

## Psychological mechanisms contributing to the effort in negation processing

Since the 1960s, psycholinguistic investigations of negation have asked whether processing of negated sentences is more challenging than processing affirmative ones. Two-stage accounts (Fauconnier 1985; Kaup et al. 2007) hold that comprehending a negative sentence (e.g., 'This abstract is not long') requires representing the embedded affirmative proposition ('abstract is long') before the final state-of-affairs ('abstract is short'). The claim was based on the findings that negative sentences were not processed fully incrementally (Fischler et al. 1983). More recently, Nieuwland & Kuperberg (2008) claimed that many of the empirical findings can be explained by pragmatic infelicity of the context in which negated sentences have been used, thus supporting a symmetrical approach to negation vs. affirmation.

Darley, Kent & Kazanina (2020) argued that a perfectly symmetrical situation whereby negatives and affirmatives are completely comparable in terms of processing effort is not feasible due to a mismatch that is inherent for negation processing, i.e. conflict between local lexical activation vs. global interpretation. E.g., in 'This abstract is not long' locally the lexical item 'long' activates concepts such as 'lengthy' that must be inhibited later when the global interpretation for the sentence is derived (corresponding to 'The abstract is short'). Hence rather than ascribing observed lack of full incrementality in negation processing uniquely to architectural factors (as is the case in classic two-stage accounts), Darley et al. underscore the role of psychological mechanisms in negation processing.

Darley et al's account predicts that overall processing difficulty of negated sentences should be affected by the position of the NEG-marker in the sentence. If the NEG-marker comes early in the sentence as in factitious 'Not is this abstract long', then the parser can suppress spreading activation from lexical items more quickly than if it occurs late as in factitious 'This abstract is long not'. [By contrast, in a classic two-stage account the position of NEG-marker is irrelevant because computation of negation is postponed until the very end.] In two mouse-tracking experiments we test this prediction by manipulating the position of NEG-marker in Russian (that has a free word order) sentences such as (1). The critical Exp. 2 uses a simplified design and features an even more natural task for participants than the completion task used in Exp 1\*. After seeing a 2x2 grid with 2-4 objects for a few seconds, the participant must respond to a negated question such as (1a/b) or an affirmative control (2a/b) by choosing one of two objects on the screen.

The local-global conflict account predicts an interaction of position (early/late) and sentence polarity (AFF/NEG) on mouse trajectories (this would be a replication of the main finding from Exp1).

**Sample size.** Simulations based on Exp.1 revealed a minimal sample size of n=60 in Exp.2 (power: 80%, signif. level - .05). So far, we have run 29 participants.

\* Exp. 1 is a sentence-completion task and was presented at AMLaP 2019.

Table 1. Questions used in Experiment 2. Both late and early orders are grammatical and neutral in Russian.

- |     |                 |   |                    |                    |
|-----|-----------------|---|--------------------|--------------------|
| (1) | a. {NEG, late}  | V etot raz  | v nizhnej chasti   | chego net?         |
|     |                 | this time   | in the bottom part | what is not there  |
|     |                 | <i>This time, what is not there in the bottom part?</i> |                    |                    |
|     | b. {NEG, early} | V etot raz  | chego net          | v nizhnej chasti?  |
|     |                 | this time   | what is not there  | in the bottom part |
|     |                 | <i>This time, what is not there in the bottom part?</i> |                    |                    |
| (2) | a. {AFF, late}  | V etot raz  | v nizhnej chasti   | chto est'?         |
|     |                 | this time   | in the bottom part | what is there      |
|     |                 | <i>This time, what is there in the bottom part?</i>     |                    |                    |
|     | b. {AFF, early} | V etot raz  | chto est'          | v nizhnej chasti?  |
|     |                 | this time   | what is not there  | in the bottom part |
|     |                 | <i>This time, what is there in the bottom part?</i>     |                    |                    |

Figure 1. Sample trial from Experiment 2

