

Comprehension of negated sentences across languages: Does linear position of negation matter?

Negation is a universal phenomenon, and negated sentences are assumed to be more difficult to process than affirmative sentences [1]. However, it is largely unknown to which extent this processing difficulty is mediated by cross-linguistic variation. Our study asks whether the linear position of the sentential negator affects how negation is processed in two typologically different languages: German and Spanish. In German, the negator appears after the finite verb, and thus, linearly speaking, relatively late in a sentence. By contrast, in Spanish the negator is always realized preverbally, and thus, linearly speaking, very early in a sentence. This difference could affect the comprehension of negation, since negation is typically assumed to be processed in two steps, even in the face of pragmatic licensing [2]. Specifically, 2-step accounts propose that comprehenders first process the information being negated (i.e., activating the counterfactual/alternate state-of-affairs) and later, in a second step, integrate the negator to derive the factual state-of-affairs [2,3]. We examine whether the earlier availability of the negator in Spanish might enable comprehenders to process negation more incrementally, for example by stopping the activation of a counterfactual interpretation. To our knowledge, our study is the first to compare negation processing in monolingual native speakers of two typologically different languages using the same experimental design.

Three experiments using two-alternative forced-choice picture selection were conducted with different German and Spanish speakers. Participants were presented with a short story that introduced a clear QUD, hereby licensing the use of negation (Fig 1a). Each story described a situation, in which a character faced a choice between two actions, and ended with either an affirmative or a negative target sentence revealing the character's decision. The target sentence was accompanied by two pictures representing the two actions mentioned in the story. Participants had to choose the picture matching the target sentence (Fig.1b). Experiment 1 presented contexts and test sentences in written mode (German: n=40, Spanish: n=41); response times (RT) were measured from the onset of picture presentation. Experiment 2 (German: n=100, Spanish: n=102) and Experiment 3 (Spanish: n=69) presented stimuli auditorily at the same time as the pictures, which would allow Spanish participants to profit from the earlier availability of the negator. Here, RTs were measured from the earliest point at which listeners could make a picture choice, i.e., the onset of *nicht/schon* (German) and the onset of the verb (Spanish).

Accuracy was above 95% in all experiments. The results of the RT analysis, using linear mixed-effects models for correct RTs, showed that responses were significantly slower in the negative than in the affirmative condition both in German and in Spanish across experiments (Fig. 2), despite the presence of a pragmatically felicitous context (in line with [3, 4]). Experiment 1 failed to find evidence of an interaction between language and polarity, consistent with 2-step accounts [2,3,4]. However, the visual presentation of the target sentence forced participants to read the target sentence until the end—before choosing between pictures. Thus, the lexical material in the target sentence may have increased the activation of the counter-factual state-of-affairs, potentially neutralizing the advantage associated with the early negator position in Spanish. Addressing this possibility, Experiment 2 used auditory stimuli and allowed participants to respond while hearing the sentence. There was a main effect of language in the unexpected direction, but no evidence of a language×polarity interaction: Spanish participants took longer to respond than German participants; post-hoc analyses confirmed that most Spanish speakers tended to wait for the end of the sentence. In Experiment 3, a shorter timeout (500 ms vs. 5,000 ms) was used to encourage earlier choices in Spanish speakers. On average, RTs in the negative condition were longer than in the affirmative condition, and negation processing costs were comparable to the German speakers in Experiment 2.

In sum, we observed a main effect of polarity in German and in Spanish. Despite the similar processing profiles, we propose that they reflect two **different** underlying mechanisms. In German, the late negator is encountered after the proposition has been built and must then be

integrated into the discourse representation of the affirmative sentence. This process aligns with two-step accounts and is similar to an event-semantic reanalysis [see 5]. In Spanish, the negator is encountered before a proposition has been built. When presented with the verb, the listener may experience a conflict between the expectation to negate something and the activation of an event triggered by the verb. Alternatively, the listener may be surprised to encounter the negator rather than one of the verbs denoting the two possible actions in the context. In both scenarios, a slowdown in RTs is expected, which cannot be accounted for by 2-step accounts.

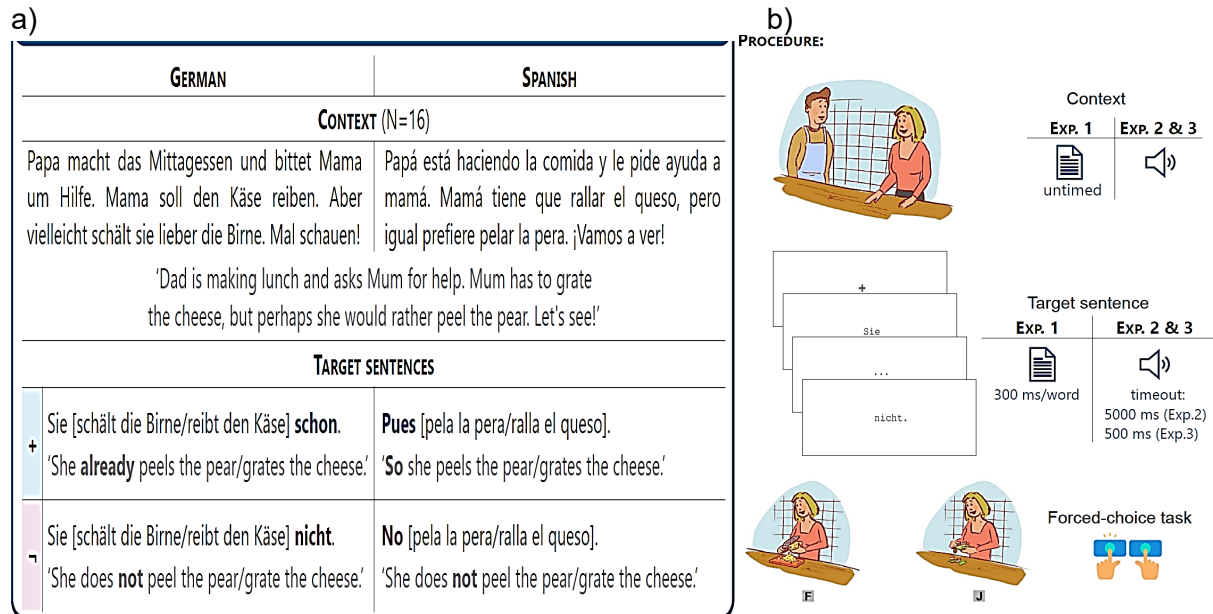


Figure 1. a) Sample stimuli and b) experimental procedures.

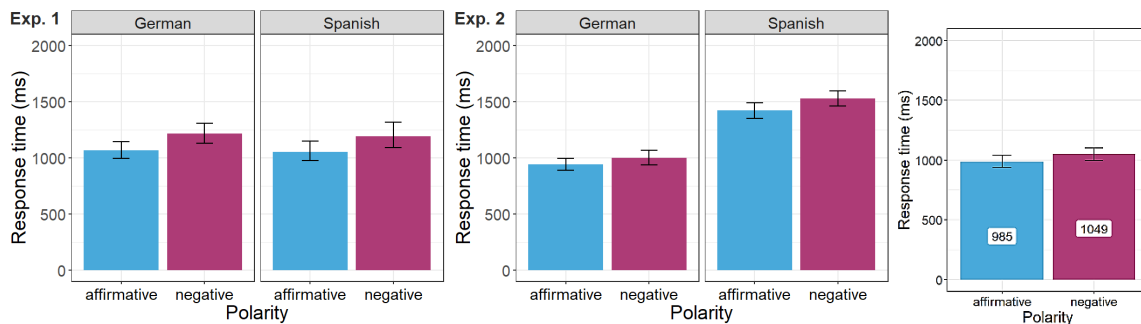


Figure 2. Response times in Experiments 1, 2 and 3 (Spanish only)

References. [1] Kaup, B. & Dudschig, C. (2020). Understanding negation: Issues in the processing of negation. *The Oxford Handbook of Negation*, 635–655. OUP. [2] Lee, M., Kim, H. S., Lee, G., Noh, Y., & Kim, S. Y. (2025). Incremental processing of postverbal negation: ERP evidence from Korean. *JNeurolinguistics*, 75, 101259. [3] Kaup, B., Lüdtke, J., & Zwaan, R. A. (2005). Effects of negation, truth value, and delay on picture recognition after reading affirmative and negative sentences. In *Proc. Annual meeting CSS* (Vol. 27, No. 27). [4] Kaup, B., Lüdtke, J., & Zwaan, R. A. (2006). Processing negated sentences with contradictory predicates: Is a door that is not open mentally closed? *JPrag*, 38(7), 1033–1050. [5] Makrodimitris, C. & Schulz, P. (2025). Comprehension of complex sentences containing temporal connectives: How children are led down the event-semantic kindergarten-path. *JCL*, 52(3), 615–647.