

Not so hard: Children produce appropriate sentence completions following negation

Background. While understanding language in real time, both children and adults are continually forming expectations about what might come next.^{1,2} This requires building up and updating a representation of the unfolding discourse and incorporating new constraints as they appear. Negation, a logical operator which reverses truth value, imposes unique constraints on what can come next. Upon encountering negation in a sentence, the comprehender must quickly update her representation of the discourse and her predictions. This is evident in (1):

- (1) a. Pushing people on the playground is
- b. Pushing people on the playground is not

The sentence fragment in 1a leads the comprehender towards a particular set of completions – *bad, wrong, mean*, etc. However, if the next word instead turns out to be “not,” as in 1b, the set of probable continuations reverses (*good, nice, okay*, etc.). This updating must happen rapidly before the next word is uttered. Furthermore, if the comprehender has already generated one or more predictions before encountering the negator, then she must inhibit those guesses.

Children show robust understanding of negation in online comprehension studies by 3–4 years,^{3,4} and explicit prediction tasks demonstrate that 5-year-old children can produce contextually-appropriate lexical predictions.⁵ Can children quickly *update* their lexical predictions after encountering negation in a natural sentence? This is critical for understanding how children represent negation in contexts that are most similar to the everyday input that they encounter. We investigate this question using a sentence completion task with pragmatically licensed negation in children aged four-and-a-half to six-and-a-half.

Method. We presented children ($N = 48$, $M_{age} = 5.4$, $Range = 4.5–6.5$) with sentence fragments that were either *affirmative* or *negated*, such as those in 1a and 1b, and prompted them to complete the sentence with whatever word they thought would come next. Children completed 40 trials (20 aff, 20 neg, randomized). A coder who was blind to sentence condition categorized each response as either *affirmative-fitting* (an appropriate response for the affirmative sentence stem), *negated-fitting* (an appropriate response for the negated sentence stem), fitting both stems, or fitting neither. We collapsed both and neither into “other incorrect.”

Results. Children produced affirmative-fitting responses to affirmative stems 67% of the time, and negation-fitting responses to negated stems 55% of the time, demonstrating a robust sensitivity to the context regardless of sentence polarity (Figure 1). We also looked at whether and how often children gave “reverse polarity” responses – completing a negated sentence with an affirmative-fitting word, or vice versa. Children responded to negated stems with affirmative-fitting words 24% of the time, and to affirmative stems with negated-fitting words 11% of the time (Figure 2). A generalized logistic mixed effects model revealed a main effect of Stem Polarity, such that children were more likely to produce reverse polarity responses to negated stems (e.g. responding “mean” to 1b). An exploratory analysis revealed a correlation with age, with older children giving fewer reverse polarity responses to negated stems (Figure 3).

Conclusions. Young children are aware of how negation changes the way in which a sentence is likely to continue. Children’s explicit lexical predictions are sensitive to the polarity of a sentence stem, demonstrating an ability to rapidly incorporate negation into their unfolding representation of the discourse. Despite the open-ended nature of the task (i.e. no forced choice selection or visually depicted alternatives), children were able to tractably generate alternatives after encountering negation. Interestingly, however, the fact that children produced more reverse polarity responses for negated stems suggests that, at least some of the time, children may have trouble inhibiting their prior predictions. Given that this effect was negatively correlated with age, future work will adapt this paradigm for use with younger children to explore the developmental trajectory.

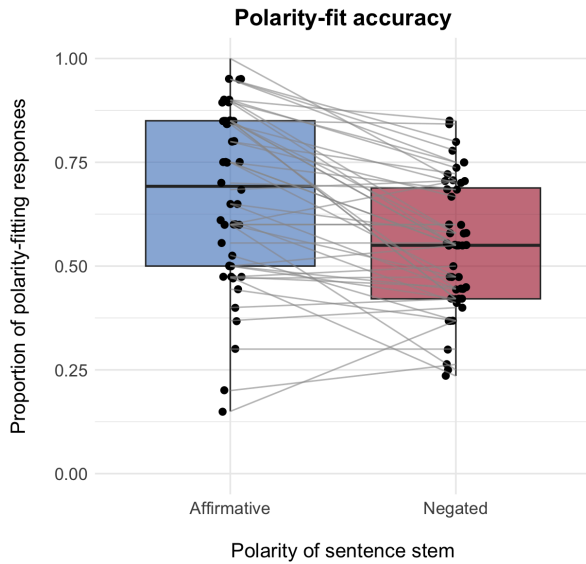


Figure 1. How often do children's responses match the polarity of the sentence stem? Main effect of Stem Polarity ($b = -0.70$, $SE = 0.11$, $z = -6.32$, $p < .001$)

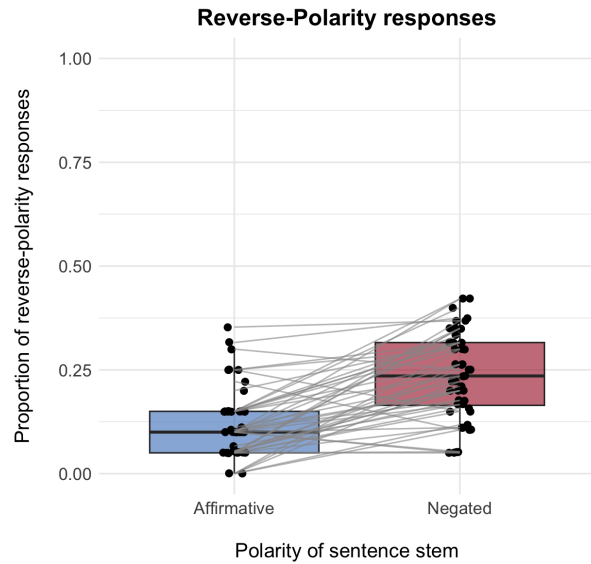


Figure 2. How often do children give reverse polarity responses? Main effect of Stem Polarity ($b = 1.05$, $SE = 0.14$, $z = 7.51$, $p < .001$)

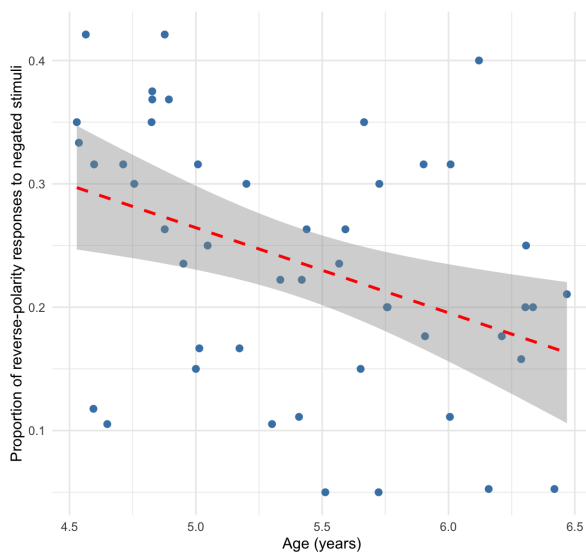


Figure 3. Exploratory correlation of reverse polarity responses to negated stems with age. Each dot shows a child's proportion of reverse polarity responses (in the negated condition only) as a function of their age.

References:

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