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ERP studies of visual and auditory processing of negated sentences

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Introduction

Previous research shows that negation is ignored in initial processing and the event-related potential (ERP) component N400 is insensitive to negation in the presence of semantic priming effects [2-3, 5]. But other evidence has shown that negation can be readily integrated and incongruities in negated sentences can elicit an N400 [6]. Most of this research has focused on negated forms such as not, or any while little is known about prefixally negated words (e.g. unauthorised, ununauthorized) despite their high frequency of occurrence in language use [7].

Aim and research questions

- Two ERP experiments in visual and auditory modalities to investigate affirmatives (authorized), prefixal negation (unauthorized) and sentential negation (not authorized) in sentential contexts such as example (1):

1) The White House announced that the new Obama biography was authorized/unauthorized/not authorized and the details in the book were correct/wrong in actual fact.

ERPs time-locked to the critical word (underlined), the congruency of which was determined by the adjective (bold) in the first part of the sentence. We asked the following questions:

**Visual study:**
- Is there a delay in the integration of negated meanings?
- Is prefixal negation processed similar to the negated form or the affirmative form?

**Auditory study:**
- Is auditory presentation of sentences more natural and easier than visual processing?

### Results

<table>
<thead>
<tr>
<th>Visual</th>
<th>Auditory</th>
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<tbody>
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<td><strong>Sentential negation</strong></td>
</tr>
<tr>
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**Note:** In the two figures above, the shaded areas indicate all the time windows where a significant difference between the incongruent and congruent conditions in each sentence type was found. For presentation purposes, only parts of the (significant) results are reported where the estimated difference (ES) the standard error within parentheses and the *p*-value (significant > .05) are reported.

### Method

**EEG recording and processing**
- Offline referenced to average of both mastoids
- Filters of 0.01 and 40 Hz
- ICA for removing eye artifacts
- Epochs of 1000 ms (plus 100 ms baseline)

**Amplitudes for congruent and incongruent conditions analyzed for each negation type and each time window separately**
- Mixed-effects modeling, multiple models of various complexity compared, model with lowest AIC reported
- Regions of interest (anterior/central/posterior) and hemisphere (left/mid/right) added as predictors
- Subject and electrode as random factors

### References


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