

Production and Comprehension of Sentence Negation in Child German*

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Introduction

The acquisition of sentence negation has been well-studied since the late seventies (Clahsen 1988; de Villiers and Tager Flusberg 1975; Déprez and Pierce 1993; Dimroth 2009; Drozd 1995; Hamann 2000; Meisel 1997; Penner, Tracy, and Weissenborn 2000; Stromswold and Zimmermann 2000; Wode 1977). Independent of the language to be acquired, negation particles, for example *no* and *not* in English, belong to the first elements children produce in the early multiword stage (e.g., Wode 1977). It has been argued that already three-year-olds use negation elements target-like with respect to semantic and syntactic properties (cf. Clahsen 1988 for German). In contrast to the extensive research on the production of negation, to date few studies have investigated children's comprehension of negated sentences. Moreover, to our knowledge studies have not looked at production and comprehension of sentence negation in the same children, thus leaving open the question of whether there is an asymmetry in the acquisition path between both modalities.

Taking as a starting point the traditional assumption that comprehension precedes production (cf. Clark 1993), we would predict that at age three children have no difficulty understanding negated sentences. On the other hand, it has been claimed that production may precede comprehension. This position has received support for example from findings on the acquisition of binding

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principles (delay of principle B effect, Baauw et al. this volume), of infinitival complements (Grimm, Schöler, and Wintermantel 1975), and of focus particles (Müller, Schulz, and Höhle 2010). The evidence to date is still limited, as few studies have investigated comprehension and production in the same children, and few studies have used a number of different methods within the same modality to reach converging evidence. Therefore, a production-comprehension asymmetry may not be present within the same group of subjects or may be specific to a particular linguistic task.

Regarding negation, production may be expected to precede comprehension for the following reasons. At the early multiword stage negation particles are functionally closely linked to focus particles in that they serve as bootstrapping elements to project functional categories. Accordingly, negation particles form necessary prerequisites for acquiring complex syntactic structures, and are already produced around age two (Penner, Tracy, and Weissenborn 2000). In contrast, errors seem to persist late in development in formal comprehension tasks requiring children to handle logical negation (Feldman 1972).

Previous studies on the acquisition of negation could only partially address the question of a production-comprehension asymmetry. First, no study tested production and comprehension of sentence negation with the same group of children. Second, no study provided longitudinal data for production and comprehension examining larger groups of monolingual children.

Therefore, we investigated the acquisition of negation in monolingual learners of German, using a combined cross-sectional and longitudinal design. To compare production and comprehension skills, the same children were tested with an elicited production paradigm and a truth value judgment task. Both tasks are part of the standardized language test *Linguistische Sprachstandserhebung – Deutsch als Zweitsprache* (LiSe-DaZ, Schulz and Tracy, in press). All participants were tested twice in a six-month interval at age 3;7 and age 4;2. The data are part of the larger research project MILA¹, which compares the acquisition of morphosyntactic, semantic, and phonological abilities of monolingual children and early second language learners of German.

The paper is structured as follows: Section 2 provides theoretical background on sentence negation. Section 3 summarizes previous studies dealing with the acquisition of sentence negation. Our research hypotheses are formulated in section 4. The design and results of the present study are presented in

1. The children take part in the project MILA (The relation between migration background and language impairment in children's language achievement, Principal Investigator: Petra Schulz), which is part of the Research Center IDEa.

section 5. Finally, section 6 provides a general discussion of the findings and suggests directions for future research.

Syntactic, semantic, and pragmatic aspects of sentence negation

Unlike contrastive negation, which serves to deny a specific constituent, sentence negation denies the whole proposition of a sentence. Sentence negation is assumed to occur in all languages, but languages use different lexical and syntactic means to express negation.² In the following, core syntactic, semantic, and pragmatic aspects of negation are summarized that were relevant for our acquisition study of sentence negation in German.

Sentence negation belongs to the class of non-anaphoric negation (Bloom 1970). Non-anaphoric negation is defined as denoting a “negative relationship [that] holds between neg and some part or the whole of the sentence or phrase with which neg occurs in construction” (Wode 1977: 90). In contrast, anaphoric negation corrects parts of an aforementioned utterance. In German, both negation types have in common that the negation is expressed by a free morpheme, *nein* ‘no’ in anaphoric negation (as a sentence equivalent); *nicht* ‘not’, *kein* ‘no’ (as a determiner), and *niemals* ‘never’ in the case of non-anaphoric negation.

Sentence negation is exclusively expressed by the negation particle *nicht* ‘not’ in German. The position of *nicht* is fixed, but depending on the sentence type and the required movements of verb and objects, it may appear sentence finally or sentence internal. This is illustrated in the following examples ((1a–c) taken from LiSe-DaZ, Schulz and Tracy in press).

- (1)
- a. *Die Ente schwimmt nicht.*
the duck swims not
‘The duck is not swimming.’
 - b. *Das Mädchen gibt dem Jungen den Ball nicht.*
the girl gives the-DAT boy the-ACC ball not
‘The girl does not give the ball to the boy.’
 - c. *Der Junge fährt nicht mit dem Skateboard.*
the boy drives not with the-DAT skateboard
‘The boy is not riding a skateboard.’

2. Sentential negation can be realized either via morphological marking or as a negation particle (German, French) or via negative verbs as in some African languages (Dahl, 1993).

- d. *Ich sehe, dass die Ente **nicht** schwimmt.*
 I see that the duck not swims
 ‘I see that the duck is not swimming.’

(1a) to (1d) show that the position of the negation particle *nicht* is closely related to the placement of the finite verb. Whereas sentence negation occupies a fixed position within the sentence structure, the position of the finite verb varies with respect to sentence type. Since German is a V2-language, the finite verb in a main clause moves to the second position regardless of which constituent is placed in sentence-initial position. In this case, the finite verb precedes *nicht* (1a–c). In a subordinate clause, the finite verb stays sentence-final, and the negation particle precedes the finite verb (1d).

Moreover, in German sentence negation may be realized either directly adjacent ((1a), (1c), (1d)) or non-adjacent (1b) to the verb. This is in contrast to the cross-linguistic tendency to realize sentence negation only adjacent to the finite verb (Meisel 1997). Definite arguments and semantically [+ specific] indefinite arguments of the verb must be scrambled in front of the negator (Steube 2006). Accordingly, to achieve an interpretation of *nicht* as sentence negation in (1b) the scrambled constituents *dem Jungen* and *den Ball* have to be reconstructed within the scope of the negator (Sudhoff 2008). Prepositional adjuncts like *mit dem Skateboard* in (1c), on the other hand, do not scramble over the negation particle *nicht*. The same restriction holds for example for the extended verbal complex consisting of constituents as predicates (2a), as well as for modal adverbials (2b) that cannot scramble over the sentence negation particle *nicht* (Steube and Sudhoff 2007).

- (2) a. *Die Studentin war **nicht** in der Universität.*
 The student was not in the university.
 ‘The student was not at the university’
- b. *Die Studentin tanzt **nicht** gut.*
 The student dances not good.
 ‘The student doesn’t dance well’

The precise syntactic analysis of the sentential negator *nicht* is still a matter of debate. Researchers agree that *nicht* projects a maximal phrase of its own (i.e., a NegP (Pollock 1989) or an adjunct (Haider 2004)), and that it occupies a fixed position within the sentence structure. In the following, we assume that *nicht* is located in the specifier of NegP that directly dominates VP (Meisel 1997 or the extensive discussion in Hamann), and the head of NegP is empty.

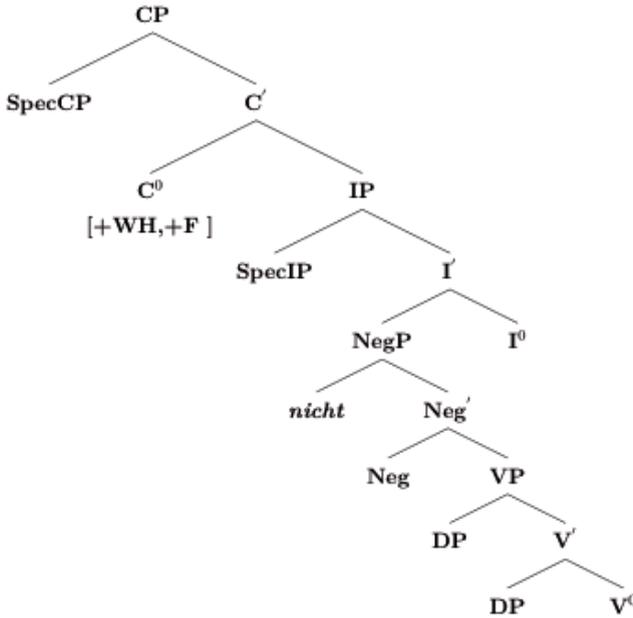


Figure 1. Syntactic structure of negation in German (cf. Meisel 1997)

Concerning its semantic properties, sentence negation differs from contrastive negation, which in German is expressed by the phonologically identical particle *nicht*. As mentioned above, sentence negation denies the whole proposition of a sentence, while contrastive negation has scope only over the constituent it is adjoined to (Steube and Sudhoff 2007), as illustrated in (3a) (repeated from (1b) vs. (3b)).³ Focused constituents are marked by capital letters.

- (3) a. *Das Mädchen gibt dem Jungen den Ball nicht.*
 the girl gives the-DAT boy the-ACC ball not
 ‘The girl does not give the ball to the boy.’
- b. *Das Mädchen gibt dem Jungen nicht den BALL, sondern ...*
 the girl gives the-DAT boy not the-ACC ball,
 sondern ...
 but...
 ‘The girl does not give the BALL to the boy, but ...’

3. In contrast to Steube and Sudhoff (2007), Jacobs analyzes contrastive negation as adsentential; it can only be adjoined to verbal projections as VP, IP, and CP (Jacobs 1982: 276f).

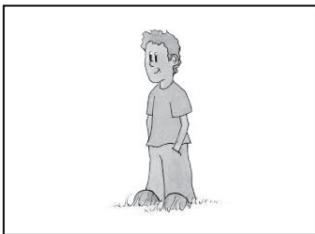
In (3a) the proposition ‘the girl gives the ball to the boy’ is denied, i.e. the sentence meaning is ‘it is not the case that the girl gives the ball to the boy’. (3b) means ‘the thing that the girl gives to the boy is not the ball’ OR ‘the girl gives something to the boy and it is not a ball’. While sentence negation occupies a fixed position in the sentence structure, contrastive negation is analyzed as an adjunct that is adjoined to the negated constituent. This constituent is focused, and is marked with contrasting stress. Typically, contrastive negation offers an alternative ending, which might be added by *sondern*, as *sondern den Schläger* ‘but the racket’.

Turning to pragmatic properties of sentence negation, negated sentences can be used in two different types of contexts. They can be a true description of a situation (henceforth called ‘true negatives’) as in (4) or a false description of a situation (henceforth called ‘false negatives’) as in (5) (examples taken from Wason 1972: 20).

(4) 57 is **not** an even number. True negative

(5) 92 is **not** an even number. False negative

Note that in order to evaluate (4) and (5) the actual discourse context in which the negated mathematical statements are being uttered does not play a role. However, often negated sentences are used in situations where the actual context decides about truth or falsity of a negated statement. Thus, the interpretation of a negated sentence requires matching the negated proposition with the actual discourse context. This is demonstrated in examples (6) and (7) (picture taken from LiSe-DaZ, Schulz and Tracy in press).



(6) True negative:
Ibo schläft nicht.
Ibo sleeps not
‘Ibo is not sleeping.’

(7) False negative:
Ibo steht nicht.
Ibo stands not
‘Ibo is not standing’

Given that the picture above depicts a boy named Ibo, (6) is a true negative because it describes the situation on the picture correctly. (7) is a false negative because Ibo is in fact standing. Clark (1976) assumes that more processing steps are necessary to evaluate a true negative as compared to a false negative.

Thus, processing true negatives in language comprehension is assumed to be harder than processing false negatives. As can be inferred from (6) and (7) above, in everyday discourse false negatives seem more natural and thus are much more frequently used than true negatives (cf. Wason 1972). As Wason states, “a negated sentence typically denies what is supposed to be true” (Wason 1972: 35). The sentence in (6) “*Ibo is not sleeping*” might be a true negative describing the depicted situation, but that is not the reason for saying it. Rather, it denies the assumption of the listener that Ibo is sleeping and thus could be said to function as a false negative regarding the listener’s belief. A true negative regarding the context would be the statement *Ibo is not sleeping* in a situation where nobody expects Ibo to sleep. Hence, using a negated sentence to confirm a proposition is contrary to its natural function and is therefore unexpected in language production.

Additionally, Wason (1972: 28) states that “negation functions within an affirmative context”. Accordingly, verifying sentence (8) without a given affirmative context is harder than verifying it with an affirmative context such as “4 is even and ...” (Wason 1972: 28).

(8) 5 is *not* even

Summarizing this section, sentence negation possesses complex syntactic, semantic, and pragmatic properties that all have to be mastered by the language learner.

Previous acquisition studies

In section 3.1 previous studies on the production of sentence negation are summarized; section 3.2 describes previous research on the comprehension of negated sentences.

Production of sentence negation

Several studies have investigated the production of negation in monolingual language acquisition. For German, two studies by Clahsen (1988) and Wode (1977) are the most comprehensive ones. Based on spontaneous production data of two monolingual children, Wode proposes four developmental stages. At Stage I, children use phonetic variants of *nein* ‘no’ in isolation. Around age 1;7, children enter Stage II realizing *nein* in a clause-external position. Following Wode, this pre-sentential *nein* can either function as anaphoric nega-

tion or as a non-anaphoric negation that is established at the semantic level, but is not fully acquired at the syntactic level.⁴

At stage III, *nicht* ‘not’ is used sentence internally, gradually replacing the non-anaphoric *nein*-structures. Although main aspects of the syntactic realization of sentence negation are in place now, children still fail to obligatorily scramble definite noun phrases at stage III. Thus, they realize finite verb and negator in adjacent positions resulting in a contrastive reading as in (9), while actually intending the interpretation to be a sentence negation as in (10).

- (9) **Das Mädchen isst nicht den Bonbon.*
 The girl eats not the candy.
 ‘The girl is not eating the candy.’

- (10) *Das Mädchen isst den Bonbon nicht.*
 The girl eats the candy not.
 ‘The girl is not eating the candy.’

Clahsen (1988) analyzed the spontaneous speech data of six children. Unlike our assumptions, Clahsen analyses *neg* as a head instead of a specifier of NegP. According to his account, INFL and *neg* build a syntactic island, which cannot be affected by movement operations at this stage. Scrambling takes place once the children master subject-verb agreement⁵ and thus become aware that the INFL-*neg* complex forms a derived structure. As a consequence, the unanalyzed unit is split into its lexical and syntactic constituents (Clahsen 1988: 15). When obligatory scrambling takes place, at the latest by age three, children enter stage IV in Wode’s classification, and sentence negation is produced in an adult-like way.

Recent findings by Dimroth (2009) and Winkler (2006) going back to Penner (2000) provide further support for a close relationship between negation and finiteness in child language. More precisely, Dimroth (2009) argues that sentence negators such as *nicht* provide stepping stones for the acquisition of finiteness. In accordance with this view, finiteness is marked more frequently in negated sentences than in affirmative ones around age two (Dimroth 2009, but see Hamann 2000 for a discussion of counterevidence). These results

4. In contrast, Drozd analyzes pre-sentential negation in English as target-like non anaphoric metalinguistic exclamatory sentence negation (Drozd 1995).

5. Drenhaus’ sentence repetition data (2000) shows that children up to age 6;1 do not obligatorily scramble objects in front of negation. This contradicts the findings of Clahsen (1988) and Wode (1977), using both the method of spontaneous speech analysis.

further strengthen the assumption that the negation particle *nicht* is recognized early in acquisition.

Comprehension of sentence negation

Most comprehension studies up to date focused on older children and investigated the interplay of sentence negation and other structural phenomena, including definite and indefinite noun phrases (Romain 1988), scrambling of indefinite noun phrases (Krämer 1998; Unsworth 2005), and scope ambiguities caused by universal quantification (e.g. Gualmini 2004; Musolino and Lidz 2006).

Few studies address whether and how sentence negation is processed in younger children. Using a preferential looking paradigm, Gilkerson, Hyams, and Curtiss (2004) found that 14- to 25-months-old monolingual children acquiring American English have a basic understanding of sentence negation. When presented with a negated sentence, children looked for a shorter period of time at the picture that was negated than at the same picture accompanied with an affirmative sentence. To react this way, children had to identify the negator and possess at least some understanding of its negating properties. Accordingly, the authors conclude that children as young as 14 months are able to distinguish between sentences with and without the negation element *not*.

The studies by Wason (1965) and also by de Villiers and Tager Flusberg (1975) demonstrated that context and pragmatics of negated sentences crucially affect their interpretation for children. Their starting point was evidence from adult processing demonstrating that negated sentences are more difficult to parse than affirmative sentences, and that true negatives are more difficult to parse than false negatives (Wason 1972). Replicating Wason's study (1965) with younger subjects, de Villiers and Tager Flusberg used a sentence completion design with children aged two to five years. Six or seven objects or drawings were placed in front of a child, with one differing from the others (e.g., seven cars and one baby bottle). Then the experimenter pointed to one of the objects and asked "This is a ___?" or "This is NOT a ___?", thus eliciting true affirmatives and true negatives. Following the exceptionality hypothesis (Wason 1965), de Villiers and Tager Flusberg hypothesized that answering a negative probe for the exceptional item is more plausible and therefore easier than answering a negative probe for one of the similar items. This hypothesis was confirmed for all age groups. Only implausible negatives (i.e. denying the common characteristic of the similar items) were associated with long response times and higher error rates. If embedded in a plausible context, four-year

old children showed no differences in the interpretation of true negatives and affirmative sentences (de Villiers and Tager Flusberg 1975).

For German, data on the comprehension of negated sentences is only available from the norming data of the standardized language test SETK 3–5.⁶ Children aged 3;0 to 3;11 are given a picture-choice task with two test items and children aged 4;0 to 5;11 are given an act out task, again with two items. The three-year-olds responded correctly in about 76% of the cases, compared to 85 % correct responses in the four- and five-year-olds. This data does not allow detailed conclusions to be drawn about the acquisition of negation in German, as only a few items were tested and as additional linguistic phenomena such as relative clause formation were included in the test material.

Research questions and hypotheses

Focusing on children's comprehension of sentence negation, the present study addressed four questions. The first was whether there is an asymmetry between production and comprehension of negated sentences in child German. Extending the argumentation that production may precede comprehension (Baauw et al. this volume; Müller, Schulz, and Höhle 2010) to sentence negation, we formulate as Hypothesis 1:

- (H1) Monolingual German speaking children who produce *nicht* still have a non target-like comprehension of sentence negation.

The second question concerned the syntactic aspects of negated sentences. Recall that in German sentence negation may appear adjacent or non-adjacent to the finite verb. Therefore, we were interested in exploring how these syntactic factors affect comprehension of negated sentences. Assuming that verb non-adjacent negation is more complex than verb adjacent negation because the former but not the latter requires object scrambling, we state as Hypothesis 2:

6. Ofner (2007) investigated the acquisition of contrastive negation with a sentence completion task in monolingual German speaking children. Four- to six-year-old children had difficulty interpreting structures containing contrastive negation. The children performed correctly to contrastive negation of the subject in 62% of the cases, in contrast to only 33% correct responses to contrastive negation on the verb and 35% correct responses to contrastive negation on the object.

- (H2) Comprehension of verb adjacent negation is easier than of verb non-adjacent negation.

To date, detailed research on the acquisitional stages children go through towards mastering true and false negatives is still lacking. Wason (1972) found that in adults false negatives are relatively easy to interpret, while true negatives are more prone to errors. For English-speaking four-year-olds, difficulties with the interpretation of true negatives were observed as well (de Villiers and Tager Flusberg 1975). We thus formulate as Hypothesis 3:

- (H3) Comprehension of false negatives is easier than of true negatives.

Our last question addressed the interaction of syntax (i.e. the structural position) and pragmatics (i.e. context matching) of sentence negation, using a regression analysis. Since many pragmatic abilities that require context integration are not yet in place in pre-schoolers (Hickmann 2000; Schulz 2007), as Hypothesis 4 we state:

- (H4) The pragmatic factor *context matching* predicts children's performance on negated sentences better than the syntactic factor *structural position*.

The study

Participants

We tested 34 typically developing monolingual German-speaking children (11 girls, 23 boys) in two test rounds. All participants take part in a larger study on the acquisition of German as the first or the second language. The age ranged from 3;5 to 4;1 ($M = 3;7$, $SD = 2$ months) in the first test round, and from 4;0 to 4;5 ($M = 4;2$, $SD = 1.8$ months) in the second test round. All children had an age appropriate non-verbal IQ, with a mean of 89 ($SD = 13$) assessed by the non-verbal part of the K-ABC (Melchers and Preuss 2003). All children attended regular kindergartens and according to a parent questionnaire did not show any signs of language impairment or language delay, of hearing problems or psycho-social deprivation.

Pretest

1. A pretest administered at the beginning of the first test round (age 3;7) served to select the children for the present study. Only children who produced the negation particle *nicht* consistently participated in the main test. Production of the negation particle *nicht* was assessed via the subtest Elicited Production of the standardized language test LiSe-DaZ (Schulz and Tracy in press), which comprises 14 test items in total. Different sentence types (main, subordinate, questions) and word classes (modal and auxiliary verbs, prepositions, conjunctions) are elicited. Three test items aim at eliciting the negation particle *nicht*. Example (11) illustrates a typical test item for sentence negation. After a lead-in sentence, children are prompted to complete the utterance so that it conveys the intended meaning. Due to the occurrence of *nicht* in a preceding sentence this may be seen as a repetition task rather than as a production task. However, note that this sentence and the prompt for the child are separated by an intervening sentence. Therefore, simple repetition is impossible. Moreover, many studies have shown that children are successful at imitation only if this structure is already present in the child's grammar (MacDaniel et al. 1996).

- (11) Experimenter: *Lise und Ibo gehen jetzt weiter. Den Hund wollen sie aber nur mitnehmen, wenn er nicht mehr wegrennt.*
 ‘Lise and Ibo continue their walk. They want to take the dog with them if he doesn’t run away anymore.’
- Lead-in: *Ibo sagt zu dem Hund: Du darfst nur mitkommen, ...*
 Ibo says to the-DAT dog: You can only come with ...
 ‘Ibo says to the dog: You can only come with us...’
- Child: *wenn du **nicht** mehr wegrennst.*
 if you not anymore run away
 ‘if you don’t run away anymore.’

As expected, all 34 children consistently used *nicht* appropriately in the elicited contexts at the first test round at age 3;7 and were thus included in the main study. Comparing children's performance to the age norms, they all reach T-values of 42 and higher and thus fall within the normal range.

Material and procedure of the main test

Children's comprehension of sentence negation was tested with the subtest *Comprehension of Negation* of the standardized language test LiSe-DaZ (Schulz and Tracy in press), using a variant of the truth value judgment task.

Importantly, the truth value judgement task does not show children's preference, but measures which interpretation is actually possible for the child (cf. Gordon 1996). The comprehension of negation task works as follows: The experimenter shows the child a picture introduced by a short lead-in sentence, and then a hand puppet makes a statement about the picture, while the child is looking at the picture. The task of the child is to decide whether the puppet's utterance is correct or incorrect with respect to the picture. Two example test items are given in (12) and (13).

(12)



Experimenter: *Guck mal, hier ist ein Mädchen, ein Junge und ein Ball.*

'Look, there are a girl, a boy, and a ball.'

Puppet: *Das Mädchen gibt dem Jungen den Ball nicht.*

The girl gives the-DAT boy the-ACC ball not.

'The girl isn't giving the ball to the boy.'

Experimenter: *Stimmt das?*

'Is that right?'

Child: *Ja, das stimmt.*

'Yes, that's right.'

(13)



Experimenter: *Guck mal, hier ist Lise, ein Rucksack und Ibo.*

'Look, there are Lise, a backpack, and Ibo.'

- Puppet: *Lise gibt Ibo den Rucksack nicht.*
 Lise gives Ibo the-ACC backpack not.
 ‘Lise isn’t giving the backpack to Ibo.’
- Experimenter: *Stimmt das?*
 ‘Is that right?’
- Child: *Nein, das stimmt nicht.*
 ‘No, that’s not right.’

Each of the participants was tested individually by trained student assistants in a quiet room in their kindergarten. There was an interval of six months between the two test rounds ($M = 5.5$, $SD = 1.5$). The sessions were video-recorded for later data check against the onsite-coding and for further individual analyses. No response-contingent feedback was given by the experimenter. When the child failed to supply an answer, test items were repeated once.

A total of 12 negated sentences were presented to each child in a 2×2 design.⁷ Two test conditions varied the syntax and two the pragmatics of the negated sentence, each comprising six test items. An overview of the design is given in Table 1. The order of presentation was random.

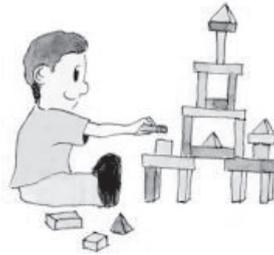
Table 1. Number of items in the subtest “Comprehension of negation” by condition

		Syntax		Total items
		Verb adjacent	Verb not adjacent	
Pragmatics	True negative	3	3	6
	False negative	3	3	6
	Total items	6	6	12

Regarding the factor Syntax, the position of the negation particle with respect to the finite verb was varied. (14) illustrates the verb adjacent position, and (15) the not verb-adjacent position of *nicht*.

7. Note that affirmative sentences were not included in the standardized test.

(14)



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

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

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

Child: *Nein, das stimmt nicht.*
'No, that's not right.'

(15)



Experimenter: *Guck mal, hier sind ein kleiner Junge und eine Ente.*
'Look, there are a small boy and a duck.'

Puppet: *Der kleine Junge füttert im Park die Ente nicht.*
The small boy feeds in park the-ACC duck not.
'The small boy is not feeding the duck in the park.'

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

Child: *Ja, das stimmt.*
'Yes, that's right.'

Regarding the factor Pragmatics, the matching between the visual context and the puppet's statement was varied. True negatives are illustrated in (12) and (15): Here the puppet's statement confirms the situation depicted in the picture

and hence requires an affirmative response. False negatives are illustrated in (13) and (14). In this case the puppet's statement had to be denied.⁸

Coding of responses

Children's responses were coded as correct and incorrect. Depending on the pragmatic conditions the target response was 'yes' to a true negative, and 'no' in the case of a false negative. Table 2 summarizes which responses were coded as target-like and which as incorrect for these two conditions.

Table 2. Types of correct and incorrect responses to the test items

Condition	Correct responses	Incorrect responses
TRUE NEGATIVE	Yes.	No.
'The girl doesn't give the ball to the boy.'	That's right. No, she is not giving it to him. She is kicking the ball away.	That's not right. She is giving it to him.
FALSE NEGATIVE	No.	Yes.
'Lise doesn't give the backpack to Ibo.'	That's not right. She is giving it to him.	That's right. No, she is not giving it to him.

Results

General results

This section summarizes the quantitative results. A more detailed analysis with respect to the four hypotheses follows in the subsequent subsections.

Figure 2 illustrates the high proportion of correct responses (age 3;7: mean = 9,2, SD = 2,12; age 4;2 mean = 9,6, SD = 2,07). Comparing children's performance with the age norms in the standardized test, across the two test rounds all but three children fall within the age-appropriate norm, with T-values of 41 or above. A comparison of children's performance across the two test rounds yielded no significant difference. As a group, children performed above chance at both test rounds (Age 3;7: $t(33) = 8.718$, $p < .001$; Age 4;2: $t(33) = 10.078$, $p < .001$; One-Sample T-test).

8. Note that the role of the context supplied by the picture differs in the two pragmatic conditions. In false negatives, the picture depicts the agents, objects, and the activity, which are then referred to in the puppet's statement. In true negatives, however, the verb used in the puppet's true negative statements is not given in the picture.

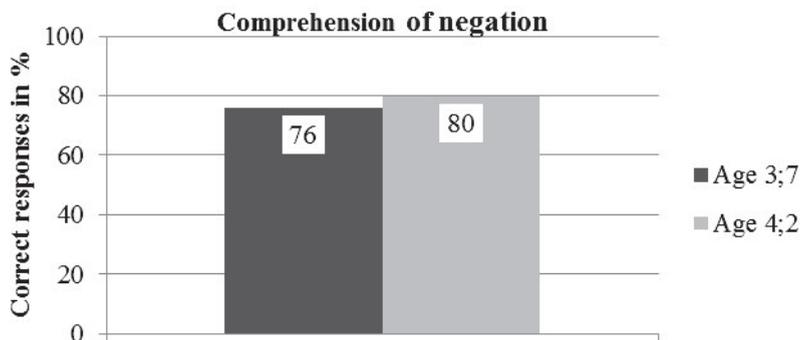


Figure 2. Proportion of correct responses in the subtest Comprehension of Negation

Overall, these results show that the children could identify the negation particle *nicht* within the negated sentence. If the children had simply ignored the sentence negation, a reverse response pattern would have emerged (i.e. answering 'yes' instead of 'no' and vice versa to all test items). This pattern was not observed in any of the children.

Production and comprehension (H1)

H1 hypothesized that children who produce *nicht* still have a non target-like comprehension of sentence negation. As mentioned in Section 5.2, all children who participated in this study produced *nicht* appropriately in the contexts used in an elicited production task. Table 3 illustrates children's individual performance in the comprehension task for both test rounds.

All children had five or more correct responses. For the present purposes, mastery was then calculated for each child, defining mastery as performance above chance. Based on binomial distribution, mastery was reached if a child responded correctly to nine or more out of the 12 test items. According to this definition, 71% of the children (24 of 34) mastered negation at the first test round, and 74 % (25 of 34) showed mastery six months later.

Put differently, at age 4;2 still 26 % of the children had not reached the criterion for mastery. This indicates that although all children used sentence negation appropriately at the age of three, comprehension of negation is not necessarily mastered at the age of four.

Table 3. Number of subjects by responses correct for both test rounds in the comprehension task.

Number of correct responses	Age 3;7	Age 4;2
0/12	–	–
1/12	–	–
2/12	–	–
3/12	–	–
4/12	–	–
5/12	2	1
6/12	5	3
7/12	1	2
8/12	2	3
9/12	5	6
10/12	8	7
11/12	8	3
12/12	3	9

Comparing verb adjacent and verb non adjacent negation (H2)

The factor Syntax varied the position of negation particle and finite verb. The proportion of correct responses to verb adjacent and verb non-adjacent sentence negation are depicted in Figure 3. Children performed significantly better on the verb adjacent condition at age 3;7 ($Z = -2.769$, $p = .006$, Wilcoxon-test), and at age 4;2 ($Z = -3.099$, $p = .002$, Wilcoxon-test).

Table 4. Mastery (✓) and non-mastery (–) of verb adjacent and verb non-adjacent negation by the children

	N First test round (age 3;7)	N Second test round (age 4;2)
✓ verb adjacent	14	14
✓ verb non-adjacent	0	1
– verb adjacent	11	13
– verb non-adjacent	9	6
sum	34	34

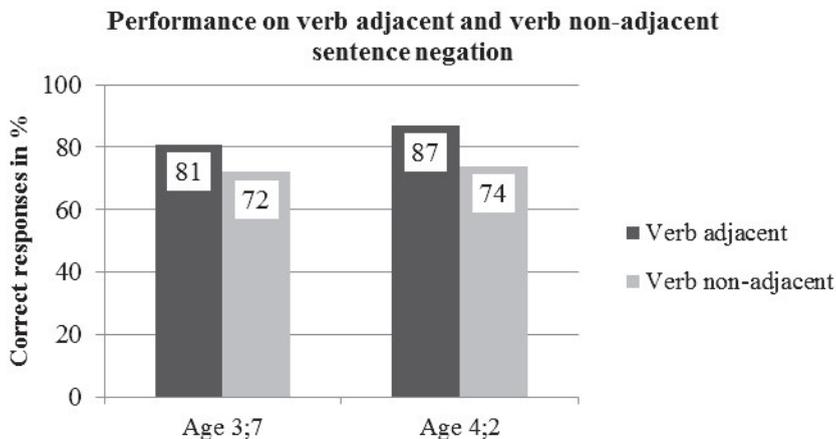


Figure 3. Proportion of correct responses to verb adjacent and verb non-adjacent sentence negation

To investigate the developmental stages in this syntactic aspect of negation, mastery of verb adjacent negation and verb non-adjacent negation was calculated for each child. In both conditions mastery was again defined as performance above chance. Mastery was reached if a child responded correctly in at least five of the six test items. Table 4 summarizes the distribution of mastery across the two conditions.

14 out of the 34 children (41%) mastered verb adjacent and verb non-adjacent negation at age 3;7 and 4;2 respectively.⁹ 11 children (32%) mastered verb adjacent, but not verb non-adjacent negation in the first test round. In the second test round, three of them also mastered verb non-adjacent negation, six did not improve their performance, and two had not reached the criterion for mastery in both conditions. Interestingly, there still were nine children (26%) in the first test round and six (18%) in the second test round, who did not reach mastery in either condition. As expected, mastery of verb non-adjacent negation without mastery of verb adjacent negation occurred very infrequently (only one child at age 4;2).

These results suggest that syntactic aspects of sentence negation are not fully acquired at the age of four. First, children mastered negation in the sentences

9. Looking at the 14 children mastering both conditions in the first test round, 10 of them also performed well in the second test round. Three out of 14 mastered verb adjacent negation only, and one child unexpectedly reached mastery of verb non-adjacent negation but not of verb adjacent. Such a response pattern was not found in any child in the first test round.

in which the negator *nicht* is adjacent to the finite verb. Then mastery of verb non-adjacent negation requiring object scrambling is reached. This acquisition order is indicated by the fact that, in both test rounds, more children mastered verb adjacent than verb non-adjacent negation. However, note in this analysis the factor Syntax was considered without taking into account the contribution of the factor Pragmatics.

Comparing true and false negatives (H3)

In this analysis, the proportion of correct responses to the condition true negative (i.e. a negated sentence that confirms the given situation) and the condition false negative (i.e. a negated sentence that is false in a given situation) are compared. The results are presented in Figure 4. Children's performance on false negatives was significantly better than on true negatives at both test rounds (Age 3;7: $Z = -2.445$, $p = .014$, Age 4;2: $Z = -3.341$, $p = .001$, Wilcoxon-test).

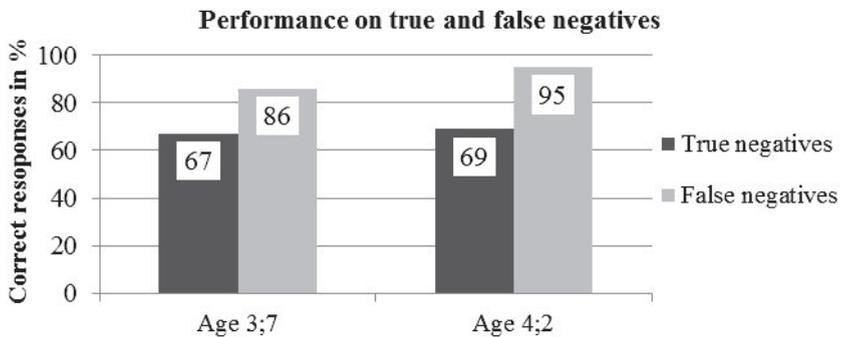


Figure 4. Proportion of correct responses to true and false negatives

To look into the individual response patterns, we calculated children's mastery for true negatives and for false negatives. Again, the criterion for mastery was performance above chance, here defined as giving at least five out of 6 correct responses per condition. Children's mastery patterns are depicted in Table 5.

14 out of 34 children (41%) mastered false and true negatives in the first test round, and 16 (47%) in the second test round.¹⁰ In the first test round, there was only one child (3%) failing in both conditions; this child reached mastery of

10. Out of 14 children mastering both conditions in the first test round, 10 showed the same performance in the second test round, four reached mastery of only false negatives, and one child mastered true negatives but not false.

false negatives at the second test round. 15 children (29%) mastered false negatives, but not true negatives in the first test round. In the second test round, five of them also mastered true negatives, nine did not improve their performance, and one child reached mastery of only true negatives.

Table 5. Number of children with mastery (✓) and non-mastery (–) of false negatives and true negatives.

(N=34)	N First test round (age 3;7)	N Second test round (age 4;2)
✓ false negatives	14	16
✓ true negatives		
– false negatives	4	2
✓ true negatives		
✓ false negatives	15	16
– true negatives		
– false negatives	1	0
– true negatives		
sum	34	34

As expected, mastery of true negatives was rarely observed. Only four of the 34 children mastered true negatives but not false negatives at age 3;7, and only two of these 34 at age 4;2.¹¹

In sum, these results provide evidence that false negatives are acquired before true negatives. This is indicated by the fact that, in both test rounds, more children mastered false but not true negatives than vice versa. Moreover, the number of children mastering false but not true negatives increases over the interval of six months. This suggests that children not mastering either condition in the first test round mastered false negatives more successfully than true ones at the second.

11. These children consistently responded with yes to all test items. Such a response pattern may reflect a yes-bias, which has been argued to occur if a child is not able to perform a task (Siegal 1997).

Syntactic and pragmatic factors as predictors for comprehension of negated sentences (H4)

Our data show that children performed better on verb adjacent than on verb non-adjacent negation, and that false negatives were easier to interpret than true negatives. Next, we investigated how these syntactic and pragmatic factors interact. Two hierarchical multiple regression analyses were performed to uncover which factor (syntax or pragmatics) predicted children's comprehension of negation better in the two test rounds.

The results of the regression analysis for the first test round are depicted in Table 6. For our model, only the pragmatic factor is a significant predictor of children's performance in the test at age 3;7.

Table 6. Results of the regression analysis for syntactic and pragmatic factors at the first test round

	<i>b</i>	Standard error <i>b</i>	β	<i>t</i>	Significance
Step 1					
Constant	2.735	.262			
Syntax	-.294	.166	-.151	-1.774	.078
Step 2					
Constant	3.574	.347			
Syntax	-.294	.159	-.151	-1.847	.067
Pragmatics	-.559	.159	-.288	-3.509	.001

The regression results for the second test round in Table 7 indicate that both factors Syntax and Pragmatics significantly predict children's performance. Based on the value of *t*, we can assume that the contribution of the predictor Pragmatics was greater than the contribution of the predictor Syntax.

Table 7. Results of the regression analysis for syntactic and pragmatic factors at second test round.

	<i>b</i>	Standard error <i>b</i>	β	<i>t</i>	Significance
Step 1					
Constant	2.985	.267			
Syntax	-.382	.169	-.192	-2.264	.025
Step 2					
Constant	4.265	.332			
Syntax	-.382	.153	-.192	-2.506	.013
Pragmatics	-.853	.153	-.428	-5.591	.001

In sum, the results of the regression analyses for both test rounds indicate that children's performance on comprehension of negation is better predicted by the factor Pragmatics.

Summary of the results

The children who participated in the study all produced *nicht* appropriately at the age of three using an elicited production task. However, many children still had difficulty interpreting negated sentences at the age of four. These findings suggest an asymmetrical development with production preceding comprehension. With respect to the syntactic factors, significant differences between verb adjacent and verb non-adjacent negation were found in both test rounds (age 3;7 and 4;2). Regarding the pragmatic aspects, an examination of the individual comprehension data revealed an advantage for false negatives over true negatives. Moreover, the regression analyses indicated that the pragmatic factor context matching is a better predictor for children's performance on comprehension of negation than the syntactic factor position.

Discussion

With a focus on comprehension, this study investigated the acquisition of sentence negation in German-speaking children. All children who participated in this study produced the negation particle *nicht* appropriately in the contexts supplied in the subtest *Elicited Production* of LiSe-DaZ (Schulz and Tracy in press). Children's comprehension of negation was assessed using the true value judgement task *Comprehension of Negation* of LiSe-DaZ (Schulz and Tracy in press).

With respect to the relationship between production and comprehension, the results suggest an asymmetrical acquisition. While all children produced *nicht* target-like in the first test round at age 3;7, they still had difficulty interpreting negated sentences at age 4;2. Thus, production of *nicht* does not coincide with target-like comprehension of sentence negation, confirming hypothesis (H1).

A further finding of the study is that the order of the negation particle and the finite verb affect children's comprehension of negated sentences. Verb adjacent negation was easier to interpret than verb non-adjacent negation in both test rounds, confirming (H2). This result may be due to the fact that non-adjacent negation is more complex than verb adjacent in that only the latter requires object scrambling. To correctly interpret the negated sentence,

scrambled objects have to be reconstructed within the domain of negation, which still seems to be problematic at age four.

Regarding the pragmatic aspects of negation, children performed significantly better on false negatives than on true negatives, confirming hypothesis (H3). These results corroborate previous findings in adults (Wason 1972). However, in view of the fact that four-year-old children in de Villiers and Tager Flusberg's study (1975) had little difficulty interpreting true negatives, this difference between the true and false negatives is surprising. It may be that the truth value judgement task we used is more taxing than the sentence completion task used by de Villiers and Tager Flusberg. In truth value judgement tasks, the child has to match a specific reading of a sentence to a picture. Therefore, the child needs to understand the sentence and to evaluate whether the sentence correctly describes the picture. In sentence completion tasks no such decision about a sentence-picture matching is required.¹²

Concerning the interaction between syntactic and pragmatic aspects of sentence negation, we found that children's performance on comprehension of negation can better be predicted by the pragmatic factor. Thus, hypothesis (H4) can be confirmed.

According to Wason (1972) and de Villiers and Tager Flusberg (1975), context plays a major role in the interpretation of negated sentences. If there is no context or if the presented context does not licence the negation, false negatives outperform true negatives, since only false negatives are used in everyday speech. Our findings confirm this. In both sessions, children who did not master true negatives performed well on false negatives. A similar tendency to reject the test sentences is reported by Gualmini (2004), studying the interaction of negation and quantification. In line with Wason (1972), Gualmini argues "that children's non-adult behaviour documented in previous studies results from the failure to satisfy the felicity conditions associated with negative statements" (Gualmini 2004: 957f). Our results thus indicate that the lead-in sentences used in the truth value judgement task do not license both types of negatives equally well. Especially, the context given was not specific enough to licence the true negative condition.

Summarizing our findings, we suggest the following acquisition path for the comprehension of sentence negation, taking as the point of departure Wode's (1977) stage IV:

12. In addition, one reviewer raises the question of whether false negatives may be more difficult to reject than true negatives in general. In false negatives, it is crucial that the action depicted in the picture is recognized as matching the verb in the test sentence. However, our results do not support this hypothesis.

- A. Target-like production of negated sentences
- B. Correct interpretation of false negatives with verb adjacent negation
- C. Correct interpretation of false negatives with verb non-adjacent negation
- D. Correct interpretation of true negatives

To reach converging evidence across tasks, future studies should employ a variety of methods with the same children and within and across the modalities comprehension and production. In addition, further studies are needed with younger children to explore when children first start interpreting negated sentences correctly and how acquisition of production and comprehension interact in children before age three.

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