

## Does negation influence the choice of sentence continuations? Evidence from a four-choice cloze task

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Although there has been considerable investigation of lexical expectations in affirmative sentences (see Kuperberg & Jaeger, 2016), little is known about how negative sentence fragments are completed. In four experiments, we used a four-choice cloze task to investigate how negation might interact with world and linguistic knowledge to influence the choice of continuations. We structured the word choices to shed light on three possibilities: do participants prefer negation to be used strictly logically, or is their preference influenced by the plausibility of the event described? If the second, are they more likely to make a choice that denies a plausible positive event or that describes a plausible negative event?

Participants saw sentence fragments (*The child will (not) eat the ...*) and clicked on one of four alternatives: a plausible word (*yoghurt*), a weak world knowledge violating word (*shellfish*), a severe world knowledge violating word (*branch*) or a semantic violation inducing word (*minivan*). In the affirmative condition, the plausible word should be the overwhelming choice. In the negative condition, if participants prefer negation to be used logically, the four choices should be equally likely. If they prefer negation to be used as the denial of a plausible positive event, they should favor the plausible word (*The child won't eat the yoghurt*). If they prefer it to be used as a description of a plausible negative event, they should favor the weak world knowledge violating word (*The child won't eat the shellfish*). We also included a 3-level manipulation (Trio, They, and LexAss) of the association between the agent, the verb, and the patient, which drove the plausible words to have either high or low conditional probability. This manipulation appears in Figure 1, but it had no effects, so we will not discuss it further.

In Experiment 1 (N=60 in German in lab), there was a clear difference in the frequency of the four words ( $\chi^2(3) = 4744.4$ ,  $p < .01$ ; see Figure 1 for all data); the plausible word was chosen overwhelmingly. However, there was no effect of sentence polarity ( $\chi^2(3) = 4.74$ ,  $p = .19$ ). This suggests that participants preferred negation to deny a plausible positive situation, but the lack of a polarity effect raises the concern that participants may not have integrated negation into the sentence meaning. In Experiment 2 (N=60, English online), we added 48 fillers that could only be answered correctly if negation was considered (*Which animals don't live in dens? sharks/foxes/rabbits/skunks*). A polarity effect emerged ( $\chi^2(3) = 44.17$ ,  $p < .001$ ), suggesting participants processed the negation. We also replicated Experiment 1's word choice finding ( $\chi^2(3) = 4594.5$ ,  $p < .001$ ); The plausible word was chosen most frequently in both affirmative and negative conditions. In Experiment 3 (N=64, English online), we added hedges to the experimental sentences (*Of course/obviously/certainly/definitely the child will (not) eat the yoghurt/shellfish/branch/minivan*) to render the violations more expected in the negative conditions. Consistent with this, polarity now influenced the frequency of each of the four word choices (all  $ps < .001$ ). The plausible word was still most likely in the negative conditions, but the distribution was flatter. A polarity effect was also apparent ( $\chi^2(3) = 472.33$ ,  $p < .001$ ). Experiment 4 (N=66, English online) investigated whether the observed plausibility effects can be generalized to other aspectual forms (*The child has (not) eaten the yoghurt/ shellfish/ branch/minivan*). The pattern was similar to Experiment 2, with a polarity effect ( $\chi^2(3) = 22.45$ ,  $p < .001$ ) and a strong preference for the plausible word in both affirmative and negative conditions ( $\chi^2(3) = 5128.7$ ,  $p < .001$ ).

This body of findings suggests that upcoming continuations are chosen based on plausibility in both affirmative and negative sentences, with negation inspiring a robust preference that a plausible situation will be denied. Experiment 4 shows that this preference is not modulated by the internal representation of events, but Experiment 3 confirms that it can be

modulated by changes to the expected informativity of the sentence. Overall, these results are in line with a pragmatic account of negation which supports the idea that negation favors a context of plausible denial (Wason 1965).

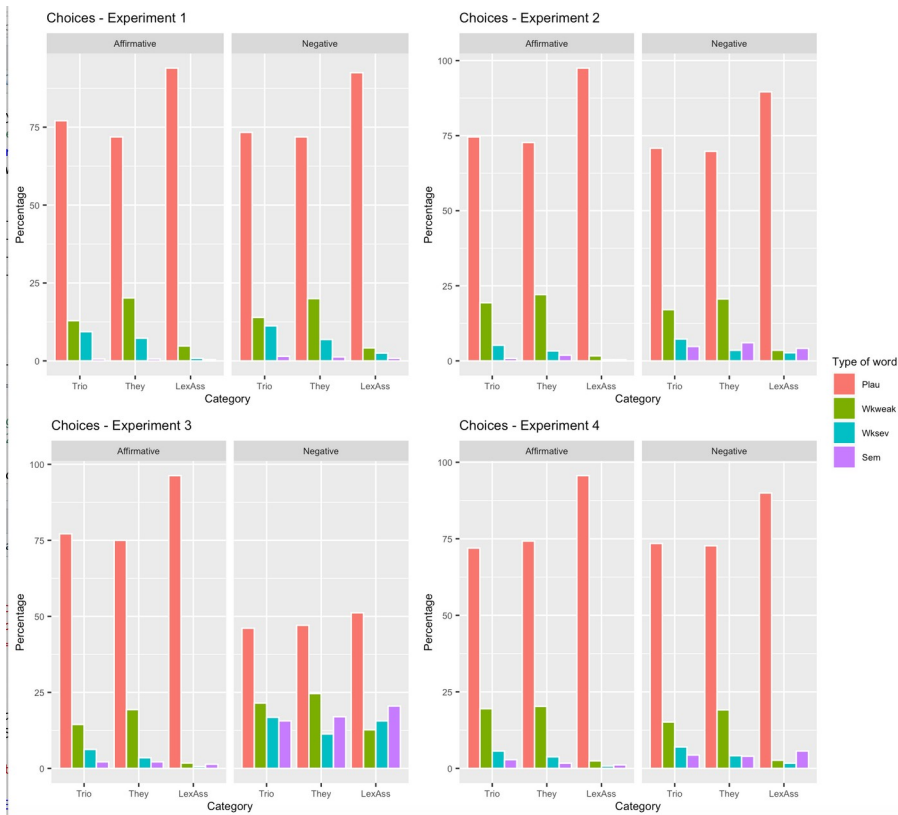


Figure 1: Choices of chosen type of word depending on fragment polarity (aff/neg) and category (trio, they, lexical association)