

To be or NOT to be: Processing of negation according to language background

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The processing of negation in a speaker's first language (L1) has been found to occur in one of two ways: either following a two-step account or a pragmatic account. The two-step account states that negation is processed at a later stage of comprehension, following the interpretation of the affirmative form (Kaup et al., 2006; Kaup et al., 2007). Therefore, speakers are expected to incur a processing cost when interpreting a negated sentence in comparison to affirmative sentences. In contrast, using Event Related Potentials (ERP), Nieuwland and Kuperberg (2008) found that speakers process negated sentences effortlessly, by using their pragmatic and real-world knowledge. This pragmatic account proposes that information provided at the beginning of a sentence allows speakers to predict whether an upcoming negated element is plausibly true. For example, negation in a sentence such as "*the bird is not a tree*", does not incur a processing cost, as the sentence is true according to our real-world knowledge. The pragmatic account is supported by the absence of an N400 ERP component (attributed to semantic violation) for the negated element in pragmatically true sentences and the presence of an N400 in pragmatically untrue sentences (Nieuwland and Kuperberg, 2008). Although these differing accounts have been investigated for native speakers, they have not yet been explored with second language (L2) speakers. These speakers may face difficulties using pragmatic information, as they may be using bottom-up techniques when interpreting the sentence, resulting in slower processing.

The current study investigated the electrophysiological response to negation in L1 French-L2 English speakers (n=13) and simultaneous bilingual French-English speakers (n=10). All participants read 64 English sentences, (32 affirmative, 32 negated) via the rapid serial visual presentation technique while their neural activity was measured. The conditions of the target adjective varied in both affirmative and negated sentences in relation to the adjective at the beginning of the sentence. These adjectives either matched in terms of plausibility (true: 'The jury found him innocent because the fire was recognized as not intentional in court') or mismatched (false: 'The jury found him guilty because the fire was recognized as not intentional in court'). The EEG values corresponding to the second adjective in the sentence were subsequently analyzed in order to reveal any possible N400 and P600 effects.

L2 speakers showed an increased negativity to the negated predicate in the true sentence context around 600ms, with a significant effect of sentence type (affirmative vs. negated: $p=.011^*$). This negativity (a late N400 effect) may indicate that L2 speakers require a longer period of time to process the elements of the sentence compared to native speakers. L2 speakers also show a late positivity to the negated predicates in false sentence contexts, between 700-900ms, with a significant effect of sentence type (affirmative vs. negated: $p=.028^*$) Simultaneous speakers show similar processing of both sentence types in the true sentence context ($p=.531$). These results suggest that there is no added difficulty in the processing of true sentences. Whereas in the false sentence context, they show both a positivity (at 500ms, in the frontal and central regions, $p=.003^*$) and a negativity (around 400ms, in posterior regions $p=.011^*$) to the negated predicate. This apparent shift from negative to positive may be caused by the interaction that occurs between the negated predicate and the true condition of the sentence.

The current results indicate that L2 speakers do not appear to be utilizing their pragmatic knowledge to process negation in true sentence contexts. Yet, when conflicting pragmatic information is presented, negation appears to be processed with ease. Therefore, L2 speakers appear to only align with the two-step processing account in true contexts. On the other hand, simultaneous speakers show the opposite pattern, with negation creating a processing cost in false contexts. This particular processing closely aligns with that of a pragmatic account for negation.

These results provide evidence for both the two-step and pragmatic accounts of negation processing, indicating both accounts can be used depending on a speakers' language background.

References

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