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Farshchi, Sara; Paradis, Carita; Andersson, Richard

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Narrow and broad functions of negation in a miniature artificial language
Sara Farshchi, Carita Paradis and Richard Andersson
Lund University
Contact: sara.farshchi@englund.lu.se

Background
- Negated words and statements result in higher processing difficulty when compared to non-negated statements. This processing cost can show up in the form of higher error rates, longer response times, longer fixation durations or a higher number of regressions.
- Some studies suggest that the processing cost associated with negation is not only restricted to syntactically negated information but words with negative semantics such as fear, a small proportion and forget also take longer to process than affirmatives (Clark, 1969; Just & Carpenter, 1971; Just & Clark, 1973). If this is in fact true, it should be the case that words such as unhappy – called the “narrow” function of negation in this study – should also involve a processing cost compared to their non-negated word and a perfectly-negated form (Sherman, 1976; Hosain, 1973). However, all the research has found a higher processing cost for the broad negation type (not happy) compared to the narrow negation type (unhappy). Whether perfectly-negated words function as single lexical items rather than negated items is still debated.
- Two potential confounds in all these studies are 1. Length differences and 2. Frequency differences between the negated forms and the non-negated forms listed below:

<table>
<thead>
<tr>
<th>Narrow negation: unhappy</th>
<th>Broad negation: not happy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No negation: happy</td>
<td></td>
</tr>
</tbody>
</table>

Research goals
High accuracy rate for the three conditions

How?
- Test the processing cost associated with the narrow negation (unhappy), broad negation (not happy) and no-negation forms (happy)?
- Investigate any differences in response times and error rates as well as error types in the negated and non-negated conditions?
- Control for length and frequency differences between the forms by using an artificial language learning (ALL) to reach more convincing results.

Procedure
- Learning phase [part 1]: 5 artificial prefixes (Table 1) used for teaching the three prefixes learned through images:

<table>
<thead>
<tr>
<th>Learning phase [part 2]: 8 novel artificial words for the testing phase, learned through images:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sa: saw</td>
</tr>
</tbody>
</table>

Analysis and results
- Linear mixed effects and mixed effects logistic regression models were used for analysis.
- Errors were divided into False Alarms (FA) and Misses (M) for further analysis.

Discussion
- A higher accuracy rate was observed for the no-negation condition, narrow condition and broad condition, in that order. This suggests a higher processing difficulty for narrow negation (unhappy) compared to the negation condition, both correct and incorrect responses. This suggests that both negation types were significantly more difficult than the no-negation condition.
- No differences were found in the response times between narrow and broad negation types, suggesting they were both equally difficult in this ALL task.
- The error analysis revealed that the highest proportion of errors was of the Miss type and these were made in the broad negation condition. This suggests participants had difficulty comprehending the function of broad negation, while this error type was not as common for the narrow negation. Participants found it easier to comprehend the function of narrow negation and less frequently missed the correct cases.

Conclusions
- Further evidence in support of the difficulty of processing with negation.
- Processing difficulty found for narrow negation (prefixal negation) compared to the no-negation condition (base form), contrary to the findings in previous studies.

References