ERP studies of visual and auditory processing of negated sentences

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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, no or any while little is known about prefixally negated words (e.g. unauthorized, unintentional) despite their high frequency of occurrence in language use [7].

### Aim and research questions

- Two ERP experiments in visual and auditory modalities to investigate affirmitives (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

#### Visual

<table>
<thead>
<tr>
<th>Approach</th>
<th>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.</th>
<th>The White House announced that the new Obama biography was not authorized and the details in the book were correct/wrong in actual fact.</th>
<th>The White House announced that the new Obama biography was unauthorized and the details in the book were correct/wrong in actual fact.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affirmative</td>
<td>Sentential negation</td>
<td>Prepositional negation</td>
<td>Affirmative</td>
</tr>
<tr>
<td>FZ</td>
<td>1000 ms</td>
<td>FZ</td>
<td>1000 ms</td>
</tr>
<tr>
<td>CZ</td>
<td>-2.24 (1.00), t = 2.23</td>
<td>CZ</td>
<td>-2.24 (1.00), t = 2.23</td>
</tr>
<tr>
<td>PZ</td>
<td>0.45 (0.12), t = 0.24</td>
<td>PZ</td>
<td>0.45 (0.12), t = 0.24</td>
</tr>
</tbody>
</table>

#### Auditory

<table>
<thead>
<tr>
<th>Approach</th>
<th>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.</th>
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<td>FZ</td>
<td>1000 ms</td>
</tr>
<tr>
<td>CZ</td>
<td>-1.43 (1.13), t = 1.13</td>
<td>CZ</td>
<td>-1.43 (1.13), t = 1.13</td>
</tr>
<tr>
<td>PZ</td>
<td>0.45 (0.12), t = 0.24</td>
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</table>

### Open questions

- Prefixal negation more difficult than sentential negation. Why? Unnatural use?
- Early positivity for prefixal negation in auditory study?
- ERP effects in auditory studies later than those in visual study, unlike previous research?
- Pre-N400 negativity in auditory study (affirmatives), an N250 [1,4]?