russia"), presented word-by-word, and mixed with 60 non-counterfactual filler sentences. Counterfactual and real-world statements were matched for CW expectancy and for average truth-value rating based on the results of two independent pre-tests. Our hypothesis involved the amplitude of the N400 ERP (Kutas & Hillyard, 1980), which indexes early semantic processing costs and is sensitive to subtle variations in discourse-semantic fit (Kutas, Van Petten & Kluender, 2006). If real-world knowledge disrupts counterfactual comprehension, if only briefly, despite this strong context, then critical words in counterfactually true statements should evoke a larger N400 compared to counterfactually false statements and real-world true statements. In contrast, if incoming words are mapped onto the most relevant interpretive context without delay and without initial regard to real-world truth-value, then false statements should elicit an N400 effect compared to true statements, for counterfactual and real-world statements alike. In line with the latter hypothesis, false words elicited larger N400 ERPs than true words, in negated counterfactual sentences and real-world sentences alike (see Figure 1). These indistinguishable N400 effects of propositional truth-value, elicited by opposite word pairs,

argue against disruptions by real-world knowledge during counterfactual comprehension, and suggest that incoming words are mapped onto the counterfactual context without any delay. Thus, provided a sufficiently constraining context, propositional truth-value rapidly impacts ongoing semantic processing, be the proposition factual or counterfactual.

Counterfactual True
If the N.A.S.A had not developed its Apollo Project, the first country to land on the moon would be Russia...
 Counterfactual False
If the N.A.S.A had not developed its Apollo Project, the first country to land on the moon would be America...
 Real-world True
Because the N.A.S.A developed its Apollo Project, the first country to land on the moon has been America...
 Real-world False
Because the N.A.S.A developed its Apollo Project, the first country to land on the moon has been Russia...

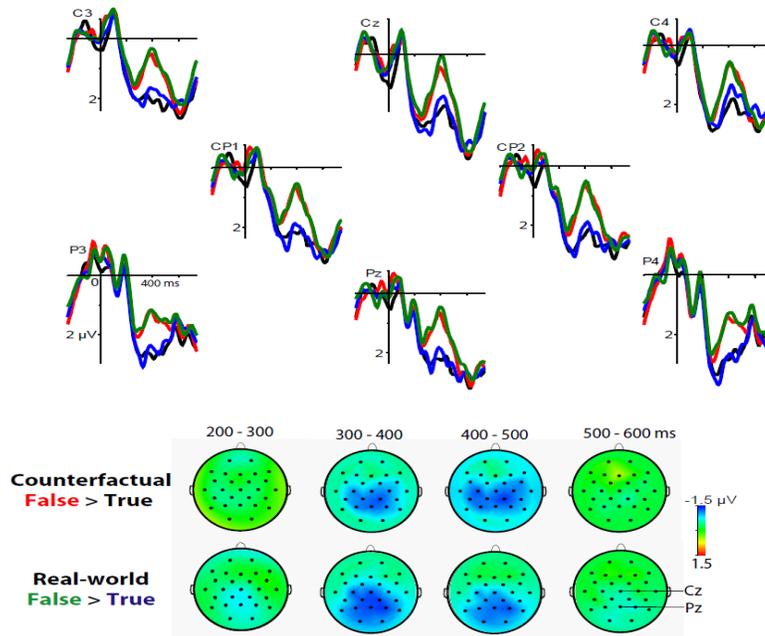


Fig. 1. Electrophysiological effects of truth-value in counterfactual sentences and real-world sentences. The waveforms show the grand average event-related potentials (ERPs) elicited by critical words per condition at 8 selected electrodes. Negative voltage is plotted upwards and waveforms are filtered (5 Hz high cut-off, 12 dB/oct) for presentation purpose only. Stimuli consisted of counterfactual and real-world sentences that were either true or false (examples are provided above the graphs). Scalp distributions of the difference effects (false minus true sentences) in adjoining 100 ms analysis windows are given below the graphs.

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