

The Role of Negation Position in German: Developmental Patterns in Children's Comprehension

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1. Introduction

The ability to negate—that is, to reason about what is not the case—is a fundamental yet highly abstract and cognitively complex aspect of human language and cognition. Previous acquisition research on negation shows that children begin to produce negation elements early, typically in their second year of life (e.g., Clahsen 1988, McDermott-Hinman et al. 2024). However, adult-like interpretation of sentential negation emerges after age two, generally between the ages of three and six (Austin et al. 2014, Feiman et al. 2017, Nordmeyer & Frank 2014, Schulz & Grimm 2019, Thornton 2020). Variation in the reported age of mastery for negation comprehension has been linked to the observation that children's performance is mediated by multiple factors, such as the truth/falsity of the negated sentence (e.g., Akyama 1984, Kim 1985, Wason 1972, Wojtecka et al. 2011, 2013), as well as the pragmatic context (e.g., Nordmeyer & Frank 2014, 2018) and characteristics of the experimental task (e.g., Reuter et al. 2018).

An important property of negation is that, while it is a universal feature of language, languages differ widely in how they express negation lexically and syntactically. These differences are likely to also influence how children acquire negation in their first language. For example, German has different words for denial (*nicht* 'not') and for prohibition and rejection (*nein* 'no'), while Spanish has one word for expressing these functions (*no* 'not/no'). A recent study by McDermott-Hinman et al. (2024) finds that use of negation for denial emerges earlier in German than in Spanish. According to the authors, their results imply that the more transparent concept-word mappings in languages like German compared to Spanish may facilitate learning the markers for negation. In terms of

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word order in negated sentences, studies show that children acquiring Spanish produce target-like sentential negation earlier than children acquiring German. By 2;2 years, the negator *no* is placed correctly before the finite verb in Spanish (Bel 1996). German-speaking children produce sentential negation early as well, by age 2, and place *nicht* (not) in main clauses correctly in relation to the finite verb (Clahsen 1988, see examples (1) to (3)). They have difficulty, however, with negated sentences containing definite objects up to age 3, because they fail to consistently scramble definite objects across the negator (see (2) vs. (3), Clahsen 1988). This finding supports the idea that children find it easier to acquire the word order of negated sentences in languages with a fixed negation position such as Spanish than in languages such as German, which allow variation in negation placement.

How syntactic factors—like variable negator positions—affect children's understanding of negation has received little attention (but cf. Wojtecka et al. 2011). To address this gap, the present study investigates German, which, as noted above, exhibits multiple surface positions for sentential negation, making it particularly well suited for testing whether and how negator position affects children's comprehension. To investigate developmental changes in children's understanding of negation, we adopted a longitudinal design and assessed performance when children were three, four, and five years old.

The remainder of the paper is structured as follows. Section 2 briefly describes the pattern of negation in German. Section 3 summarizes previous findings on negation comprehension and discusses factors mediating children's performance. Section 4 details the present study and reports the results. Section 5 provides a discussion and Section 6 concludes with some open questions.

2. Sentential negation in German

German sentential negation is expressed by the negator *nicht* 'not'. There is a consensus that *nicht* is located in a fixed position below TP (Zeijlstra 2004). Syntactic accounts differ regarding whether *nicht* is adjoined to VP as an adverb (Jacobs 1982) or whether it occupies the specifier position of a low NegP (Haegeman 1995). Because of additional movement processes in German clause structure, the negator *nicht* can occupy different surface positions. In main clauses the finite verb obligatorily moves to the second position (C⁰), reflecting the V2 nature of German. The finite verb precedes the negator, as illustrated in (1). For the purposes of our study, we refer to the structure in (1) as 'close negation', since the negator immediately follows the finite verb.

(1) Close negation

Der Junge spielt **nicht** mit den Bausteinen.
 The-NOM boy plays not with the-DAT bricks
 'The boy is not playing with the bricks.'

German is a scrambling language, i.e., definite objects must move out of the VP to a higher position, which places them before the negator in order to yield sentential negation (Steube 2006, Sudhoff 2008). This is illustrated in (2), where the definite object *die Ente* ‘the duck’ has been scrambled across the negator. In the following, we refer to this structure as ‘distant negation’ because the negator does not directly follow the finite verb and appears as the last element of the sentence.

(2) Distant negation

Der Junge füttert die Ente **nicht**.
 The-NOM boy feeds the-ACC duck not
 ‘The boy is not feeding the duck.’

Note that (2) has a non-scrambled variant, which is illustrated in (3):

- (3) Der Junge füttert **nicht** die Ente (, sondern den Hund).
 The-NOM boy feeds not the-ACC duck (, but the dog)
 ‘The boy is not feeding the duck (but the dog).’

This variant is grammatical in German, but it is usually interpreted as constituent negation and not as sentential negation. This difference arises because the negator in (2) has wide scope and denies the entire proposition (‘It is not the case that the boy is feeding the duck’), whereas the negator in (3) scopes only over the following constituent, i.e., the DP *the duck*.

3. Previous comprehension studies on negation

The ability to understand negative expressions starts to develop during the second year of life. Using a preferential looking paradigm, Gilkerson et al. (2004) find that 14- to 25-months-old English-speaking children are sensitive to the presence of the negator *not* (e.g., *The girl is (not) sleeping*): when hearing a negated sentence, children’s gaze duration to the image representing the negated verb, i.e., a girl sleeping, was shorter than when hearing an affirmative sentence. The authors conclude that children as young as 14 months distinguish between sentences with and without the negator; hence, they possess some understanding of its negating properties. Early understanding of negation has also been found in word learning experiments (de Carvalho et al. 2021). During a habituation phase, 18-months-old French-speaking children learned that *bamoule* means ‘penguin’ and *pirdaling* means ‘cartwheeling’. At test, children saw a penguin spinning accompanied by a sentence negating the verb (*It’s not pirdaling*; ‘verb-switch condition’) and a penguin cartwheeling accompanied by a sentence negating the noun (*It’s not a bamoule*; ‘noun-switch condition’). Children’s looking times increased more between the habituation phase and the test phase in the noun-switch condition than in the verb-switch condition. These higher looking times

indicate that children recognize the negative sentence as false with respect to the specific visual context. According to the authors, this finding demonstrates some early understanding of negation.

Studies investigating children's comprehension of negation with more complex experimental paradigms have found that adult-like interpretation of sentential *not* emerges only at later ages (Austin et al. 2014, Feiman et al. 2017). In these studies, English-speaking children had to find an object that was hidden by the experimenter in one of two containers. A second interlocutor asked the experimenter about the location (e.g., *Is the ball in the bucket?*). The experimenter replied with an affirmative (*It's in the bucket*) or a negated sentence (*It's not in the bucket*). Twenty-month-old children were insensitive to the negator and searched for the object in the container mentioned independently of whether they had listened to an affirmative or to a negative sentence. The 24-month-olds performed at chance level. Only the 27-month-old children were able to search systematically in the correct container.

Further evidence from studies using different experimental designs indicates that difficulties with negation comprehension often persist beyond age two and may extend to around age five (Doyle et al. 2019, Nordmeyer & Frank 2014, Schulz & Grimm 2019, Thornton 2020). In line with a large body of research on adult processing of negation (see the review in Kaup & Dudschig 2020), the truth value of negated sentences has been found to mediate children's comprehension of negation (e.g., Akyama 1984, Kim 1985, Wasow, 1972, Wojtecka et al. 2011, 2013). In addition, comprehension difficulty has been shown to be influenced by pragmatic licensing (e.g., Nordmeyer & Frank 2014, 2018) and by task-related factors (e.g., Reuter et al. 2018). Addressing the role of truth for comprehending negated sentences, Wojtecka et al. (2011, 2013) compared the comprehension of true negatives as in (4), i.e., negated sentences that are a true description of a situation, and false negatives as in (5), i.e., negated sentences that are a false description of a situation.

- (4) Context: A boy is throwing a helmet away from a girl called Lise.
The boy is not giving the helmet to Lise. True negative
- (5) Context: A girl called Lise is petting a dog.
Lise is not petting the dog in the park. False negative

When presented with (4) and (5) as part of a truth value judgement task, adults will accept the negated sentence in (4) and reject the negated sentence in (5). Wojtecka et al. (2011, 2013) found that three- and four-year-old German children performed better with false negatives than with true negatives, confirming earlier studies (e.g., Wasow 1972, Kim 1985).

Pragmatic factors have likewise been implicated in the understanding of negation. Focusing on nonexistence negation, Nordmeyer and Frank (2014) presented two- to four-year-old children with two pictures: a picture of a boy holding apples and a picture of a boy holding nothing. When hearing *Look at the boy with no apples*, children's eye-gaze behavior revealed that the four-year-olds

looked at the correct picture while two-year-olds looked systematically to the wrong picture; three-year-olds performed at chance. Three-year-olds performed better, however, when the correct picture displayed an informative alternative, e.g., a boy holding presents.

The study by Nordmeyer and Frank (2014) demonstrates that contextual support is crucial for negation understanding in three- and four-year-olds. Testing two-year-old children, Reuter et al. (2018) found that task-related factors strongly mediated comprehension: in a picture-choice task, two-year-olds could correctly identify the target image only when affirmative sentences were presented before negated sentences.

The studies discussed so far have relied on the observation that many aspects of negation comprehension are consistent across languages. However, given the considerable lexical and syntactic variation in how negation is expressed—both across and within languages, as noted in Section 1 and 2—the question of how syntactic factors, like variable negator positions, affect children's understanding of negation has received little attention. One notable exception is the study by Wojtecka et al. (2011) on German. Using a truth value judgement task, the authors examined how German-speaking children comprehend 'close' and 'distant' negation (see (1) and (2)). They found that three- and four-year-olds performed better on sentences with close negation than with distant negation (age 3: 81% vs. 72% correct; age 4: 87% vs. 74% correct), leading them to conclude that the syntactic properties of sentential negation are not yet fully acquired by age four.

In summary, previous acquisition studies indicate that the adult-like understanding of sentential negation emerges between roughly 27 months and five years of age. Children's comprehension is shaped by semantic, pragmatic, and task-related factors, with truth/falsity playing a particularly prominent role in truth value judgment tasks. With the exception of Wojtecka et al. (2011), these studies did not examine to what extent syntactic factors affect children's comprehension of negated sentences. The present study addresses this gap by examining how the position of negation affects children's comprehension at age three, four, and five.

4. The present study

Taking the findings by Wojtecka et al. (2011) as a starting point, we ask whether children acquiring German have more difficulty with 'distant' than with 'close' negation, when evaluating the truth value of false and true negatives. We choose a longitudinal design, which would allow us to detect how these two factors influence negation comprehension across development.

4.1. Participants

Monolingual typically-developing German-speaking children were tested three times one year apart. The sample for the first test round consisted of 61 children (3;6–4;1 years, $M = 3;9$ years). Forty-three of these children participated in the second test round (4;5–5;1 years, $M = 4;7$ years) and 38 of these children

also participated in the third test round (5;6–6;1 years, $M = 5;8$ years). The data was collected in kindergartens in and around Frankfurt/Main, Germany. Each child was tested individually in a quiet room in their kindergarten.

4.2. Design and Materials

Children's comprehension of sentence negation was assessed via Truth Value Judgement, using a scale from the standardized language test *LiSe-DaZ* (Schulz & Tracy 2011). The task was as follows: in each trial, the experimenter presented the child with a picture accompanied by a short introductory sentence. A hand puppet uttered a negated statement, and the child had to decide whether the puppet's utterance was correct with respect to the picture shown. We used a 2 x 2 within-subjects design, which crossed the factors Negation Position (close/distant negation) and Truth (true/false negative), resulting in four conditions with three items each. The limited number of items was necessary to ensure that the entire language test could be completed within 30 minutes. The test items were presented in a fixed, pseudo-randomized order. An example item for distant negation is given in (6). The puppet's utterance matches the situation depicted in the picture, i.e., it is a true negative; hence, an affirmative response is required.

(6)



Adult: *Guck mal, hier ist ein Mädchen, ein Junge und ein Ball.*
 'Look, there is a girl, a boy, and a ball.'

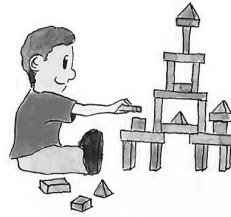
Puppet: *Das Mädchen gibt dem Jungen den Ball nicht.*
 The girl gives the boy the ball **not**
 'The girl is not giving the ball to the boy.'

Adult: *Stimmt das?* 'Is that right?'

Child (expected answer): *Ja.* 'Yes.'

An example for close negation is given in (7). The puppet's utterance does not match the situation depicted in the picture, i.e., it is a false negative; hence, a rejective response is required.

(7)



Adult: *Guck mal, hier ist ein Junge und hier sind Bausteine.*
 'Look, there is boy and there are bricks.'

Puppet: *Der Junge spielt **nicht** mit den Bausteinen.*
 The boy plays **not** with the bricks
 'The boy is not playing with the bricks.'

Adult: *Stimmt das?* 'Is that right?

Child (expected answer): *Nein.* 'No.'

4.3. Results

The analysis is based on a total of 1704 observations: 732 from the first test round, 516 from the second test round, and 456 from the third test round. Children's *yes*- and *no*-responses were coded as correct and incorrect (accuracy). A correct response (coded as 1) required a *no*-answer for false negatives and a *yes*-answer for true negatives; *yes*-answers for false negatives and *no*-answers for true negatives constituted incorrect responses (coded as 0).

Overall, the number of correct responses increased with age (see Figure 1). In the first test round, at age 3;9, the children answered 8.9/12 items (74%) correctly; in the second test round, at age 4;7, they responded to 10.3/12 items (86%) correctly, and in the third test round, at age 5;8, 10.8/12 items (90%) were correct. The width of the violin plots in Figure 1 varies with the density of data points, reflecting the number of children in a specific region. The wider region in the upper part of the violins increases from age 3 to age 4 to age 5, indicating that the number of children with a high performance increases. The violin plots also show that the distribution of the data points covers a larger range of scores at age three than at age four and five indicating that low performance decreases with age.

Figure 2 shows the mean accuracy by age and condition. Defining mastery as 90% accuracy, children at age 3 and at age 4 only exhibit mastery of close false negatives; distant true negatives show the lowest performance at both ages. By age 5, children demonstrate mastery across all conditions except distant true negatives, for which accuracy remains as low as at age 4. Descriptively, accuracy for true negatives is lower than for false negatives at all three ages. At age 3 and at age 4, distant negatives exhibit lower accuracy scores than close negatives. At age 5, the disadvantage of distant over close negatives is present in true negatives, but no longer in false negatives, there the pattern is actually reversed.



Figure 1. Violin plots depicting the total sum score per test round.

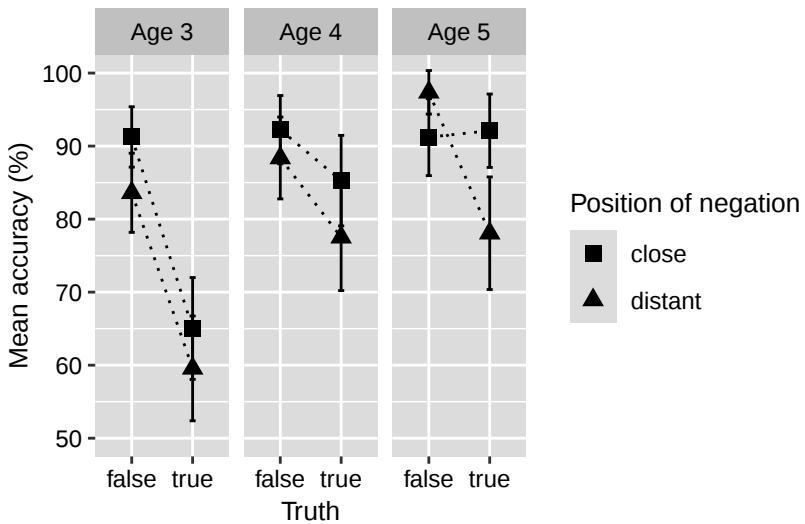


Figure 2. Mean accuracy (in %) and 95% confidence interval per condition and test round.

The accuracy data were analyzed in R (R Core Team 2024) using a generalized linear mixed-effects model (*lme4* package; Bates et al. 2015). We fitted a model to estimate whether children scored better on items with close negation compared to items with distant negation (*Negation position*), and whether children scored better on false than true negatives (*Truth*), as a replication

of previous research (e.g., Wojtecka et al. 2011, 2013). In addition, the model was fitted to estimate whether children's performance changes over time (*Age*). *Negation position*, *Truth*, and *Age*, and their interaction were entered as fixed factors. The two binary predictors *Negation position* and *Truth* were coded as sum contrasts (*Negation position*: close +0.5, distant -0.5; *Truth*: false +0.5, true -0.5). *Age* (in months) was centered and included as a continuous variable. The model contained by-subject and by-item varying intercepts as well as by-subject varying slopes for *Age*.¹ The complete model output for the fixed effects is provided in the Appendix. There was a significant main effect of *Age*, with children's accuracy increasing over time ($\beta = 0.0697$, $z = 5.249$, $p < .001$). There was also a main effect of *Truth*, with higher accuracy for false negatives than for true negatives ($\beta = 1.5099$, $z = 3.926$, $p < .001$). Moreover, there was a three-way interaction of *Age*, *Truth*, and *Negation position* ($\beta = -0.1310$, $z = -3.768$, $p < .001$). To understand this interaction better, we examined the effect of *Negation position* and *Truth* on children's performance separately for each test round (age 3, age 4, age 5). Each model included *Truth* and *Negation position*, and their interaction as fixed effects and by-subject varying intercepts. The models for age 3 and age 4 revealed a significant main effect of *Truth* (age 3: $\beta = 1.7019$, $z = 7.944$, $p < .001$; age 4: $\beta = 0.8974$, $z = 3.046$, $p = .002$) and a significant main effect of *Negation position* (age 3: $\beta = 0.5337$, $z = 2.575$, $p = .01$; age 4: $\beta = 0.5754$, $z = 1.966$, $p = .049$); the interaction of *Truth* and *Negation position* was not significant (age 3: $\beta = 0.5136$, $z = 1.242$, $p = .214$; age 4: $\beta = -0.1256$, $z = -0.215$, $p = .829$). The model for age 5 revealed a significant main effect of *Truth* ($\beta = 1.2201$, $z = 2.966$, $p = .003$) and a significant interaction of *Truth* and *Negation Position* ($\beta = -2.6914$, $z = -3.266$, $p = .001$). Further inspection via pairwise comparisons with Tukey adjustment (*emmeans* package; Lenth 2023) showed a significant difference between true distant and false distant ($p < .001$), but not between true close and false close ($p = .995$).

5. Discussion

The current study examined with a longitudinal design whether syntactic factors, specifically the surface position of the negator, systematically affect children's comprehension of negated sentences, when asked to make truth value judgments. Two main results emerged. First, our study adds to the large body of research showing that true negatives are more challenging than false negatives, for children and for adults, in out-of-the-blue contexts. Second, our study offers novel evidence for a systematic influence of syntactic position on children's comprehension, observable between ages three and four and still partially present at age five. At ages three and four, children had more difficulty when the negator appeared distant from the finite verb than when it directly followed the finite verb in both true and false negatives. At age five, this advantage of close over distant position of negation was still present in true negatives.

¹ Models with more complex random effects structure did not converge.

What makes distant negation more difficult to understand than close negation, and why are true negatives especially challenging when the negation appears in a distant position?

Let us first consider the difficulty associated with true negatives. Under so-called “two-step” accounts, negated sentences are typically processed in two steps (e.g., Kaup et al. 2005; for a review see Kaup & Dudschig 2020). For example, when hearing the sentence *The girl is not giving the ball to the boy*, listeners first represent the alternate state-of-affairs expressed by the affirmative sentence (*The girl is giving the ball to the boy*). In a second step, this alternate representation is suppressed or inhibited, and then the actual state-of-affairs is represented. According to these accounts, negated sentences are in general more difficult than affirmative sentences, because affirmatives do not involve this second step. Additionally, while affirmatives show a processing advantage for true over false sentences, no such advantage is observed for true negatives relative to false negatives. This is because at the point of verification, for example of a picture, the alternate state-of-affairs is still activated and interferes with the truth value judgement, resulting in incorrect *no*-responses and longer reaction times. False negatives, in contrast, are not more difficult to understand. During picture verification, the still-active alternate state-of-affairs matches the picture, resulting in correct *no*-responses and faster reaction times because there is no interference with the truth value judgment. Importantly, two-step accounts do not consider where in a sentence the negator occurs.

Let us now turn to why children find it more difficult to interpret negated sentences when the negator occurs in a distant position than in a close position. We propose that this difficulty results from the need to reanalyze the initial event-semantic representation, at a very late point in sentence interpretation. This has been coined the “event-semantic kindergarten-path” (Schulz 2024, Schulz & Makrodimitris 2025) and was originally proposed to account for children’s difficulty with non-iconic *after*-sentences. While syntactic kindergarten-path effects are argued to explain children’s difficulty with processing temporary syntactic ambiguities (e.g., *Put the frog on the napkin in the box*, Trueswell et al. 1999), event-semantic kindergarten-path effects are intended to account for children’s difficulty in revising initial event-semantic representations. To illustrate, in *after*-sentences such as *John ate the banana, after he read the letter*, the sentence-medial *after* is a late cue for how to order the events and requires revision of the initial event representation. The listener encounters first the main clause and establishes Event 1. Upon encountering *after*, she needs to establish another event, which is in fact prior to Event 1. Consequently, Event 1 has to be reanalyzed as the subsequent event and the second event has to be reanalyzed as the first event.

Negation—or cancellations more generally—represents an extreme case of event-semantic kindergarten-paths, where events are not just reordered but subtracted from the semantic representation established thus far (Schulz 2024). Consider the examples for distant negation in (8) and for close negation in (9) from our study, which illustrate the different surface positions of negation.

- (8) Das Mädchen gibt dem Jungen den Ball **nicht**.
 The girl gives the boy the ball not
- (9) Der Junge spielt **nicht** mit den Bausteinen.
 The boy plays not with the bricks

In (8), the negator is the very last word of the sentence. The sequence preceding the negator constitutes a grammatical sentence, which would denote an event in which the girl gives the boy the ball, resulting in a corresponding proposition *p*. When the negator *nicht* is encountered, it signals to the listener that this event has not taken place. As a result, the event-semantic representation has to be revised, and the truth value of *p* needs to be reversed. This is difficult for children because the cue for revising the initial event-semantic representation occurs very late. In (9), the pre-negator sequence constitutes a grammatical sentence as well. However, different from (8), the negator appears earlier, allowing the listener to revise the event-semantic representation before encountering the remaining constituent—in this case, the PP. This advantage of close over distant negation may also manifest in shorter response times for timed truth-value judgments, but determining whether it does requires further research.

Combining the two sources of difficulty in children's comprehension of negation, we can now address why distant true negatives are particularly challenging, remaining difficult until after age five. According to the event-semantic kindergarten-path, target-like comprehension is especially challenging when an initial representation requires revision and the cue for revision occurs late, as in distant negated sentences. When hearing a true negative, the listener builds an initial representation of an event *E1* (e.g., 'the boy gives the girl the ball') that conflicts with the actual state-of-affairs (e.g., the picture in (6)). This conflict is only resolved when the negator, i.e. the cue for reversing the truth value, is encountered. The later the cue appears, the harder it is for the child to resolve the conflict, and the more it disrupts the truth value judgment, leading to incorrect *no*-responses. This initial conflict and the subsequent reversal of the truth value are also present in close true negatives, but, crucially, the cue for revision occurs earlier than in distant true negatives.

It is open whether embedding the test sentences in a richer pragmatic context would change the response patterns we found for limited contexts. Also recall that the items were part of the scale of standardized language test; hence, a replication with more items would be desirable. We leave for further research the question of how children interpret negated sentences when the negator occurs, before an initial event-semantic representation can be built, illustrated below for German with composite tense (10a) and in a subordinate clause (10b).

- (10) a. Das Mädchen hat dem Jungen den Ball **nicht** gegeben.
 The girl has the boy the ball **not** given
 ‘The girl did not give the ball to the boy.’
 b. ... dass das Mädchen dem Jungen den Ball **nicht** gibt.
 ... that the girl the boy the ball **not** gives
 ‘... that the girl does not give the ball to the boy.’

Similarly, we did not address how scrambling the definite DPs (see Section 2) affects comprehension difficulty. Distant negation, as in (8), may be harder because the scrambled DPs (and verb) must be reconstructed within the negator’s domain to obtain a wide-scope reading (Sudhoff 2008). On this view, (10) may be as difficult as (8), since in both cases the definite DPs are scrambled across the negator.

6. Conclusion and outlook

Our study confirms that children find true negated sentences more difficult to comprehend than false ones and provides novel evidence for a systematic effect of syntactic position on negation comprehension. At ages three and four, children experienced greater difficulty when the negator appeared late in the sentence than when it immediately followed the finite verb, for both true and false negatives. By age five, this disadvantage of late negation position persisted for true negatives. Together, these findings on the development of children’s comprehension of sentential negation support the predictions of the event-semantic kindergarten path (Schulz 2024, Makrodimitris & Schulz 2025): children struggle to revise initial event-semantic representations when the cue for the revision occurs late in the sentence.

Future research is needed to understand how children process sentential negation when the negator appears very early—before any event-representation can be formed. In an ongoing project, we are investigating this question in Spanish, a language in which negation is always realized before the finite verb (for preliminary results, see Vilà Dolado et al. 2026).

Appendix

Table 1. Model summary (fixed effects, 1704 observations).

Predictor	Estimate	Std. Error	z-value	p-value
(Intercept)	2.2432	0.2528	8.875	< .001
Age(centered)	0.0697	0.0133	5.249	< .001
Negation position	0.4612	0.3814	1.209	0.227
Truth	1.5099	0.3846	3.926	< .001
Age(centered)*Negation position	-0.0181	0.0173	-1.044	0.296
Age(centered)*Truth	-0.0225	0.0174	-1.293	0.196
Negation position*Truth	-0.4628	0.7630	-0.607	0.544
Age(centered)*Negation position*Truth	-0.1310	0.0348	-3.768	< .001

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