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# Acquisition of the Dutch NPI *hoeven* ‘Need’: From Lexical Frames to Abstract Knowledge

Jing Lin<sup>a</sup>, Fred Weerman <sup>a</sup>, and Hedde Zeijlstra<sup>b</sup>

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## ABSTRACT

This article aims to investigate how Dutch children may eventually converge on a targetlike distribution of *hoeven* ‘need,’ a modal verbal NPI (Negative Polarity Item), based on its appearance in the scope of merely some but not all of its possible licensors in the language input (i.e., the induction problem). Imitation performance was obtained from 106 monolingual Dutch children (2;09–5;10; mean = 4;04; *SD* = 8.5 months) using an elicited imitation task. Results suggest that before age 3, children only accept *hoeven* to appear with either the sentential negation *niet* ‘not’ or the negative quantifier *geen* ‘no.’ After age 3, children start developing their knowledge of the licensing of *hoeven* in other negative expressions as well—namely *niemand* ‘nobody,’ *weinig* ‘few,’ and *alleen* ‘only’—and eventually allow *hoeven* in the scope of these negative words after age 5. Based on these developmental patterns, we assume that children initially analyze *hoeven* as bearing a lexical dependency with either *niet* or *geen*, represented by two lexical frames [HOEF NIET] ‘need not’ and [HOEF GEEN] ‘need no’ and that they develop a dependency relationship between the NPI and an abstract negator *NEG* later on, which is realized by an abstract analysis [HOEF NEG] ‘need NEG.’ Adopting a distribution-based learning approach, we show that the two lexical frames are established based on *hoeven*’s overwhelming occurrence with either *niet* or *geen* in the input. As for the development of the abstract analysis, we argue that children’s knowledge of syntactic decomposition of negation is of crucial importance. Since [HOEF NEG] turns out to be the representation of the NPI in late child grammar, we moreover argue that *hoeven* is an NPI, due to its lexical dependency with the abstract negator *NEG*.

## ARTICLE HISTORY

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## 1. Introduction

The Dutch modal verb *hoeven* ‘need’ is a Negative Polarity Item (NPI), which is restricted to contexts that are negative in one way or another (Hoeksema 1994, 2000; van der Wouden 1994, 1997; Zwarts 1981, 1986, 1995; among others). As demonstrated in (1a) to (1c), for instance, *hoeven*

- |     |    |  |        |            |      |               |               |
|-----|----|--|--------|------------|------|---------------|---------------|
| (1) | a. | Sam  | hoefde | gisteren   | niet | te            | voetballen.   |
|     |    | Sam  | needed | yesterday  | not  | to            | play football |
|     |    | ‘Sam did not have to play football yesterday.’ |        |            |      |               |               |
|     | b. | Niemand  | hoefde | gisteren   | te   | voetballen.   |               |
|     |    | nobody   | needed | yesterday  | to   | play football |               |
|     |    | ‘Nobody had to play football yesterday.’       |        |            |      |               |               |
|     | c. | Sam  | hoefde | nauwelijks | te   | voetballen.   |               |
|     |    | Sam  | needed | hardly     | to   | play football |               |
|     |    | ‘Sam hardly had to play football.’             |        |            |      |               |               |

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can appear in negative contexts that are introduced by the sentential negation *niet* ‘not,’ negative indefinites like *niemand* ‘nobody,’ or seminegative adverbs like *nauwelijks* ‘hardly.’

In addition to the three examples given in (1), *hoeven* can also appear in other kinds of negative environments (see previous references and see Appendix I for an overview and examples). However,

- (2) \*Sam/\*Iemand      hoefde      gisteren      te      voetballen.  
 Sam/Somebody      needed      yesterday      to      play football  
 Int.: ‘Sam/Somebody had to play football yesterday.’

in simple affirmative contexts like (2), for instance, the appearance of *hoeven* is ungrammatical (Zwarts 1981, 1986; Hoeksema 2000; among others).

Although *hoeven* can appear in various kinds of negative contexts, native speakers of Dutch do not use all of them to license the NPI in their daily communication. A survey in *het Corpus Gesproken Nederlands* (the Spoken Dutch Corpora, Oostdijk 2004) shows that only five kinds of contexts turn out to be commonly used to license *hoeven*.<sup>1</sup> They are negative contexts introduced by the sentential negation *niet* ‘not,’ the negative quantifier *geen* ‘no,’ negative indefinites like *niks* ‘nothing,’ or exclusive expressions like *slechts* ‘merely’ and contrastive contexts marked by focus markers like *wel* ‘surely.’

This suggests an induction problem for language-acquiring children (see Pearl & Sprouse 2015 and Pearl & Mis 2016 for recent investigation on this topic). How do children eventually establish an analysis of *hoeven* that generalizes its occurrence to all kinds of licensing environments (see Appendix I), based on input evidence that only contains the NPI in a limited set of licensing contexts? By investigating children’s performance in an elicited imitation task, this article will explore how children’s representation(s) of *hoeven* may change over development, such that they can achieve a generalizing analysis of the NPI, which gives rise to its appropriate distribution in the target language. We will discuss different factors that may affect the acquisition of *hoeven*, such as children’s vocabulary knowledge of different negative expressions, their semantic and syntactic knowledge of negation, and input frequency. Our acquisition results will moreover shed light on a theoretical question of NPI-hood—namely, why *hoeven* is an NPI, restricted to those contexts described at the beginning of the article (see also Appendix I).

We organize our article as follows. Section 2 introduces previous findings on the acquisition of the NPI. Section 3 presents the current experiment. Afterwards, results are presented in Sections 4. Regression analyses are reported and interpreted in Section 5. Discussion follows in Section 6, and finally, Section 7 concludes the article.

## 2. Previous findings on the acquisition of *hoeven* ‘need’

The literature features two studies on the acquisition of the NPI *hoeven*: van der Wal (1996) (see also Koster & van der Wal 1996) and Lin, Weerman & Zeijlstra (2015). Van der Wal investigated how children may have acquired the target distribution of the NPI by analyzing *hoeven*’s distribution in children’s spontaneous speech (1;05,09–3;10,17;  $N = 15$ ), children’s performance in an elicited imitation task with context provided plus acting out (3;00–3;11;  $N = 15$ ), and a grammaticality judgment task using paper and pencil (7;09–19;  $N = 104$ ). Lin, Weerman & Zeijlstra approach the acquisition of the NPI *hoeven* through a corpus search in the CHILDES database (MacWhinney 2000) (1;00–5;00;  $N = 59$ ). The main observation of the two studies is that, whereas some negative expressions are attested

<sup>1</sup>Data were collected from various elements of the corpora: Component a, “Spontaneous conversations (face-to-face)”; Component c, “Spontaneous telephone dialogues (recorded via a switchboard)”; and Component d, “Spontaneous telephone dialogues (recorded on MD via a local interface).” A total of 1,670 utterances containing *hoeven* are attested. We consider a licenser as commonly used to license the NPI only when it appears at least ten times in the selected components as a *hoeven* licenser. Relevant frequency data are provided in Appendix II.

**Table 1.** Emergence Age of Different Negative Expressions as *Hoeven* Licensers in Child Dutch (Based on van der Wal 1996 and Lin, Weerman & Zeijlstra 2015).

Age	2;00	4;00	5;00	7;00
Licenser	<i>niet</i> 'not'	<i>niet</i> 'not' <i>geen</i> 'no' <i>niks</i> 'nothing'	<i>niet</i> 'not' <i>geen</i> 'no' <i>niks</i> 'nothing' <i>alleen</i> 'only'	<i>niet</i> 'not' <i>geen</i> 'no' <i>niks</i> 'nothing' <i>alleen</i> 'only' <i>weinig</i> 'few' <i>niet alle</i> 'not all' <i>bijna niks</i> 'almost nothing' <i>nooit</i> 'never'

as *hoeven* licensers at younger ages, others emerge as licensers of *hoeven* later on. For instance, around age 2 children already use *niet* to license the NPI, but they do not use *alleen* as *hoeven* licensers until age 5. The emergence age of different negative expressions attested as *hoeven* licensers, as put forward by van der Wal and Lin, Weerman & Zeijlstra, is summarized in Table 1.

Van der Wal interpreted the findings as evidence for a learning path of the NPI rooted in the development of children’s knowledge of different negative expressions: “Expansion of the negation vocabulary gives children the opportunity to unfold the already present sensitivity to the restricted distribution of NPIs, and the one-sided use of *niet* (*not*) gradually gives way to more variety in licensing, thus approaching the adult model of licensing more closely” (van der Wal 1996:4.2.2).

However, as shown in Lin, Weerman & Zeijlstra (2015), van der Wal’s learning hypothesis of *hoeven* is confronted with a number of empirical problems.<sup>2</sup> Instead, Lin Weerman & Zeijlstra argue for a learning path in which children initially analyze it as having a lexical dependency with *niet*, i.e., [HOEF NIET], and reanalyze it, shortly after age 4, as having a lexical dependency with an abstract negator NEG, i.e., [HOEF NEG] (see Postal 2000). Yet, Lin, Weerman & Zeijlstra’s hypothesis may be formulated too strong, as it is well known that children’s spontaneous production does not necessarily represent every single piece of the target grammar acquired by the child. For instance, in their CHILDES survey, Lin, Weerman & Zeijlstra do not observe any child utterances in which *weinig* is used to license the NPI *hoeven*. But this does not exclude the possibility that the children have already acquired *weinig* as a proper *hoeven* licenser and just do not yet use it to license *hoeven* in their spontaneous speech. Thus, the suggested learning path requires experimental verification, as pointed out by the authors themselves.

3. The current study

To access children’s knowledge of *hoeven* licensing, and investigate the representation of this knowledge at different ages, we decided to carry out a cross-sectional experiment, which we will introduce in detail in this section. An important reason for us to opt for an experimental investigation instead of a corpus study is that experiments can examine both children’s knowledge of constructions or words that frequently attested in their spontaneous speech, as well as their awareness of those that are not or seldom attested. Thus, the current experiment also enabled us to evaluate the learning path hypothesized in Lin, Weerman & Zeijlstra (2015), which is proposed based merely on corpus findings.

3.1. Method

Following the first experimental investigation of the acquisition of the NPI (van der Wal 1996), we opted for an elicited imitation task. An elicited imitation task is a research method often employed to assess acquisition in different linguistic domains by children below the age of 6, such as (morpho-) syntax and semantics (Carrow 1974; Montgomery, Montgomery & Stephens 1978; Scholl & Ryan 1980; Keller-Cohen

<sup>2</sup>Due to space limitations, we refer the reader to Lin, Weerman & Zeijlstra (2015:7.1) for a thorough evaluation of the learning hypothesis of *hoeven* proposed in Wal (1996) and will not discuss it further in this article.

1981; Fujiki & Brinton 1987; Lust, Flynn & Foley 1996; Panitsa 2001; among others). In an elicited imitation task, a child is asked to first listen carefully to (prerecorded) stimuli and then repeat the stimuli exactly as they heard it (Lust, Flynn & Foley 1996; Vinther 2002). When the child repeats a stimulus as precisely as she can, she is claimed to construct her own mental representation of it according to her own grammatical rules acquired thus far (Chomsky 1964; Keenan & Hawkins 1987; Scholl & Ryan 1980; Eisenbeiss 2010). If a stimulus sentence is compatible with the child's own grammatical system, he repeats the stimulus immediately after hearing it (Scholl & Ryan 1980). On the other hand, if a stimulus is incompatible with her current grammar of the target language, then the participant corrects it in accordance with her own grammar or does not repeat it at all (Kenney & Wolfe 1972; Brown 1973; Panitsa 2001; Vinther 2002).

Besides the first acquisition study of NPIs (van der Wal 1996) having employed this method, there are two other reasons that motivated us to use an elicited imitation task. Since children are claimed to draw from their own grammatical system when constructing their own mental representation of a stimulus, not only repetition responses can be seen as evidence for acquisition of the manipulated phenomenon: Correction responses or strategies may also provide insight into children's underlying representations of the phenomenon examined. Another important reason that we used an elicited imitation task instead of, for instance, a grammaticality judgment task is that Dutch children are not able to give an explicit grammatical judgment on NPI licensing until age 5, as reported in van der Wal (see also Ambridge & Rowland 2013 for a recent discussion of this method with young children).

### 3.2. Design

The aim of the current study was to explore how children may develop an analysis that generates the targetlike distribution of the NPI, based on its appearance in a limited set of licensing environments in the input (i.e., the induction problem in language acquisition). We therefore included other negative expressions that have different frequencies as *hoeven* licensors in the input.

In Section 1, we assumed that the *Corpus Gesproken Nederlands* may give us a baseline view of the language input. More precise input information, however, should be gathered from a corpus more likely to contain speech data toward a Dutch-acquiring child. We therefore investigated the CHILDES database (MacWhinney 2000) to obtain the relevant input frequency information. In particular, we analyzed *hoeven*'s distribution in child-directed speech from five Dutch subcorpora in CHILDES: *BolKuiken* (Bol & Kuiken 1990), *CLPF* (Fikkert 1994; Levelt 1994), *Groningen* (Wijnen & Bol 1993), *vanKampen* (van Kampen 1994), and *Wijnen* (Wijnen 1988, 1992; Elbers & Wijnen 1992). Altogether, 598 utterances containing the NPI are found in child-directed speech. Under the assumption that the child-directed speech recorded in CHILDES at least provides a representative and quantitative view of the language input, we selected the following negative expressions to manipulate in our experiment. They are: *niet* 'not,' which licenses *hoeven* 79.3% of the time in the input (474 out of 598); *geen* 'no,' which licenses *hoeven* in the input 12.3% of the time (74 out of 598); *alleen* 'only,' which hardly appears as a *hoeven* licensor in the input, i.e., 0.6% of the time (4 out of 598); and *niemand* or *weinig*, which are not even attested as *hoeven* licensors in the input. The relevant input data are provided in Appendix III.

Given these input frequency data, we distinguish three frequency categories for the manipulated licensors in the current research: high frequent (*niet*), frequent (*geen*), and low frequent (*niemand*, *weinig*, and *alleen*). The inclusion of these low frequent licensors is crucial: They help to examine whether children are indeed able to develop an analysis of the NPI that generates *hoeven*'s occurrence even with those negative expressions that are hardly attested as *hoeven* licensors in the input. What is also crucial to the current research aim is that all selected negative expressions seem to be acquired by Dutch 3-year-olds (van der Wal 1996: Table 4.1). This can exclude the possibility that children do not give repetition responses due to their lack of lexical knowledge of manipulated licensors. In addition to the five negative conditions, we also included an unlicensed condition by placing *hoeven* in simple affirmative sentences to examine children's awareness of *hoeven*'s distributional constraint: It cannot survive without a proper licensor.

A total of 20 fillers were employed in the experiment. To neutralize the effect of every test stimulus containing the modal verb *hoeven*, half of the fillers contained a modal verb as well, of which six involved *willen* ‘will’ and four involved *kunnen* ‘can.’ Both modal verbs occupy the same syntactic position as the NPI modal *hoeven*. However, they are polarity insensitive: They are neither NPIs like *hoeven* nor PPIs (Positive Polarity Items) like *moeten* ‘must’ (see Iatridou & Zeijlstra 2010, 2013). This means that the modal fillers display the same syntactic structure as our test stimuli. Moreover, we counterbalanced the polarity of the modal fillers: Half of the fillers were manipulated to be negative (with one of them involving *niks* and the rest *niet*). In this way, the modal fillers were matched to the test stimuli with respect to their semantic environment as well. More importantly, *willen* and *kunnen* are two modal verbs, which Dutch children as young as 2 years old already frequently use in their spontaneous speech (see Jonkers 2015 for recent findings). Therefore, the inclusion of modal fillers as described previously was useful in gathering baseline imitation performance for the participants. By comparing their repetition behavior in the six test conditions with that in the corresponding negative or affirmative filler conditions, we were able to examine the participants’ knowledge of the licensing of the NPI modal *hoeven* in a relative way, with as little age-related or working memory influence as possible. An overview of the experimental conditions is provided in Appendix IV.

### 3.3. Stimuli

To avoid, or at least minimize, the possibility of children giving a repetition response from memory alone without first establishing their own mental representations of a stimulus, the length of stimuli in an elicited imitation task must be controlled (Montgomery, Montgomery & Stephens 1978; among others). Stimuli need to be long enough to override children’s memory capacity but short enough for comprehension because children must construct their own mental representations of them without omitting too many words. Montgomery, Montgomery & Stephens (1978), for instance, proposed that stimuli containing six to seven words are short and thus easy for children between 4 and 6 years old, whereas those containing nine to 10 words are of a medium length and are more difficult for children of the same age range. We opted for the medium length, based on our results from a pilot study (3;03–5;12,  $N = 12$ ).

To exclude other confounding variables, we kept the stimuli exactly the same for all participants—regardless of their ages. In doing so, we had to anticipate that this stimuli length might be easier for older participants given their working memory capacity, thus yielding better imitation performance by older children in general. Words appearing in the stimuli were attested in daily communication with children below approximately 5 years old. To ensure that the stimuli were of similar syntactic complexity, we only used main clauses.

In the following we present some examples of our test stimuli; the reader is referred to Appendix V for the test stimuli employed in the current experiment. In (3), we present examples of *hoeven* licensed by *geen* or *weinig*; in (4), we show an example of unlicensed *hoeven*. Two examples of grammatical fillers—one with a modal and the other without—are presented in (5a) and (5b) respectively.

- (3) a. Voor        het        feest        vandaag   hoeft   Ezel        geen        liedje        te        oefenen.  
       for        the        party        today       needs   Eeyore   no        song        to        practice  
       Lit.: ‘Eeyore has to practice no songs for the party today.’  
       ‘Eeyore does not have to practice any songs for the party today.’  
       b. Knorretje hoeft weinig bloemen van de grond op te rapen.  
       Piglet        needs few        flowers from the ground to pick up  
       ‘Piglet has to pick up few flowers from the ground.’



- (4) \*Beer hoeft samen met zijn vriendjes mooie liedjes te zingen.  
 Pooh needs together with his friends nice songs to sing  
 Int.: 'Pooh has to sing nice songs together with his friends.'
- (5) a. Beer en Knorretje kunnen heel leuk met zijn tweetjes spelen.  
 Pooh and Piglet can very nice with their two play  
 'Pooh and Piglet can play with great fun with the two of them.'
- b. Met het koude weer draagt Beer alleen een blauwe sjaal.  
 with the cold weather wears Pooh only a blue scarf  
 'With the cold weather, Pooh only wears a blue scarf.'

To ensure that the participants' performance was not influenced by how the stimuli were presented, we prerecorded the stimuli using an MP3 recorder with a middle-aged, female native Dutch speaker. The stimuli were pronounced as naturally as possible, avoiding any special intonation or stress on a particular word. The order of the presentation of the stimuli was counterbalanced.

### 3.4. Participants and procedure

A total of 106 monolingual Dutch children participated (2;09–5;10; mean = 4;04;  $SD = 8.5$  months), recruited via day care centers and primary schools in the Netherlands. No participants above age 6 were recruited because only children below that age are reported to be suitable participants when using imitation methods (see Section 3.1). The experiment was conducted individually and took place at educational institutions, either in a quiet corner of the child's classroom (for younger children) or in a room next to the classroom (for most older children). We first invited a participant from the classroom for a game and explained to the participant how the game would proceed and what we expected her/him to do. Each participant underwent four trials to become familiar with the experimenter and the experiment. If the participants appeared to understand that they were expected to repeat the prerecorded sentences as exactly as possible, the experiment started. Two experimenters were present during the experiment: one for testing the participant and the other for recording the child's responses and taking notes. The experiment lasted an average of 15 minutes for the 4- and 5-year-olds, while the younger participants took five minutes more, on average.

### 3.5. Response categorization

While one experimenter tested the child, the other experimenter noted any critical changes or corrections in the child's responses to the stimuli on a score sheet, when applicable. Additionally, we recorded the child's responses on an MP3 recorder for later transcription and analysis. Children's responses to the stimuli were divided into two main categories: *repetition response* and *nonrepetition response*.

The category of *repetition responses* refers to responses in which the participants repeated the stimuli. However, as we controlled the length of the stimuli such that the participants needed to first establish their own mental representations of the stimuli, it was hardly ever the case that the participants were able to repeat every single word in a stimulus. We therefore focused only on how the participants reacted to the licensing of *hoeven* and defined *repetition* in the current study, as the responses in which at least both the NPI *hoeven* and its licenser were repeated in the manipulated order. Moreover, since the aim of the current research lies in the acquisition of the NPI, we also disregarded errors that are irrelevant to *hoeven* licensing, such as non-target-like use of definite articles or omission of the complementizer *te* 'to.'



The category of *nonrepetition responses* is further divided into four subcategories: *no response*, *substitution*, *omission*, and *addition*. The subcategory of *no response* covers the instances in which the participant either did not give any response at all after hearing a stimulus or gave an irrelevant response such as *Ik weet het niet* 'I don't know' or *Heb 'm niet gehoord* 'I didn't hear it.'

As for *substitution*, consider the test stimulus in (3a) as an example, repeated as (6). An instance of *substitution* is counted if the participant substituted the manipulated licenser *geen* with another licenser, e.g., *niet* in (7a); substituted the NPI *hoeven* with another verb, e.g., *gaat* 'goes' in (7b); or substituted both the NPI and the manipulated licenser by an alternative, as shown in (7c).

- (6) Voor het feest vandaag hoeft Ezel geen liedje te oefenen.  
 for the party today needs Eeyore no song to practice  
 Lit.: 'Eeyore has to practice no songs for the party today.'  
 'Eeyore does not have to practice any songs for the party today.'

- (7) a. Voor het feest vandaag hoeft Ezel niet liedje te oefenen.  
 for the party today needs Eeyore not song to practice  
 'Eeyore does not have to practice songs for the party today.'
- b. Voor het feest vandaag gaat Ezel geen liedje oefenen.  
 for the party today goes Eeyore no song practice  
 Lit.: 'Eeyore is going to practice no songs for the party today.'  
 'Eeyore is not going to practice any songs for the party today.'
- c. Voor het feest vandaag gaat Ezel niet liedje oefenen.  
 for the party today goes Eeyore not song practice  
 'Eeyore is not going to practice any songs for the party today.'

A *nonrepetition response* is categorized as *omission* if the participant omitted the NPI, resulting in a Root Infinitive construction, as shown in (8a); left out the manipulated licenser, as given in (8b); or omitted both of them, as illustrated by (8c).

- (8) a. Voor het feest vandaag Ezel geen liedje oefenen.  
 for the party today Eeyore no song practice  
 'Eeyore practice no songs for the party today'
- b. \*Voor het feest vandaag hoeft Ezel liedje oefenen.  
 for the party today needs Eeyore song practice  
 Int.: 'Pooh has to practice songs for the party today.'
- c. Voor het feest vandaag Ezel liedjes oefenen.  
 for the party today Eeyore songs practice  
 'Pooh practice songs for the party today.'

A *nonrepetition response* is categorized as *addition* if the participant gave a grammatical response by adding a negation to license the NPI while confronted with a stimulus containing unlicensed *hoeven*. Consider here the ungrammatical stimulus in (4), repeated as (9). An instance of *addition* is counted if the participant gave (10) as a response, in which a negation *niet* is added to license the manipulated unlicensed NPI.

- (9) \*Beer hoeft samen met zijn vriendjes mooie liedjes te zingen.  
 Pooh needs together with his friends nice songs to sing  
 Int.: 'Pooh has to sing nice songs together with his friends.'
- (10) Beer hoeft niet samen met zijn vriendjes mooie liedjes te zingen.  
 Pooh needs not together with his friends nice songs to sing  
 'Pooh does not have to sing nice songs together with his friends.'

#### 4. Results

To provide an overview of how the children's repetition performance developed over time, we present in Figure 1 the mean repetition scores for different experimental conditions at different ages, i.e., the raw results. The mean repetition scores, represented on the *y*-axis, are between 0 and 1, as we assigned 1 to all *repetition* responses and 0 to all *nonrepetition* responses (see further Subsection 3.5). The *x*-axis shows seven age bins with an interval of five months.<sup>3</sup> (Dotted) Lines of different colors indicate the different experimental conditions manipulated in the current study, including the six test conditions containing the target NPI *hoeven* and the two filler conditions containing polarity-insensitive modals *willen* or *kunnen*.

Overall, we see that the children's repetition performance improves when they grow older, although the difference between the mean repetition scores at younger and older ages seems to differ, depending on the condition. In what follows, we will provide a more detailed description of the results. We will start with the results obtained for the filler conditions, in which a polarity-insensitive modal (*willen* or *kunnen*) is manipulated in affirmative or negative contexts. We describe and interpret the results of the two filler conditions first because they can provide baseline information showing how often our participants were able to give a repetition response to a grammatical stimulus with a polarity insensitive modal, which we know the participants between the tested age range should be able to process, reconstruct, and repeat (see Subsection 3.3). For ease of data interpretation, Figure 2 repeats the repetition results obtained for the two filler conditions from Figure 1 without any other conditions.

At younger ages, i.e., between 2;09 and 3;11, the average repetition scores attested for the filler conditions are between 0.40 and 0.60, which increase to 0.90 between 4;00 and 4;04 and reach even

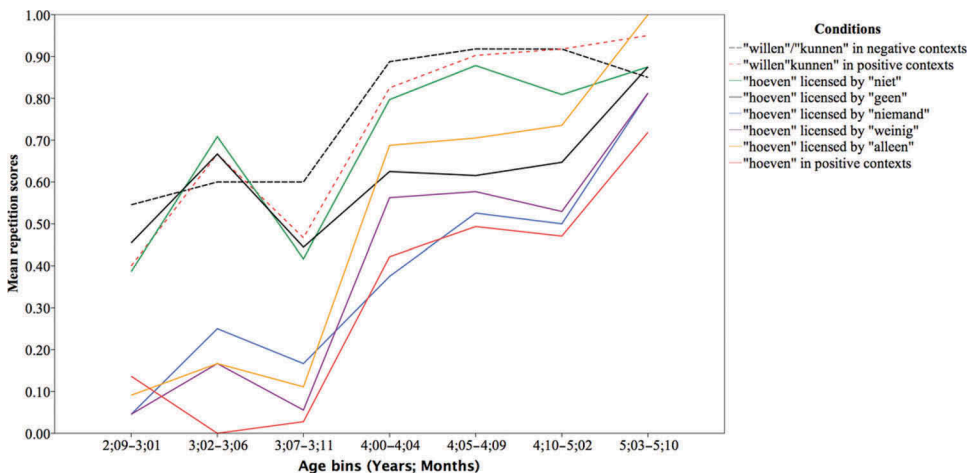


Figure 1. Mean repetition scores per experimental condition.

<sup>3</sup>We thank one of the reviewers for his/her suggestion to make larger age bins for clearer data presentation.

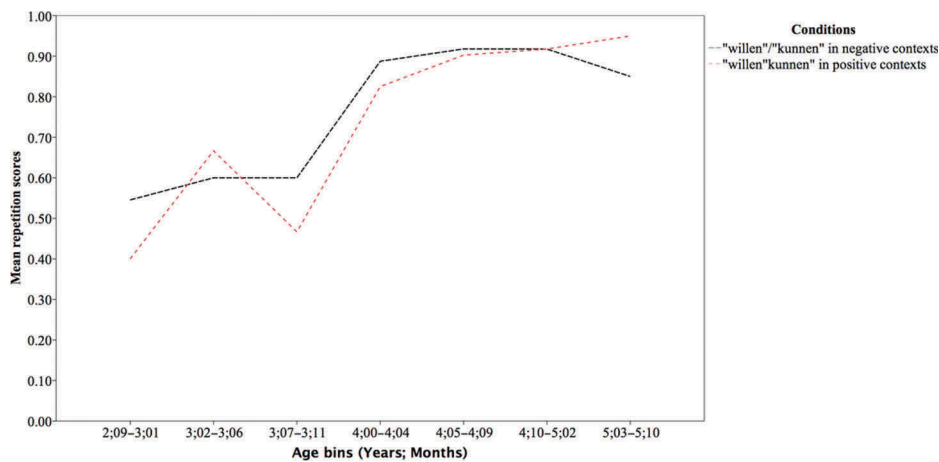


Figure 2. Mean repetition scores for the two filler conditions.

higher values at older ages. Since Dutch 2- and 3-year-olds are already able to use the two modal verbs *willen* and *kunnen* fairly frequently in their spontaneous speech (see Jonkers 2015), the development of the participants' repetition performance observed for the filler conditions suggests some age-related reactions to task demands.

The age-related effect can be explained in terms of working memory capacity. Although we did not measure the participants' short-term memory due to practical limitations, it is very likely that younger participants' more limited working memory capacity made it harder for them to remember and repeat the filler stimuli. Another reason for the age-related effects may be the syntactic structure of the filler stimuli. As shown in a recent study using an elicited imitation task with Dutch children, subordinate clauses with two verbs—one modal and one lexical verb—are difficult for children below the age of 4 to process and to (re)produce (Meyer & Weerman 2016: Figure 3, Figure 6). Since our filler stimuli also all contain a modal and a lexical verb, they could be relatively difficult for the 3-year-olds in the current experiment, which in turn could explain the relatively low repetition scores of the younger participants. Since our filler stimuli all contain a modal and a lexical verb, they could be too difficult for the 3-year-olds in the current experiment, which could cause the relatively low

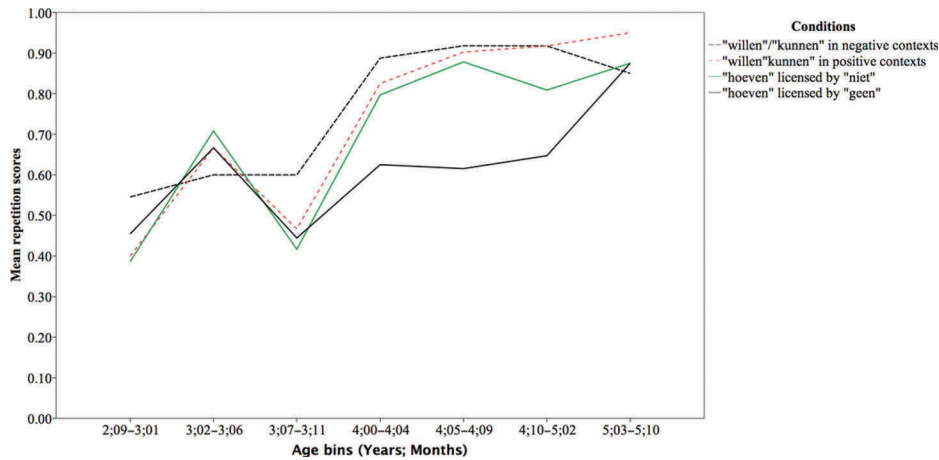


Figure 3. Developmental pattern akin to the baseline.

repetition scores of the younger participants. Whatever the reason, we will consider the participants' imitation performance in the filler conditions as baseline when interpreting and analyzing their performance observed for the six test conditions.

We now move on to the participants' imitation performance attested for the test conditions in which *hoeven* is manipulated in different semantic contexts. Bearing the participants' baseline performance in mind—namely, their repetition scores for the filler conditions—the results obtained for the six test conditions strongly suggest two developmental patterns. On the one hand, when confronted with *hoeven* licensed by *niet* or *geen*, the participants show similar imitation performance as the baseline throughout the examined age range. Figure 3 repeats the relevant data from Figure 1, i.e., the baseline conditions (dotted lines) and the *hoeven* conditions licensed by *niet* and *geen* (solid lines).

Between 2;09 and 3;11, the average repetition scores for both the baseline conditions and the conditions of licensing by *niet* and *geen* are between 0.40 and 0.60; whereas the mean repetition scores increase for the relevant baseline and test conditions to at least 0.70 between 5;03 and 5;10.

On the other hand, the participants' imitation performance for the other four test conditions containing *hoeven* (i.e., licensed by *niemand*, *weinig*, *alleen*, and in affirmative contexts) shows a different trajectory, compared to the baseline. This second developmental pattern is presented in Figure 4, in which the baseline results are indicated by dotted lines.

Although the children's repetition scores in these four test conditions seem to converge on the baseline at older ages, which are at least 0.70 between 5;03 and 5;10, the scores are much lower compared to the baseline at younger ages. Between 2;09 and 3;11, for instance, the participants on average score around 0.50 with modal fillers (i.e., the baseline conditions), whereas the average repetition scores are only around 0.10 in the four relevant test conditions.

The results presented so far give rise to two questions that require further analysis. One question is whether the development of children's knowledge of *hoeven* licensing by *niet* and *geen* indeed displays a distinct pattern compared to that of *hoeven* licensing by *niemand*, *weinig*, and *alleen*. Another question is whether children are unable to detect *hoeven*'s distributional constraint, since the older participants do not only show higher repetition scores for the grammatical test stimuli but also for the ungrammatical stimuli containing *hoeven* in affirmative contexts.

In the next section, we will answer these questions by analyzing our experimental results in two regression models. Moreover, we will explore what the regression results can tell us about (the development of) children's knowledge of the NPI *hoeven* over time, which contributes to our research aim of investigating how children can eventually achieve the target analysis of the NPI *hoeven*, based on its appearance in merely a limited set of its possible licensing contexts in the input (see Section 1).

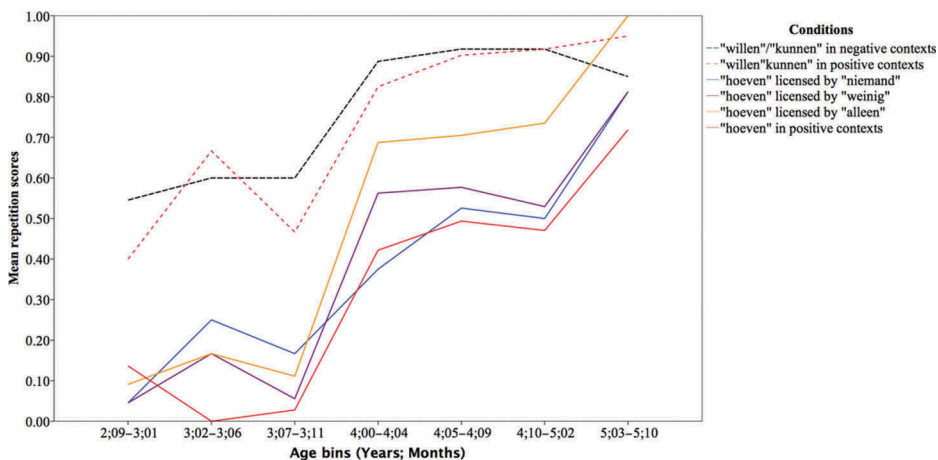


Figure 4. Developmental pattern distinct from the baseline.

## 5. Analysis and interpretation

We start with investigating children's awareness of *hoeven*'s ungrammaticality in affirmative contexts. After that, we will analyze the development of children's knowledge of *hoeven* licensing by different negative expressions over time. This is because *hoeven*'s ungrammaticality in affirmative contexts is a crucial characteristic that categorizes the modal verb as an NPI—whatever representation(s) of it Dutch children may have during their acquisition trajectory.

### 5.1. Children's awareness of *hoeven*'s distributional constraint

As already mentioned in Section 4, the developmental pattern illustrated in Figure 4 seems to suggest that Dutch children are developing a non-target-like analysis of *hoeven* that allows it to appear in positive environments as well. In order to investigate whether Dutch children are aware of *hoeven*'s ungrammaticality in affirmative contexts, we employed a general linear mixed-effect logistic regression model to predict the repetition performance of the participants, i.e., *Repetition* (either 1 in the case of *repetition* or 0 in the case of *nonrepetition*). This regression model has three fixed factors. *Age*, coded in terms of months, centered, is a continuous factor; *Modal type* and *Context polarity* are two categorical factors. *Modal type* has two levels: *NPI* (i.e., *hoeven*) and *non-NPI* (i.e., *willen* or *kunnen*). *Context polarity* has two levels as well: *negative* (e.g., introduced by *niet* or *geen*) and *positive* (i.e., simple affirmative contexts). *Participant* and *Stimulus* are modeled as random factors. The main effect of each of the three fixed factors, as well as the respective two-way interaction effects for these fixed factors, are included in the model. Results of this regression analysis (only for the fixed factors) are presented in Table 2. See Appendix VI for results of the random factors.

As the results presented in Table 2 show, we find a significant effect for each of the three fixed factors. As for the three interaction effects, only that between *Modal type* and *Context polarity* turns out to be significant. We now describe and interpret these significant effects. The significant main effect of *Age* (Coef.  $\beta = 0.117$ ) means that the older participants are more likely to give a repetition response to our stimuli than the younger participants.

The significant main effect of *Modal type* (Coef.  $\beta = 2.192$ ) means that the participants—independent of their age—are more likely to show good repetition performances with the stimuli containing *willen* or *kunnen*, two polarity-insensitive modals, than with those containing the NPI modal *hoeven*. Given the fact that only *hoeven* is ungrammatical in positive contexts, whereas *willen* and *kunnen* are not, it is far from surprising that children show significantly worse imitation performances when confronted with *hoeven* stimuli. Children's knowledge on *hoeven*'s ungrammaticality in positive contexts results in their poor imitation performance with stimuli in which *hoeven* appears in positive contexts, explaining the significant effect of *Modal type*.

Finally, let's look at the significant main effect of *Context polarity* (Coef.  $\beta = -0.660$ ). According to the results in Table 2, this significant effect means that the participants—independent of their age—are less likely to give a repetition response to the stimuli in which a modal verb (*hoeven*, *willen*, or *kunnen*) is manipulated in a positive context than for those in which a modal verb is manipulated in

**Table 2.** Results of the Model with *Age*, *Modal Type*, and *Context Polarity* as Fixed Factors

Predictors	Repetition					
	OR	CI (95%)	Coef. $\beta$	SE $\beta$	z	p
(Intercept)	2.42	1.81–3.23	0.884	0.148	5.985	<.001
Age (centered)	1.12	1.10–1.15	0.117	0.013	9.254	<.001
Modal type-NPI + non-NPI	8.95	6.65–12.05	2.192	0.152	14.413	<.001
Context polarity – Negative + Positive	0.52	0.40–0.68	–0.660	0.137	–4.833	<.001
Context polarity: Age (centered)	1.02	0.99–1.05	0.020	0.015	1.345	0.179
Modal type: Age (centered)	1.00	0.97–1.03	–0.005	0.015	–0.302	0.762
Context polarity: Modal type	4.05	2.30–7.14	1.399	0.289	4.836	<.001

a negative environment. Again, since *hoeven* is ungrammatical in positive contexts, whereas *willen* and *kunnen* do not have this distributional constraint, the significant effect of *Context polarity* is attributed to children's awareness of *hoeven*'s distributional constraint.

The significant effect of *Modal type* and that of *Context polarity* interpreted previously strongly suggest that our participants are aware of *hoeven*'s ungrammaticality in positive contexts. If the participants do not have the knowledge that *hoeven* is an NPI, but categorize *hoeven* as a polarity-insensitive modal just like *willen* or *kunnen*, we do not see how the significant effect of *Modal type* and that of *Context polarity* can be explained. In that case, we would expect no significant differences in the participants' imitation performances when confronted with different modal verbs (the NPI *hoeven*, or polarity-insensitive *willen* or *kunnen*) manipulated in different semantic environments (negative or positive).

Further crucial support for children's awareness of *hoeven*'s distributional constraint comes from the significant interaction effect between *Modal type* and *Context polarity* (Coef.  $\beta = 1.399$ ). This significant interaction effect means that when the polarity of the stimuli is positive, the participants are more likely to show different imitation performances between the two different modal types (i.e., NPI modal *hoeven* or non-NPI modal *willen/kunnen*) than when the polarity of the stimuli is negative. To better show what this significant interaction effect tells us about children's knowledge on *hoeven*'s distributional constraint, we illustrate this effect in Figure 5. The *x*-axis indicates the two levels of *Context polarity*: negative and positive contexts. The *y*-axis represents the predicted repetition probabilities generated by the regression model. The two lines represent the two levels of *Modal type*.

Based on Figure 5, we interpret (the direction of) the significant interaction effect between *Context polarity* (i.e., negative or positive) and *Modal type* (i.e., NPI *hoeven* or non-NPI *willen* or *kunnen*) on the predicted variable *Repetition* as follows. When it comes to non-NPI modal verbs—namely, *willen* or *kunnen*—the fixed factor *Context polarity* (i.e., either negative or positive) does not influence the participants' repetition performances. However, when it comes to the NPI modal *hoeven*, *Context polarity* does have an influence on *Repetition*: Participants are less likely to imitate the stimuli containing unlicensed *hoeven* than those in which *hoeven* is properly licensed. This provides further evidence for children's awareness of *hoeven*'s ungrammaticality in affirmative contexts.

In addition to the statistical support for children's awareness of *hoeven*'s distributional constraint we presented previously, there is also evidence from the participants' elicited production data

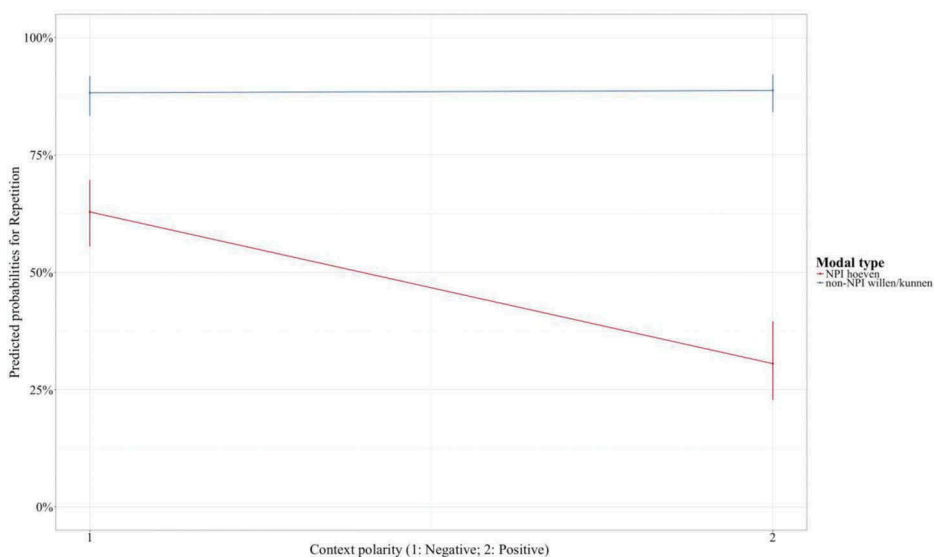


Figure 5. Interaction effect of *Modal type* and *Context polarity* on *Repetition* (Context polarity 1: Negative; Context polarity 2: Positive).



**Table 3.** Grammaticality of Participants' Responses to Grammatical and Ungrammatical Stimuli

	Grammatical Stimuli	Ungrammatical Stimuli	Total
Grammatical response	1,251	238	1,489
Ungrammatical response	14	166	180
Total	1,265	404	1,669

obtained in the current experiment. One piece of evidence comes from the grammaticality of the participants' responses to our test stimuli, in which they produce the NPI *hoeven*.<sup>4</sup> Altogether, we collected 1,669 such responses, which we divided into four categories, depending on the grammaticality of the stimuli and that of the participant's own responses. See Table 3.

Among the 1,669 responses, 89.2% contains properly licensed *hoeven* (i.e., 1,489 out of 1,669). Although in 10.8% of the participants' responses (i.e., 180 out of 1,669), the NPI *hoeven* is uttered without negation, a closer look at Table 3 shows that they are virtually all responses to ungrammatical stimuli (i.e., 92.2%; 166 out of 180). This means that the participants almost exclusively produce ungrammatically used *hoeven* when they are provided with stimuli that are themselves also ungrammatical. In fact, Dutch children do not utter unlicensed *hoeven* in spontaneous speech either (van der Wal 1996; Lin, Weerman & Zeijlstra 2015). Both elicited and spontaneous production data support the same claim: Dutch children's own representation of *hoeven* does not allow it to appear without negation.

Another aspect of the elicited production data we want to highlight here concerns various correction strategies that the participants use to grammaticalize the ungrammatical test stimuli. A further analysis of the 238 responses that fall under the category of both *grammatical response* and *ungrammatical stimuli* in Table 3 gives rise to three main correction strategies: substituting *hoeven* with another (modal) verb (61.3%; 146 out of 238); omitting *hoeven* from their responses (23.5%; 56 out of 238); and adding a negative word to license *hoeven* (15.1%; 36 out of 238). These strategies all show that *hoeven* needs to appear with a proper licenser in child Dutch.

## 5.2. Children's knowledge of *hoeven* licensing over time

In the previous subsection, we analyzed the participants' repetition behavior for the test condition containing *hoeven* in affirmative contexts. We now take a closer look at their imitation performances when confronted with *hoeven* licensed by different negative expressions in Dutch to see how children's knowledge of different *hoeven* licensers develops over time. As described in Section 4, our experimental results suggest two developmental patterns in this respect. On the one hand, children's knowledge of *hoeven* licensing by *niet* and *geen* seems to show a developmental pattern akin to the baseline condition in our experiment, i.e., the *niet-geen* pattern (see Figure 2). On the other hand, we seem to observe another pattern that is distinct from the baseline, which illustrates the development of *niemand*, *weinig*, and *alleen* as licensers of *hoeven* in child language, i.e., the *niemand-weinig-alleen* pattern (see Figure 3).

To provide statistical support for these two patterns, which can eventually tell us about the development of different negative expressions as *hoeven* licensers in child Dutch, we employed a second general linear mixed-effect logistic regression model. In this model, we analyzed the interaction effect between the participants' age and test conditions on their imitation performances. This model has two fixed factors. *Age*, coded in terms of months, centered, is a continuous factor; *Condition* is a categorical factor, with six levels. These six levels represent the five test conditions in which *hoeven* is licensed by *niet*, *geen*, *niemand*, *weinig*, *alleen*, and one filler condition (i.e., the baseline) in which a polarity-insensitive modal (i.e., *willen* or *kunnen*) is manipulated in negative environments.<sup>5</sup> To examine the two developmental patterns that arose in Section 4, we set five contrasts for *Condition*, which we summarize in Table 4.

<sup>4</sup>Here we only focus on the (un)grammaticality with respect to *hoeven* licensing.

<sup>5</sup>Only these test or filler stimuli that have the same polarity were included in this model. The filler condition in which *willen* or *kunnen* is manipulated in affirmative contexts was excluded.



**Table 4.** Five Contrasts for *Condition*

	Contrasts
1	(filler, <i>niet</i> , <i>geen</i> ) vs. ( <i>niemand</i> , <i>weinig</i> , <i>alleen</i> )
2	(filler) vs. ( <i>niet</i> , <i>geen</i> )
3	( <i>niet</i> ) vs. ( <i>geen</i> )
4	( <i>niemand</i> ) vs. ( <i>weinig</i> , <i>alleen</i> )
5	( <i>weinig</i> ) vs. ( <i>alleen</i> )

In addition to the two fixed factors, i.e., *Age* and *Condition*, there are also two random factors—*Participant* and *Stimulus*. Results of this regression analysis (only the fixed parts) are reported in Table 5. Please see Appendix VII for results for the random factors.

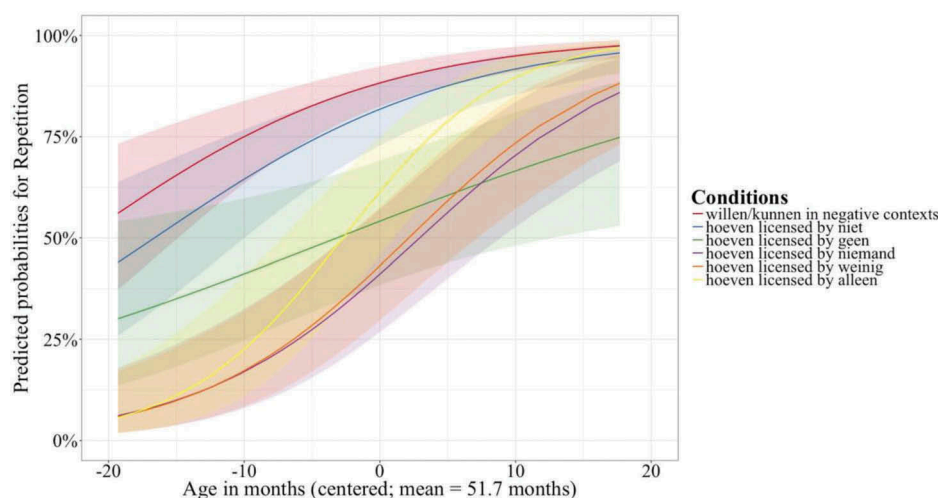
We find a significant effect of *Age* on *Repetition* (Coef.  $\beta = 0.108$ ). This means that compared to the younger participants, the older participants are more likely to give a repetition response to the stimuli in which a modal verb (*hoeven*, *willen*, or *kunnen*) is manipulated in different negative contexts. As for the other fixed factor *Condition*, three out of the five contrasts we set (see Table 5) turn out to be significant. They are Contrast 1 ([filler, *niet*, *geen*] vs. [*niemand*, *weinig*, *alleen*]), Contrast 2 ([filler] vs. [*niet*, *geen*]), and Contrast 3 ([*niet*] vs. [*geen*]). However, only one of these contrasts—Contrast 1—is attested to have a significant interaction effect with *Age* on the participants' imitation performances. In what follows, we will interpret the effect of *Condition* and its interaction with *Age* on *Repetition*.

The significance of Contrast 1 (Coef.  $\beta = 1.867$ ) means that the participants—independent of their age—are more likely to be able to repeat the negative filler stimuli and the test stimuli in which *hoeven* is licensed by *niet* or *geen* than those in which *hoeven* is licensed by *niemand*, *weinig*, or *alleen*. This provides statistical support for the two developmental patterns described in Section 4. However, the significant interaction effect between Contrast 1 and *Age* (Coef.  $\beta = -0.091$ ) suggests a convergence of the two developmental patterns in late child Dutch, since the older participants are less likely to show different imitation performances between the two levels of Contrast 1 than their younger counterparts.

The significance of Contrast 2 means that the participants—independent of their age—are more likely to give a repetition response to the negative filler stimuli than to those in which *hoeven* is licensed by *niet* or *geen*. However, the interaction between Contrast 2 and *Age* is not significant. We therefore cannot conclude any changes in the difference between the two levels of Contrast 2 over time but a parallel development, in this respect. As for the significant effect of Contrast 3 (Coef.  $\beta = 0.372$ ) and its interaction with *Age*, which is not significant, we have a similar interpretation of a parallel development. Although the participants are more likely to show good repetition performances with *hoeven* appearing in the scope of *niet* than when the NPI is licensed by *geen*, this difference does not seem to change over time.

**Table 5.** Results of the Model with *Age* and *Condition* as Fixed Factors

	<i>Repetition</i>					
	OR	CI (95%)	Coef. $\beta$	SE $\beta$	z	p
Predictors						
(Intercept)	1.83	1.37–2.45	0.606	0.148	4.099	<.001
Age	1.11	1.09–1.14	0.108	0.013	8.667	<.001
Contrast 1	6.47	3.12–13.40	1.867	0.372	5.026	<.001
Contrast 2	3.27	1.76–6.08	1.185	0.316	3.750	<.001
Contrast 3	3.81	1.84 – 7.89	1.337	0.372	3.597	<.001
Contrast 4	0.60	0.30–1.17	–0.516	0.345	–1.498	0.134
Contrast 5	0.54	0.23–1.25	–0.614	0.426	–1.442	0.149
Age:Contrast 1	0.91	0.87–0.96	–0.091	0.025	–3.578	<.001
Age:Contrast 2	1.02	0.98–1.06	0.021	0.019	1.079	0.281
Age:Contrast 3	1.04	0.99–1.09	0.038	0.024	1.588	0.112
Age:Contrast 4	0.98	0.92–1.03	–0.024	0.029	–0.820	0.412
Age:Contrast 5	0.95	0.89–1.02	–0.047	0.036	–1.295	0.195



**Figure 6.** Interaction effect of Age and Condition on Repetition.

As for Contrast 4 and Contrast 5, as mentioned, we do not find any significant results. The interaction between each of these two contrasts with Age is not significant either. This means that we do not have evidence showing that the participants display any different imitation performances when confronted with *hoeven* licensed by *niemand*, *weinig*, or *alleen*. Neither do we have evidence showing any change in this respect over time. The regression results obtained for Contrast 4 and Contrast 5 and their interactions with Age strongly suggest that the development of the children's knowledge of *hoeven* licensing by *niemand*, *weinig*, and *alleen* proceed simultaneously.

In Figure 6, we illustrate the interaction effect between Age and Condition on the participants' imitation performance in the current experiment. The x-axis represents the age of the participants in terms of months. The y-axis shows the predicted repetition probabilities generated by the regression model. Different lines represent different levels of Condition.

Based on our interpretation of the regression results in Table 5 and Figure 6, we summarize the development of the children's knowledge of *hoeven* licensing as follows. Different negative expressions turn out to be acquired at different ages as *hoeven* licensors in child Dutch. On the one hand, *niet* and *geen* already emerge as licensors of *hoeven* before the age of 3 (i.e., around -15 on the x-axis in Figure 6), although different intercepts are attested with these two negative expressions. On the other hand, however, children do not seem to be acquiring the knowledge that *niemand*, *weinig*, and *alleen* can license *hoeven* as well until the age of 4 (i.e., around -5 on the x-axis in Figure 6). Given the regression results presented in Figure 6, it appears hard to pinpoint at what age children have acquired *niemand*, *weinig*, and *alleen* as *hoeven* licensors. Nevertheless, since the participants' imitation probabilities are predicted to be around 0.70 and even higher after the age of 5 for all three relevant test conditions (i.e., around 10 on the x-axis in Figure 6), we may assume that *niemand*, *weinig*, and *alleen* are analyzed as proper licensors of *hoeven* from the age of 5. On top of this, the acquisition of *niemand*, *weinig*, and *alleen* as *hoeven* licensors also turns out to proceed simultaneously. We interpret the simultaneity as indicating the same status of *hoeven*'s occurrence with these three negative expressions in the child grammar over time. Finally, although the acquisition of different *hoeven* licensors shows two distinct patterns, the two patterns turn out to converge at older ages. Such a convergence strongly suggests that *hoeven*'s appearance with *niet*, *geen*, *niemand*, *weinig*, and *alleen* shares one single underlying representation in late child grammar.

## 6. Discussion

The acquisition path of the Dutch NPI *hoeven* that arose from our second regression model differs from what has been reported in the literature in this respect (see Section 2). In this section, we will therefore first address the differences between previous findings and our own. After that, we will discuss how the learning path attested in the current study can be explained.

### 6.1. The previous findings revisited

The regression results reported and interpreted in Subsection 5.2 strongly suggest that *niet* and *geen* already emerge before age 3 as proper licensors of the NPI *hoeven*, whereas the other negative forms (*niemand*, *weinig*, and *alleen*) appear to be analyzed as *hoeven* licensors after age 5. See Table 6.

Compared to the findings reported in the literature (see Table 1 in Section 2), the development attested in the current research shows some differences. First, the previous studies suggest that *geen* appears as a *hoeven* licensor only after age 4, whereas our results show that even the youngest participants already consider *geen* as a proper *hoeven* licensor. Second, the previous findings show that *alleen* and *weinig* do not appear as *hoeven* licensors until the age of 5 and 7 respectively, whereas our results suggest that both negative forms are possibly already categorized as *hoeven* licensors in the child grammar at around age 5. A third difference concerns *niemand*. The previous investigations do not report evidence for the acquisition of this negative form as a *hoeven* licensor till the age of 7, but our results provide evidence for *niemand* as a proper *hoeven* licensor shortly after age 5.

These differences in fact do not convey conflicting findings to those reported previously in the literature. *Niet* and *geen* remain the only negative forms that license the NPI in early child Dutch, and *niemand*, *weinig*, and *alleen* are still the “late ones.” We attribute these differences to methodological differences between the previous and the current research. Van der Wal’s results were collected in a corpus study and two experimental studies, and Lin, Weerman & Zeijlstra’s findings were obtained from corpus research only. Since spontaneous speech does not necessarily represent the exact range of children’s linguistic knowledge, the current experimental study may produce different results.

When it comes to the two experimental studies carried out by van der Wal, the following methodological choices may explain the differences between her results and the current findings. First, van der Wal only tested fifteen 3-year-olds in her elicited imitation task and only tested children’s knowledge of *hoeven* licensing by *not*, *geen*, and *alleen*; whereas the current elicited imitation task had 106 participants, sampled from a much wider age range between 2;09 and 5;11, and manipulated five negative expressions as *hoeven* licensors. The differences in sample size, age range of the participants, and number of included *hoeven* licensors between van der Wal’s elicited imitation task and the current study may all give rise to a different developmental pattern of children’s knowledge of *hoeven* licensing. Second, although van der Wal also carried out a grammaticality judgment task with a large number of participants over a large age range, there was an age gap of almost four years between the participants tested in her elicited imitation task and those participating in her grammaticality

**Table 6.** The Emergence of Different Negative Words as Licensers of *Hoeven* in Child Language Attested in the Current Experiment

Age	< 3;00	> 5;00
Licensers	<i>niet</i> ‘not’ <i>geen</i> ‘no’	<i>niet</i> ‘not’ <i>geen</i> ‘no’ <i>niemand</i> ‘nobody’ <i>weinig</i> ‘few’ <i>alleen</i> ‘only’

judgment task (see further Section 2). It is therefore not surprising that *weinig*, for instance, emerges as *hoeven* licensers around age 5 according to our results but only seems to be accepted by children as a *hoeven* licenser after the age of 7 in van der Wal (1996).

## 6.2. The early emergence of *niet* and *geen* as *hoeven* licensers

Before children are able to employ *niet* and *geen* as *hoeven* licensers around age 3, they first need to have acquired these lexical forms. As reported in van der Wal (1996: Table 4.1), Dutch children frequently use *niet* and *geen* in their spontaneous speech as early as 1;10 and 2;04 respectively. Hence, it is very likely that the two negative words are already acquired before they are used as *hoeven* licensers by Dutch 2-year-olds. But the early acquisition of these two negative forms does not necessarily entail their early appearance as *hoeven* licensers. The question arises: Why do children use *niet* and *geen* to license the NPI *hoeven* already before age 3?

Following Lin, Weerman & Zeijlstra (2015), we opt for a distribution-based learning approach to explain the early emergence of *niet* and *geen* as *hoeven* licensers in child language (see also Mintz 2002, 2003; Mintz, Newport & Bever 2002). As presented in Subsection 3.3, *niet* and *geen* are the two most frequently attested *hoeven* licensers in the child-directed speech recorded in the five Dutch subcorpora of CHILDES. Although *niet* appears more than six times more frequently than *geen* as *hoeven* licenser (i.e., 79.3% and 12.3% of the time respectively), relatively speaking, they can both be considered as frequently attested *hoeven* licensers in the input. This is because other negative forms are used as *hoeven* licensers only around 2% or 3% of the time, and some even more infrequent (see further Appendix III). Confronted with the massive co-occurrences of *hoeven* with either *niet* or *geen*, which amounts to around 90% of the input evidence containing the NPI, we assume that Dutch children initially consider *hoeven* as having a lexical dependency with both negative words. Based on Lin, Weerman & Zeijlstra, we further assume that the lexical dependency between *hoeven* on the one hand and *niet* or *geen* on the other is represented by means of lexical frames in the child grammar—namely, [HOEF NIET] and [HOEF GEEN].

The assumption that the early child analysis of the NPI only consists of two lexical frames [HOEF NIET] and [HOEF GEEN] explains why the younger participants are only able to repeat the stimuli that are compatible with at least one of the lexical frames. Since *hoeven*'s appearance in the scope of *niemand*, *weinig*, or *alleen* is not compatible with either [HOEF NIET] or [HOEF GEEN], the younger participants are predicted to show poor imitation performance on the relevant stimuli—as shown by our results (see Section 4). Moreover, the hypothesis of [HOEF NIET] and [HOEF GEEN] in early child grammar also predicts that in the case of nonrepetition responses, the younger participants do not give responses that violate the two lexical frames. In Table 7 we present an overview of nonrepetition responses of the 2- and 3-year-olds in the test conditions containing *hoeven* licensed by *niemand*, *weinig*, or *alleen*.

As can be seen from Table 7, when confronted with *hoeven* licensed by *niemand*, *weinig*, or *alleen*, the younger participants most often choose not to use the NPI in their responses if they do not repeat the stimuli (75.5%; 105 out of 139). They either omit the NPI in their responses (38.8%) or substitute it with another modal or lexical verb, such as *moeten* 'must' or *gaan* 'go' (36.7%). Another type of nonrepetition response, which is also frequently attested, involves substitution of the manipulated licenser with another

**Table 7.** Different Types of Nonrepetition Responses to Stimuli Containing *Hoeven* Licensed by *Niemand*, *Weinig*, or *Alleen* Observed for 2- and 3-Year-Olds

Type of Nonrepetition Responses	Count (%)
Omission of <i>hoeven</i>	54 (38.8%)
Substitution of <i>hoeven</i> with another (modal) verb	51 (36.7%)
Substitution of the manipulated licenser with another licenser	25 (17.9%)
Omission of the manipulated licenser	3 (2.2%)
Addition of an extra <i>niet</i>	2 (1.4%)
No responses	4 (2.9%)
Total	139

negative form (17.9%). A further analysis of the relevant production data shows that *niet* is the most employed substitution candidate (16 out of 25) and *geen* is used too (4 out of 25).<sup>6</sup>

The production data discussed suggest no violation of the hypothesized lexical frames [HOEF NIET] and [HOEF GEEN] in the younger participants' production when they do not repeat the stimuli containing *hoeven* licensed by *niemand*, *weinig*, or *alleen*. Moreover, it seems that younger participants rely on these two lexical frames when reconstructing the relevant stimuli. We therefore argue that at younger ages, children's knowledge of the NPI consists of two lexical frames: [HOEF NIET] and [HOEF GEEN].

### 6.3. The late emergence of *niemand*, *weinig*, and *alleen* as *hoeven* licensors

Whereas *niet* and *geen* already emerge as *hoeven* licensors in child language before age 3, children only seem to have acquired *niemand*, *weinig*, and *alleen* as *hoeven* licensors after age 5. Given the average ages of emergence of *niemand*, *weinig*, and *alleen* in child language, which are 2;09, 3;02, and 2;06 respectively (see van der Wal 1996: Table 4.1), it is very likely that Dutch 3- and 4-year-olds have already acquired the lexical forms of these negative expressions. This suggests that the late emergence of *niemand*, *weinig*, and *alleen* as *hoeven* licensors in child language cannot be attributed to children's lack of lexical knowledge in this respect. But why do these negative words not appear earlier as *hoeven* licensors?

As presented in Subsection 3.3, *niemand*, *weinig*, and *alleen* all belong to the category of infrequent *hoeven* licensors in the language input, as our investigation of five Dutch subcorpora in CHILDES shows that in child-directed speech *alleen* licenses *hoeven* only 0.6% of the time (4 out of 598) and *niemand* and *weinig* are not even attested as *hoeven* licensors (see Appendix III). In fact, in adult-to-adult speech (i.e., the Spoken Dutch Corpora), these negative forms belong to the category of infrequent *hoeven* licensors as well: *alleen*, *niemand*, and *weinig* license *hoeven* merely 2.9% (49 out of 1,670), 0.5% (8 out of 1,670), and 0.05% (1 out of 1,670) respectively (see further Section 1 and Appendix III). Given the infrequent occurrences of *niemand*, *weinig*, and *alleen* as *hoeven* licensors in both child-directed and adult-to-adult speech, it is not a surprise, based on a distribution-based learning approach, that Dutch 4-year-olds do not consider *niemand*, *weinig*, or *alleen* as *hoeven* licensors—though they seem to have already acquired the lexical knowledge of these negative words.

To understand the emergence of *niemand*, *weinig*, and *alleen* as *hoeven* licensors in late child Dutch, we assume that Dutch 5-year-olds have developed an abstract analysis of the NPI, which can generate *hoeven*'s distribution with these negative words, independent of their input frequencies as *hoeven* licensors. Following Lin, Weerman & Zeijlstra (2015), we hypothesize that the abstract analysis of the NPI requires a lexical dependency between *hoeven* and an abstract negator NEG. Since NEG can be analyzed as decomposable from negative indefinites like *niemand* (NEG-body), or other negative expressions such as *weinig* (NEG-many) and *alleen* (NEG-other than) (see Jacobs 1980; see also Rullmann 1995; von Stechow 2003; Penka 2011; Zeijlstra 2011), the abstract analysis of the NPI, represented by [HOEF NEG], generates *hoeven*'s appearance with *niemand*, *weinig*, and *alleen*—even though it is supported by little input evidence. The hypothesis that the emergence of *niemand*, *weinig*, or *alleen* as *hoeven* licensors is attributed to children's development of the single abstract analysis [HOEF NEG] moreover explains the simultaneity of the acquisition of these three negative words as *hoeven* licensors suggested by our regression results (see Subsection 5.2).

In fact, as Lin, Weerman & Zeijlstra argue, the abstract analysis [HOEF NEG] gives rise to *hoeven*'s appearance with various negative expressions that can be considered to contain a decomposable negator NEG, including the sentential negation *niet*, which is a specific phonological realization of NEG, and the negative quantifier *geen*, which consists of NEG and an existential quantifier. We therefore assume that [HOEF NEG] is probably the only underlying representation of the NPI in late child Dutch, explaining the convergence between the *niet-geen* pattern and the *niemand-weinig-alleen* pattern predicted by our regression model (see Subsection 5.2).

<sup>6</sup>Other words attested in this respect are *niks* 'nothing,' *alleen* 'only,' and *nog* 'yet,' which together cover 5 out of the 25 instances of substitution of the manipulated licensor.

#### 6.4. The development of [HOEF NEG]

The abstract analysis [HOEF NEG] helps children realize *hoeven*'s NPI-hood, as the presence of NEG in its underlying representation restricts it to certain negative environments only. This means that Dutch children are able to develop a generalizing analysis of *hoeven*, based on its appearance with only but not all possible licensors in the input (i.e., the induction problem; see also Section 1). But how do children eventually develop the abstract analysis [HOEF NEG]?<sup>7</sup>

One explanation for the development of [HOEF NEG] is already proposed in Lin, Weerman & Zeijlstra (2015)—although our experimental results suggest that [HOEF NEG] is developed at an older age, i.e., around 5, than that argued in the previous study, i.e., shortly after 4. In Lin, Weerman & Zeijlstra's explanation, the syntactic decomposition analysis of negative expressions such as *geen* or *niks* (see Jacobs 1980) plays a crucial role. According to this analysis, such negative forms contain, on the one hand, a syntactically decomposable negator NEG, and an existential quantifier  $\exists$  on the other, as illustrated in (11) (Rullmann 1995; Zeijlstra 2011). Under the assumption that Dutch 3-year-olds have already acquired the syntactic decomposition analysis, Lin, Weerman & Zeijlstra hypothesize that after children receive more and more input data containing *hoeven* licensed by different negative forms such as *geen*, *niks*, or *niemand*, which all contain NEG, they establish a lexical association between *hoeven* and NEG.

- (11)
- |    |                  |    |                       |
|----|------------------|----|-----------------------|
| a. | <i>geen</i> 'no' | b. | <i>niks</i> 'nothing' |
|    |                  |    |                       |

The hypothesis proposed in Lin, Weerman & Zeijlstra leads to (at least) two questions. First, how do we know that Dutch 3-year-olds have already acquired the syntactic decomposition analysis as in (11), which enables them to decompose NEG from various negative forms? Second, how much input evidence that contains *hoeven* in the scope of negative expressions apart from *niet* do children need to receive to develop [HOEF NEG]?

Following Penka (2012), Penka & Zeijlstra (2005), and Zeijlstra (2011), among others, Lin, Weerman & Zeijlstra (2015) argue that the acquisition of the syntactic decomposition analysis of negative indefinites is triggered by semantics, namely a so-called split-scope interpretation of negative forms like *niks* when appearing in deontic modal contexts, for instance. To illustrate the split-scope reading of *niks*, Lin, Weerman & Zeijlstra provide an example of a child asking her/his mum whether s/he can eat something before going to bed. Suppose the mother says (Lin, Weerman & Zeijlstra 2015:(16)):

- (12)
- |     |     |         |       |
|-----|-----|---------|-------|
| Je  | mag | niks    | eten. |
| you | may | nothing | eat   |

<sup>7</sup>As suggested by one of the reviewers, one can also assume that NEG is a preexisting category and that the lexical dependency between the NPI and NEG is part of children's inborn linguistic knowledge (see van der Wal 1996; see also Lin, Weerman & Zeijlstra 2015 for relevant discussion). In this scenario, the acquisition of the NPI is no longer a process of children developing an analysis of *hoeven*, which captures its distribution as in adult language. Rather, it becomes a process of children expanding the set of negative expressions that contain the abstract negator NEG, with which the NPI *hoeven* can appear. Under this hypothesis, the early emergence of *niet* and *geen* as *hoeven* licensors is then explained as a consequence of children's realization of both forms containing NEG at younger ages. As the reviewer correctly pointed out, our regression results are compatible with this learning path too. However, we here argue that no NEG category preexists, with which the NPI *hoeven* is lexically associated. Our argument is purely theoretical. As not all NPIs turn out to appear in exactly the same set of negative contexts as *hoeven* (see van der Wouden 1997; see also Giannakidou 2011; Lin 2015), the assumption of the preexistence of NEG as part of lexical knowledge of NPIs cannot explain the taxonomy of NPIs described in the literature. The assumption of a preexisting abstract category of negation NEG may therefore moreover give rise to under- or overgeneralization in child language. We thus argue, following Lin, Weerman & Zeijlstra (2015), that NEG is not part of children's innate knowledge but needs to be established based on language-specific evidence.



This sentence has three readings: a narrow-scope, a wide-scope, and a split-scope reading. In the narrow-scope reading, the entire negative indefinite is interpreted under the scope of the deontic modal, as illustrated in (13a). The narrow scope reading means that the mother gives her child permission or authorization not to eat before going to bed. In the wide-scope reading, as given in (13b), the entire negative indefinite outscopes the deontic modal, describing a scenario in which the mother does not have any particular things in mind that the child is allowed to eat before sleeping, e.g., candies or cookies. This asserts that the child is allowed to eat something before bedtime. In the split-scope reading, which is illustrated in (13c), the negative indefinite is not interpreted as a whole: The negation takes scope over the deontic modal, which in turn takes scope over the indefinite. By assigning (12) the split-scope reading, the mother is telling the child that s/he is not allowed to eat before sleeping.

- |      |    |  |            |
|------|----|--|------------|
| (13) | a. | ‘You are allowed to eat nothing.’                                  | may>NEG >∃ |
|      | b. | ‘There are no particular things such that you are allowed to eat.’ | NEG>∃> may |
|      | c. | ‘You are not allowed to eat.’                                      | NEG>may> ∃ |

Given this pragmatic context, the split-scope reading, i.e., (13c), is by far the most salient and the only one possible. This provides children with evidence for the decomposition analysis of negative words like *niks* in Dutch and triggers the acquisition of the syntactic knowledge in this respect. In their corpus data, Lin, Weerman & Zeijlstra (2015) find a total of 52 utterances with Dutch 3-year-olds, in which a split-scope interpretation of negative expressions like *geen* or *niks* turns out to be the only possible one. The authors therefore conclude that the relevant syntactic knowledge is already available to Dutch 3-year-olds, which facilitates the development of [HOEF NEG] at older ages. As for the amount of input evidence that is required to trigger the development of the abstract analysis [HOEF NEG], Lin, Weerman & Zeijlstra do not give quantitative descriptions. From their discussion, nonetheless, it appears to be sufficient if different negative forms such as *geen*, *niks*, or *niemand* license *hoeven* a little bit more than 15% of the time in the input (i.e., 57 out of a total of 370 utterances in which *hoeven* is attested; see Lin, Weerman & Zeijlstra 2015: Appendix 1).

Slightly modifying Lin, Weerman & Zeijlstra’s (2015) explanation, we argue that children, before they eventually establish the abstract [HOEF NEG], are not required to have acquired the syntactic decomposition analysis of all negative indefinites in Dutch but that it suffices to have acquired that only single negative quantifier *geen* is decomposed into a negator NEG and an existential quantifier ∃, as illustrated in (11a). If we consider the sentential negation *niet* as a specific phonological realization of NEG, the two lexical frames we argue that Dutch children have established in the initial stage, i.e., [HOEF NIET] and [HOEF GEEN], turn out to have the underlying representations [HOEF NEG] and [HOEF NEG ∃] respectively. Having recognized the overlap between these two representations, we hypothesize that children consider [HOEF NEG ∃] as redundant and therefore keep [HOEF NEG] as the only representation of the NPI. But how do we know that children have the knowledge of the syntactic decomposition of *geen* as [NEG ∃] before developing [HOEF NEG]?

Due to practical limitations, we did not examine 3- and 4-year-olds’ knowledge in this respect. Yet we have found some production data showing that Dutch children indeed have the knowledge that *geen* is a negative existential quantifier. In our CHILDES survey, we find a total of 66 instances of children uttering *niet een*, two separate lexical items (each reflecting a semantic component of the negative existential quantifier), out of 459 utterances in which *geen* would be expected. Relevant data are given in Table 8, followed by two examples.



- (14) a. \*Ik wil ook niet een boterham hebbe. (2;05.17)  
I will also not one sandwich have  
Lit.: 'I want to have not a sandwich either.'  
'I don't want to have a sandwich either.'  
(van Kampen 1994: laura20.cha: line 555)
- b. \*Ik hoort niet een verhaaltje. (3;09.13)  
I hear not a story  
Lit.: 'I hear not a story.'  
'I don't hear a story.'  
(Elbers & Wijnen 1992: 30913.cha: line 189)

**Table 8.** Usage of *Niet Een* instead of *Geen* Attested in the CHILDES Survey.

Age	2;00–3;00	3;00–4;00	4;00–5;00	> 5;00
<i>niet een</i>	1	34	26	5
<i>Geen</i>	0	98	187	108
Total	1	132	213	113

Usage of *niet een* instead of *geen* occurs only 14.4% of the time (i.e., 61 out of 459). However, if it occurs, approximately 92% of the time (i.e., 61 out of 66) it is attested for the 3- or 4-year-olds. This implies that children under age 5 have the knowledge that *geen* is a semantically complex negative expression in Dutch, although they may not decompose *geen* in a targetlike way, as shown in (11a).

Usage of *niet een* instead of *geen* as demonstrated in (14) is also found in the elicited nonrepetition production data obtained in the current experiment. Altogether, we had 83 nonrepetition responses to the stimuli containing *hoeven* licensed by *geen* (excluding one nonrepetition response that does not contain children's production data, which is categorized as *no-response*; see Subsection 3.5). Among these 83 responses, 23 instances of decomposition of *geen* as *niet een* are attested, namely 27.8% of the time when participants do not give repetition responses to the relevant stimuli. Moreover, such decomposition is much more likely to be attested for 4-year-olds than participants of other ages: 19 out of 23 instances are attested with 17 different 4-year-olds ( $N = 58$ ). This again suggests that children are puzzling with the targetlike syntactic analysis of *geen* (i.e., (11a)), which helps them to develop [HOEF NEG  $\exists$ ] as the underlying representation of [HOEF GEEN] and eventually leads them to the abstract analysis [HOEF NEG] later on.

If the hypothesis we proposed is on the right track, we expect that once children have developed [HOEF NEG], they only need to find out which negative expressions in their target language contains NEG for the abstract analysis to apply. However, the current experiment does not provide (counter)evidence in this respect. Hence, further investigation is required. If we find that children have already acquired the syntactic decomposition analysis of various negative expressions, but do not allow the NPI *hoeven* to appear in the scope of them, we have evidence for Lin, Weerman & Zejlstra: The development of [HOEF NEG] takes place later than the acquisition of the syntactic decomposition analysis. If we find that children simultaneously acquire the syntactic knowledge of the decomposition analysis of various negative words and allow the NPI *hoeven* to appear in their scope, that supports the explanation proposed in this article: Only the syntactic decomposition analysis of *geen* is crucial to the development of [HOEF NEG].

## 7. Conclusion

The aim of the current study was to explore how children's knowledge of the NPI *hoeven* 'need' may change over development, such that they eventually converge on a targetlike distribution of the NPI based on input evidence that contains *hoeven*'s co-occurrence with merely some but not all of its possible licensors (i.e., the induction problem). The results we obtained from 106 monolingual Dutch children (2;09–5;10; mean = 4;04;  $SD = 8.5$  months) in an elicited imitation task gave rise to the following developmental patterns in the acquisition of the NPI *hoeven*. Before the age of 3, children

only accept *hoeven* to appear with either the sentential negation *niet* or the negative quantifier *geen*. After the age of 3, children start developing their knowledge of the licensing of *hoeven* by negative expressions other than *niet* and *geen*—namely, *niemand*, *weinig*, and *alleen*—which are eventually accepted as *hoeven* licensors as well, after the age of 5.

Given the experimental findings described, we proposed a learning path in which children initially analyze the NPI as having a lexical dependency with either the sentential negation *niet* or the negative quantifier *geen*, represented by two lexical frames [HOE NIET] and [HOEF GEEN], and reanalyze it as having a dependency relationship with the abstract negator NEG later on, represented as [HOEF NEG]. Following a distribution-based learning approach (see Mintz 2002, 2003), we argued that the two lexical frames are established based on *hoeven*'s overwhelming occurrence with either *niet* or *geen* in the input. In turn, the two lexical frames restrict *hoeven*'s distribution to negative environments introduced by either *niet* or *geen* in early child Dutch. The abstract analysis [HOEF NEG], developed shortly after age 5, generalizes *hoeven* to all kinds of negative environments that contain a decomposable abstract negator NEG, thus including those introduced by *niet* and *geen* as well. Under the assumption that children's knowledge of syntactic decomposition of negation plays a crucial role in this process, we discussed two possible scenarios for how children may develop the abstract analysis [HOEF NEG], which calls for further research. The learning path of the NPI *hoeven* from lexicalization to the development of the abstract analysis [HOEF NEG] provides crucial insight into our understanding of the question of why the modal verb *hoeven* is an NPI (whereas other modals in Dutch like *willen* or *kunnen* are not). Since we argued that [HOEF NEG] is the representation of the NPI in late child Dutch, we conclude that *hoeven*'s NPI-hood is explained by its lexical dependency on an abstract negator NEG (see Postal 2000).

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## Appendix I: Possible *hoeven* licensors in Dutch

### I: Sentential negation *niet* ‘not’

- (1) Sam    hoefde    gisteren    niet    te    voetballen.  
       Sam    needed   yesterday   not    to    play football  
       ‘Sam did not have to play football yesterday.’

### II: Negative indefinites like *niks* ‘nothing’ or *niemand* ‘nobody’

- (2) Niemand    hoefde    gisteren    te    voetballen.  
      nobody    needed   yesterday   to    play football  
      ‘Nobody had to play football yesterday.’

### III. Seminegative expressions like *nauwelijks* ‘hardly’ or *weinig* ‘few’

- (3) sam       hoefde       nauwelijks       te       voetballen.  
      Sam       needed       hardly           to       play football  
      ‘Sam hardly had to play any football.’

### IV: Negative quantifier *geen* ‘no’

- (4) Sam    hoefde    gisteren    geen    voetbal    te    kopen.  
      Sam    needed   yesterday   no    football   to    buy  
      Lit.: ‘Sam had to buy no football yesterday.’  
      ‘Sam did not have to buy a football yesterday.’

### V: Quasi-negative expressions like *bijna niks* ‘almost nothing’

- (5) Sam    hoefde    gisteren    bijna niks       te    kopen.  
      Sam    needed   yesterday   almost nothing   to    buy  
      Lit.: ‘Sam had to buy almost nothing yesterday.’  
      ‘Sam hardly had to buy anything yesterday.’

VI: Negative universal expressions like *niet alles* ‘not everything’

- (6) Sam      hoefde      gisteren      niet alles      te      kopen.  
       Sam      needed    yesterday   not everything   to    buy  
       Lit.: ‘Sam had to buy not everything yesterday.’  
       ‘Sam did not have to buy everything yesterday.’

VII: *Zonder* ‘without’

- (7) Sam      kwam      thuis      gisteren      zonder      te      hoeven      voetballen.  
       Sam      came      home      yesterday   without    to      need      play football  
       ‘Sam came home yesterday without having to play football.’

VIII: Quantifiers like *hooguit* ‘at most’

- (8) Hooguit      vijf      studenten      hoefden      gisteren      te      voetballen.  
       at the most   five      students      needed      yesterday   to      play football  
       ‘Five students at the most had to play football yesterday.’

IX: Comparative clauses of inequality: *dan* ‘than’

- (9) Sam      voetbalt      vaker      dan      hij      hoeft      te      doen.  
       Sam      plays football   more often   than   he      needs   to      do  
       ‘Sam plays football more often than he has to.’

X: Exclusive expressions like *slechts* ‘merely’ (including temporal exclusive adverbs)

- (10) a. Sam      hoefde      gisteren      slechts      te      voetballen.  
       Sam      needed    yesterday   merely      to      play football  
       ‘Sam just had to play football yesterday.’  
       b. Sam      hoeft      pas      morgen      te      voetballen.  
       Sam      needs      only      tomorrow   to      play football  
       ‘Sam only has to play football by tomorrow.’

XI: Restriction of *alles* ‘everything’

- (11) Alles      wat      Sam      hoefde      te      doen      was      voetballen.  
       everything   what   Sam      needed   to      do      was      play football  
       ‘All Sam had to do was to play football.’

XII: Contrastive contexts marked by, e.g., *wel* ‘surely’

- (12) A: Sam      hoefde      gisteren      niet      te      voetballen.  
       Sam      needed    yesterday   not      to      play football.  
       ‘Sam did not have to play football yesterday.’  
       B: Nee,      dat      hoeft      hij      wel.  
       no,      that      needed    he      surely  
       ‘No, he did have to.’

## Appendix II: Distribution of *hoeven* in component a, b, and c of the spoken Dutch corpora

Licenser	Count
Sentential negation <i>niet</i> ‘not’	1,258 (75.3%)
Exclusive expressions like <i>slechts</i> ‘merely,’ <i>het enige</i> ‘the only thing,’ <i>pas</i> ‘until’	153 (9.2%)
Negative quantifier <i>geen</i> ‘no’	114 (6.8%)
Negative indefinites like <i>niks</i> ‘nothing’	110 (6.6%)
Contrastive focus markers like <i>wel</i> ‘surely’ or <i>toch</i> ‘but’	20 (1.2%)
Comparative clauses of inequality: <i>dan</i> ‘than’	7 (0.4%)
<i>zonder</i>	3 (0.2%)
Quasi-negative expressions like <i>bijna niks</i> ‘almost nothing’	1 (<0.1%)
Quantifiers like <i>hooguit</i> ‘at most’	1 (<0.1%)
Semi-negative expressions like <i>weinig</i> ‘few’	2 (0.1%)
<b>Total</b>	<b>1,670</b>

## Appendix III: Distribution of *hoeven* in the child-directed Dutch of chldes

Licenser	Count
The sentential negation <i>niet</i> ‘not’	474 (79.3%)
The negative quantifier <i>geen</i> ‘no’	74 (12.4%)
Exclusive expression <i>maar</i> ‘just’	19 (3.2%)
Negative indefinite <i>niks</i> ‘nothing’	14 (2.3%)
Contrastive focus markers like <i>wel</i> ‘surely’ or <i>toch</i> ‘but’	9 (1.5%)
Exclusive expression <i>alleen</i> ‘only’	4 (0.7%)
Negative indefinite <i>nooit</i> ‘never’	3 (0.5%)
Seminegative expression <i>minder</i> ‘fewer’	1 (0.16%)
Seminegative expression <i>weinig</i> ‘few’	1 (0.16%)
Negative indefinite <i>niemand</i> ‘nobody’	0
<b>Total</b>	<b>598</b>

## Appendix IV: The experimental design

Condition	Manipulation	Number of Stimuli
Test	<i>hoeven</i> ‘need’ licensed by <i>niet</i> ‘not’	4
	<i>hoeven</i> ‘need’ licensed by <i>geen</i> ‘no(ne)’	2
	<i>hoeven</i> ‘need’ licensed by <i>niemand</i> ‘nobody’	2
	<i>hoeven</i> ‘need’ licensed by <i>weinig</i> ‘few’	2
	<i>hoeven</i> ‘need’ licensed by <i>alleen</i> ‘only’	2
	<i>hoeven</i> in affirmative contexts	4
	<i>willen</i> ‘will’ or <i>kunnwn</i> ‘can’ in affirmative contexts	5
Filler	<i>willen</i> ‘will’ or <i>kunnen</i> ‘can’ in negative contexts	5
	other fillers	10
<b>Total</b>		<b>36</b>

## Appendix V: The experimental stimuli

Condition: *Hoeven* ‘need’ licensed by sentential negation *niet* ‘not’

- (1) Knorretje hoeft de pot honing niet aan Tijger te geven.  
Piglet needs the jar honey not to Tiger to give  
‘Piglet does not have to give the jar of honey to Tiger.’
- (2) Samen met Beer hoeft Knorretje helemaal niet bang te zijn.  
together with Pooh needs piglet all not afraid to be  
‘Together with Pooh, Piglet does not have to be afraid at all.’
- (3) Tijger hoeft het karretje niet samen met Beer te duwen.  
Tiger needs the cart not together with Pooh to push  
‘Tiger does not have to push the cart together with Pooh.’
- (4) Vanavond hoeft Beer niet in zijn kleine bedje te slapen.  
tonight needs Pooh not in his little bed to sleep  
‘Pooh does not have to sleep in his little bed tonight.’

Condition: *Hoeven* ‘need’ licensed by negative indefinite *geen* ‘no(ne)’

- (5) Voor het feest vandaag hoeft Ezel geen liedje te oefenen.  
for the party today needs Eeyore no song to practise  
‘Eeyore does not have to practice any songs for the party today.’
- (6) Beer en Knorretje hoeven nu echt geen honing te eten.  
Pooh and Piglet need now really no honey to eat  
‘Pooh and Piglet really do not have to eat any honey right now.’

Condition: *Hoeven* licensed by negative indefinite *niemand*

- (7) Vandaag hoeft Beer aan niemand een potje honing te geven.  
today needs Pooh to nobody a jar honey to give  
‘Pooh does not have to give anybody a honey jar today.’
- (8) Ezel hoeft nu niemand te helpen met de sneeuwpop.  
Eeyore needs now nobody to help with the snowman  
‘Eeyore does not have to help anybody with the snowman.’

Condition: *Hoeven* ‘need’ licensed by semi-negative quantifier *weinig* ‘few’

- (9) Vandaag hoeft Beer met zijn lieve vriendjes weinig te doen.  
today needs Pooh with his lovely friends little to do  
Lit.: ‘Pooh together with his lovely friends has to do little today.’  
‘Pooh and his lovely friends do not have to do much today.’
- (10) Knorretje hoeft weinig bloemen van de grond op te rapen.  
Piglet needs few flowers from the ground up to pick  
Lit.: ‘Piglet has to pick up few flowers from the ground.’  
‘Piglet does not have to pick up many flowers from the ground.’



Condition: *Hoeven* ‘need’ licensed by exclusive adverb *alleen* ‘only’

- (11) Tijger hoeft alleen het sterretje op de boom te zetten.  
 Tiger needs only the star on the tree to place  
 ‘Tiger only has to put the little star on top of the tree.’
- (12) Bij de picknick hoeft Ezel alleen maar iets te drinken.  
 at the picnic needs Eeyore only something to drink  
 ‘Eeyore only has to drink something at the picnic.’

Condition: *Hoeven* ‘need’ in affirmative contexts

- (13) \*Vanmiddag hoeft Beer met een grote zwemband om te lopen.  
 this afternoon needs Pooh with a large swim ring around to walk  
 Int.: ‘Pooh has to walk around with a large swim ring this afternoon.’
- (14) \*Beer en zijn vriendjes hoeven een grote boom te versieren.  
 Pooh and his friends need a big tree to decorate  
 Int.: ‘Pooh and his friends have to decorate a big tree.’
- (15) \*Beer hoeft samen met zijn vriendjes mooie liedjes te zingen.  
 Pooh needs together with his friends nice songs to sing  
 Int.: ‘Pooh has to sing nice songs together with his friends.’
- (16) \*Na het eten hoeven Beer en Knorretje uit te rusten.  
 After the dinner need Pooh and Piglet out to  
 Int.: ‘After dinner, Pooh and Piglet have to rest.’

# Appendix VI: Results of the random parts of mixed effects modeling using *age*, *modal type*, and *context polarity* as predictors

Random Parts	
$\tau_{00}$ , Participant	0.804
$\tau_{00}$ , Stimulus	0.366
$N_{\text{Participant}}$	106
$N_{\text{Stimulus}}$	38
$\text{ICC}_{\text{Participant}}$	0.180
$\text{ICC}_{\text{Stimulus}}$	0.082

# Appendix VII: Results of the random parts of mixed effects modeling using *age* and *condition* as predictors

Random Parts	
$\tau_{00}$ , Participant	0.606
$\tau_{00}$ , Stimulus	0.266
$N_{\text{Participant}}$	106
$N_{\text{Stimulus}}$	27
$\text{ICC}_{\text{Participant}}$	0.146
$\text{ICC}_{\text{Stimulus}}$	0.064