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5

Perception of finite verbal inflection

In the previous chapter, I concluded that, at the age of three, Dutch children have knowledge about the rules of finite verbal inflection and that they know that subject-verb agreement is obligatory. This suggests that children's acquisition of inflection takes place before this age. In order to look closer into the development of finite morphemes it is necessary to track children's development in earlier developmental stages. Due to the cognitive demands of the task itself, it is not possible to use the same elicitation tasks with the younger children as it was with the older children. The elicitation tasks that were used with the three-year-olds require several skills on behalf of the children. First, they have to learn nonce verbs. In addition, they have to place themselves in the perspective of 1st and 2nd person, and, in order to produce inversion in the 2nd person, they must also be able to ask questions. All of these tasks together are too demanding for children younger than three years. Thus they are not therefore suitable (Thornton, 1996).

As discussed in Chapter 1, Section 1.2, there are also limitations in using spontaneous speech data. Put briefly, these types of data do not allow one to effectively evaluate children's productive use of agreement inflection.

In order to examine the development of inflection in younger children, I will use an experimental technique that does not require children to produce language. In 1995, Kemler Nelson et al. discussed the possibility of exploring young children's language capabilities by using the Headturn Preference Paradigm (henceforth: HPP). HPP is an experimental technique which measures the mean length of time that infants look in the direction of an auditory stimulus. It uses this measure (looking time) as an indicator of infants' preference. The main objective of this procedure is to establish whether infants prefer one kind of stimulus over another. A preference for one stimulus over another is believed to reflect infants' ability to discriminate between the two

stimuli. There are a number of reasons why this procedure is well-suited for studying infants' language: First, the procedure does not require infants to intentionally communicate. For example, they are not required to point, answer questions, or act out commands. Infants are simply required to employ their visual attention in order to fulfill the requirements of the task.

On the basis of the results obtained from the elicited production data (see Chapter 4), a perception experiment using HPP was developed for 18 – 19 month old infants. The primary aim of this experiment was to examine whether Dutch infants perceive violations of inflection rules. That is, do young Dutch children differentiate between grammatical and ungrammatical sentences? This chapter is organized as follows: Section 5.1 summarizes perception studies, which show that infants are sensitive to various properties of functional morphemes. Section 5.2 introduces the research question and the linguistic variables in this experiment. Section 5.3 describes the methodology of the study. Results are presented in Section 5.4, followed by an interpretation of the results in Section 5.5. In Section 5.6, I discuss some issues regarding children's listening preferences and the HPP. Finally, in Section 5.7, I conclude the chapter.

5.1 Perception studies and morphosyntactic development

A number of perception studies using HPP have demonstrated that infants are sensitive to functional morphemes before they, themselves, begin to use them (Kemler Nelson et al., 1995; Jusczyk, 1998). It has been shown, for example, that 16-month-old infants acquiring English preferred to listen to strings of morphemes which were in the correct sequential order (e.g. *the kitten was hiding*) over sentences with morphemes that didn't follow standard English order (e.g. *was kitten the hiding*). Infants between 12 and 14 months, however, did not demonstrate a preference in either condition. Sensitivity to morphosyntactic dependencies between functional morphemes has also been found in 18-month-old English, Dutch, and German infants (Santelmann and Jusczyk, 1998; Wilsenach, 2006; Höhle and Weissenborn, 2003, respectively). Santelmann and Jusczyk (1998) investigated whether 15- and 18-month-old infants acquiring English were sensitive to morphosyntactic dependencies. In the experiment infants were exposed to a grammatical dependency between the auxiliary verb *is* and a main verb suffixed by *-ing* and an ungrammatical combination between the modal verb *can* and a main verb suffixed by *-ing*. The

results of this study showed that 18-month-old infants, but not 15-month-old infants, listened longer to passages containing grammatical dependencies between the auxiliary and the suffix on the main verb (e.g. *is mixing*). 18-month-old infants, did not listen as long to passages containing ungrammatical dependencies between the auxiliary and the suffix on the main verb (e.g. **can mixing*). The results of Santelmann and Juczyk (1998) were confirmed in a perception study with Dutch infants, whose ages ranged from 18 to 22 months (Wilsenach, 2006). Wilsenach studied the morphosyntactic dependency between the past participle prefix *ge-* and the auxiliary verb *heeft* 'has'. The infants in this study were divided into two groups: a test group of infants with a genetic risk of developing dyslexia, and a control group of typically developing infants. The infants were presented with grammatical passages (e.g. *de zon heeft geschinen* 'the sun has shined') and ungrammatical passages (e.g. **de zon kan geschinen* 'the sun can shined'). Wilsenach found that the control group (infants with no genetic risk of developing dyslexia) showed a significant listening preference for the grammatical passages, whereas the dyslexia risk group made no differentiation.

Although the research summarized above demonstrates that 18-month-old infants show sensitivity to various properties of function morphemes, it does not show that infants at this age are sensitive to finite verbal inflection. The experiments carried out by Soderstrom (2002) and Soderstrom, Juczyk and Wexler (2002) shed more light on this issue. The experiments focused on English children's sensitivity to the 3rd singular verbal inflection. The experiment was performed with two groups of infants, aged 16 and 19 months. The infants were presented with pairs of stimuli containing 3rd person singular inflection. One set of passages contained grammatical sentences such as in (1a), and the other set contained ungrammatical sentences, whereby verbs in the 3rd person were conjugated incorrectly, as in (1b). Researchers measured the amount of time infants looked in the direction of each passage.

(1) a. Grammatical passage:

At the bakery, the boy bakes bread. The metal spoon blends the flour and water together. Then the jet adds yeast and salt. In the next room, the very big machine kneads the dough. The next one forms the loaf for the oven. Quickly, the room begins to smell great.

b. Ungrammatical passage:

At the bakery, the boy bake bread. The metal spoon blend the flour and water together. Then the jet add yeast and salt. In the next room, the very big machine knead the dough. The next one form the loaf for the oven. Quickly, the room begin to smell great.

This study showed that 19-month-old infants listened significantly longer to the grammatical passages, whereas there was no significant difference with the 16-month-olds (although the difference was in the same direction as the 19-month-olds). However, as pointed out by Soderstrom et al. (2002), based on these findings alone, it is not clear whether infants preference was based on their sensitivity to verbal inflection or whether they simply preferred the more acoustically salient sound of the *-s* morpheme. One argument against the later interpretation is that the 16-month-olds did not discriminate between the passages. If infants simply preferred the more salient sound, one would not expect a difference between the two age groups. Instead, it is likely that this trend reflects infants' increasing grammatical knowledge over time (Soderstrom, 2002).

Overall, this result suggests that 19-month-old children learning English are sensitive to verbal inflection. However, this does not answer the questions posed here in their entirety. There are two reasons to conduct a similar study with Dutch children: First of all, cross-linguistic comparisons are necessary in order to address the question of universality. Second, the English verbal paradigm in the present tense is very limited because the only overtly marked form is the 3rd person singular (*-s*). All other forms in the paradigm have no overt marking. It is thus difficult to discern precisely how knowledgeable infants are in this domain. The Dutch paradigm is better to test their knowledge since it is richer and contains more contrastive forms. This should make it easier to detect whether infants discriminate in terms of phonology or grammar (for details about the verbal paradigm itself, see Chapter 3).

In sum, the literature overview shows that infants are sensitive to different properties of function morphemes. Research has demonstrated that, around the age of 18 months, infants develop sensitivity to various morphosyntactic dependencies. In the following paragraphs, I will discuss the Dutch perception experiment, which explores 18- to 19-month-old infants' sensitivity to finite inflection.

5.2 Hypothesis and linguistic variables

Based on my interpretation of VEKI, children have full knowledge of agreement inflection at the age of 18 months. Thus, I expect that 18- and 19-month-old Dutch infants will detect violations of finite verbal inflection. That is, they are expected to differentiate between grammatical and ungrammatical passages.

The current experiment tests an inflectional contrast between 3SG (stem + *-t*) and 3PL (stem + *-en*). Error analyses of verbal inflection (Blom and Polišenská, 2006) show that, at no age, do children overgeneralize the *-en* suffix in singular contexts (see fictive examples in [2]).

- | | | | |
|-----|----|----------------------------------|--|
| (2) | a. | overuse of <i>-en</i> in 1SG | <i>ik pakken die</i>
'I take this one' |
| | b. | overuse of <i>-en</i> in 2SG | <i>jij drinken sap</i>
'you drink juice' |
| | c. | overuse of <i>-en</i> in 2SG-INV | <i>wat drinken jij?</i>
'what drink you?' |
| | d. | overuse of <i>-en</i> in 3SG | <i>auto rijden hard</i>
'car ride fast' |

Overgeneralizations of the *-t* suffix, however, were attested in 3PL, 1SG and in 2SG-INV contexts. Dutch children thus produce utterances such as those illustrated in (3) (personal diary data).

- | | | | |
|-----|----|---------------------------------|--|
| (3) | a. | overuse of <i>-t</i> in 1SG | <i>ik gaat lezen</i>
'I go read'
(Anna, 2;8) |
| | b. | overuse of <i>-t</i> in 2SG-INV | <i>wat maakt jij?</i>
'what make you?'
(Ties, 3;3) |

- | | | |
|----|-----------------------------|---|
| c. | overuse of <i>-t</i> in 3PL | <i>poppen slaapt nu</i>
'dolls sleep now'
(Aron, 2;4) |
|----|-----------------------------|---|

Children also overgeneralize the *-ø* suffix in 3SG and 3PL as well as in 2SG. In addition, they sometimes produce utterances such as in (4) (personal diary data).

- | | | | |
|-----|----|-----------------------------|--|
| (4) | a. | overuse of <i>-ø</i> in 2SG | <i>jij maak een rondje</i>
'you make a circle'
(Tara, 3;6) |
|-----|----|-----------------------------|--|

- | | | |
|----|-----------------------------|--|
| b. | overuse of <i>-ø</i> in 3SG | <i>het meisje lees een boek</i>
'the girl read a book'
(Eladio, 3;5) |
|----|-----------------------------|--|

- | | | |
|----|-----------------------------|---|
| c. | overuse of <i>-ø</i> in 3PL | <i>kinderen drink water</i>
'children drink water'
(Laila, 3;3) |
|----|-----------------------------|---|

As discussed in Section 5.1, it is important that the experiment contains control conditions in order to disentangle grammatical from phonological preferences. Table 5.1 illustrates the four types of stimuli that were included in the experiment: one grammatical singular, one grammatical plural, one ungrammatical singular, and one ungrammatical plural. This design allowed for four comparisons: one comparison between passages containing the *-t* morpheme versus passages containing *-en* morpheme (i.e. the grey versus the white cells in Table 5.1) and three comparisons between grammatical and ungrammatical passages: (1) grammatical 3SG/PL vs. ungrammatical 3SG/PL; (2) grammatical 3SG vs. ungrammatical 3SG; and (3) grammatical 3PL vs. ungrammatical 3PL.

Table 5.1: Experiment conditions

Condition type	Example
Grammatical 3SG	<i>De wind waait door het bos.</i> ‘The wind blows through the forest.’
Ungrammatical 3SG	<i>*De wind waaien door het bos.</i> ‘The wind blow through the forest.’
Grammatical 3PL	<i>De liedjes klinken mooi.</i> ‘The songs sound beautiful.’
Ungrammatical 3PL	<i>*De liedjes klinkt mooi.</i> ‘The songs sounds beautiful.’

The four conditions allowed me to determine whether infants had knowledge of inflection or whether they had a phonological preference. If infants discriminate grammatical sentences from ungrammatical sentences, one would predict a difference in mean listening times between grammatical and ungrammatical passages. If, however, infants discriminate the sentences via phonological differences, one would predict that infants would discriminate between the *-en* and *-t* morphemes, regardless of whether or not it occurs in a grammatical or ungrammatical passage.

5.3 Method

The design of the current experiment closely followed the design used in infant perception studies discussed in 5.1. This section consists of five subsections,

which describe the method of the current experiment: participants (5.3.1), stimuli (5.3.2), apparatus (5.3.3), procedure (5.3.4) and data analysis (5.3.5).

5.3.1 Participants

The data were from 29, typically developing, Dutch infants between 18 and 19 months (twenty 18-month-olds and nine 19-month-olds; 15 boys and 14 girls). 18 additional infants participated in the study but their data were discarded due to crying (5), fussy behavior (9), average listening times less than two seconds (2) and ceiling listening times (2). The subject-loss falls within the expected range (15 – 50%), which has been reported in other perception studies with infants of the same age (e.g. Hirsh-Pasek and Golinkoff, 1996; Wilsenach, 2006; Soderstrom, 2002). Before infants were invited to participate in the experiment, parents either completed a brief written survey or telephone survey to determine their eligibility for participation in the study. All infants were growing up in a monolingual, Dutch-speaking environment. All were full term, healthy infants whose parents reported no particular problems or delays with regard to cognitive, language, or motor development throughout infancy. In addition, all children had normal hearing, and did not experience any out-of-the-ordinary. Infants with parents who suffered from dyslexia were excluded from the study.

It is very natural for young infants to show variable behavior during HPP experiments. In an attempt to classify infants' behavior more systematically, a behavior coding system was developed (Erkelens and Polišenská, 2007). As shown in Table 5.2, the coding system distinguished four behavior profiles, which relate to four different categories, each represented by a single color: (I) infants who sat still on the parent's lap and were alert until the experiment finished were categorized as 'green', (II) infants were categorized as 'blue' when they behaved just like the 'green' infants in the first half of the experiment, but tended to become restless towards the second half. (III) infants who were physically, very active but nevertheless paid attention to the stimuli were categorized as 'yellow' and (IV) infants who did not finish the experiment due to crying or moving from the caregiver's lap were included in the category 'red'. The crucial distinction between the 'green' and 'yellow' categories has to do with the amount of undesired behavior on behalf of the infant.

Table 5.2: System for coding infant's behavior during a HPP experiment (Erkelens and Poliřenská, 2007)

CATEGORY	CRITERIA
I Green N = 20	During the entire experiment (12 trials) the infant: -sits still on the caregiver's lap -reacts spontaneously to the lights -gives the impression that she is alert and relaxed -asks caregiver's attention only by turning the head (not the whole body)
II Blue N = 4	Throughout the first half of the experiment (6 trials) the infant: -behaves as defined in the 'green' category During the 2 nd half of the experiment, the infant shows one (or both) of the following behavior: -refuses to sit still (stands up) -gives impression of disinterest (thumb in the mouth or pacifier)/does not turn spontaneously to the light (experimenter must start the auditory stimuli in order to regain infant's attention)
III Yellow N = 5	During the whole experiment the infant: -stays (sitting or standing) on the caregiver's lap and reacts to the stimuli BUT in between the trials she is physically active, i.e. -constantly turns to the parent (not only head but the whole body, moves the whole body from the waist up while looking around; waves with arms; shakes head)
IV Red N = 18	Infant does not complete the experiment because (s)he: -refuses to sit still and gets off the caregiver's lap -cries and/or gives the impression that (s)he is distressed by the situation (face and body expression) -does not react to the lights Infant finishes the experiment but shows the following behavior with respect to the listening times: -mean listening time is less than two seconds per condition. -ceiling listening time in more than five trials (half of the experiment). -combination of short and ceiling listening times in more than five trials.

Infants were excluded from the experiment if they were categorized as ‘red’ (N=18). Infants categorized as ‘green’, ‘blue’ and ‘yellow’ were included in the data analysis because they all completed the testing (N=29). Out of the 29 children included in the data-analysis, 20 were categorized as ‘green’, four as ‘blue’ and five as ‘yellow’. Decisions about assigning an infant into a specific category were taken using the criteria described in Table 5.2. In order to control for the reliability of the judgment, we performed an inter-reliability check, in which eleven infants were judged by a second experimenter. The experimenters agreed on ten of eleven of the recordings, which indicates nearly perfect reliability.

5.3.2 Stimuli

The experimental stimuli consisted of sixteen passages, out of which, four functioned as familiarization trials and twelve as test trials. The twelve test passages were divided into six grammatical and six ungrammatical passages. The experiment contained four conditions (motivated in Section 5.2). Each passage (i.e. trial) contained eight sentences, (thus, eight instances of verbal inflection). Altogether, the test passages contained 48 verb types. The test contained 25 frequent verbs (verbs listed in the N-CDI standardized vocabulary for Dutch children under 36 months) (Zink and Lejaegere, 2002) and 23 less frequent verbs. An example of a grammatical and an ungrammatical passage are provided in (5). The complete overview of the passages used in the experiment is listed in Appendix 5.1.

(5) a. Grammatical passage:

Het weer blijft lekker. Het kleine meisje rent naar buiten. Mama fietst hard. De hond eet uit zijn bak. Mijn grote broer schreeuwt veel. Zijn zusje lacht hardop. De hamster piept eenzaam. Iedereen spelt graag.

b. Ungrammatical passage:

Het weer blijven lekker. Het kleine meisje rennen naar buiten. Mama fietsen hard. De hond eten uit zijn bak. Mijn grote broer schreeuwen veel. Zijn zusje lachen hardop. De hamster piepen eenzaam. Iedereen spelen graag.

English translation:

The weather stays nice. The little girl runs outside. Mummy bikes quickly. The dog eats from his bowl. My big brother shouts a lot. His sister laughs loudly. The hamster squeaks lonely. Everybody likes to play.

In order to prevent any biases in the stimuli, the passages had to meet the following requirements. Passages were matched on syllable length, however, passages with verbs suffixed by *-en*, i.e. the grammatical 3PL and the ungrammatical 3SG, logically contained eight more syllables than their counterparts (one syllable per sentence), i.e. passages with verbs suffixed by *-t*. It is necessary to mention that there are two plural suffixes in Dutch: *-en* and *-s*. In order to keep the category of nouns and verbs morphologically distinct, all nominal plural subjects in the passages were suffixed by *-s*. The passages never included finite verbs that began with *-s* or *-z* such as *slapen* ‘sleep’ or *zingen* ‘sing’. This restriction was included because it leads to ambiguity in perception: the initial phonemes *-s* and *-z* in the finite verb disguise the number of the subject. To illustrate this, consider an ungrammatical sentence **vader zingen elke ochtend* ‘father sing every morning’. In (6a), the subject might be perceived as singular and the sentence as 3SG ungrammatical. However, in (6b), one might perceive the subject as plural (suffixed by *-s*), in which case the sentence would be grammatical.

(6) a. **PERCEPTION 1:** 3SG ungrammatical

**vader zingen elke ochtend*
‘father –3SG sing –3PL every morning’

b. **PERCEPTION 2:** 3PL grammatical

vaders zingen elke ochtend
‘fathers –3PL sing –3PL every morning’

Finally, none of the passages contained pronominal subjects. The female 3rd person singular pronoun *zij* ‘she’ and the 3rd plural personal pronoun *zij* ‘they’ are homonymous, which also leads to ambiguous perception of grammaticality. This is illustrated in (7).

- (7) a. **PERCEPTION 1: 3SG grammatical**
zij danst op het strand
'she -3SG dances -3SG on the beach'
- b. **PERCEPTION 2: 3PL ungrammatical**
**zij danst op het strand*
'they -3PL dances -3SG on the beach'

The passages were audio-recorded in a sound-proof studio. A female native speaker of Standard Dutch was instructed to read the sentences as naturally as possible, so that the stimuli were representative of the infants' daily input. The grammatical and ungrammatical sentences were read using identical intonation. After the recording, the sentences were judged by two persons for overall similarity of the grammatical and the ungrammatical sentences. If one of the two judges was unsatisfied, the passage was re-recorded. The sound files were digitized in the computer at a sampling rate of 16kHz and were edited using PRAAT software (Boersma, 2001). The passages varied in length from 21 to 26 seconds.

5.3.3 Apparatus

The experiment took place in a three-sided booth constructed according to the specifications described in Santelmannn and Jusczyk (1998). As illustrated in Figure 5.1, the testing booth was constructed out of three panels set at right angles with each other. A green light was mounted on the central panel. Below the green light, there was a small hole for the lens of a video camera that recorded each session. A red light was mounted on each side-panel and a loudspeaker, through which the audio signal was played, was mounted behind each of the side-panels of the testing booth.

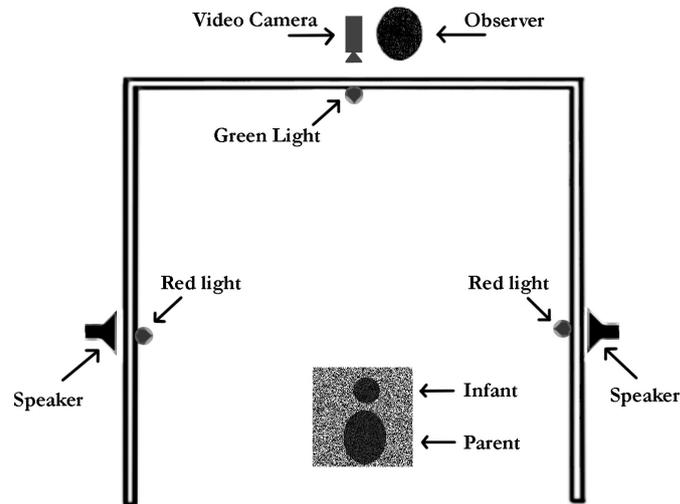


Figure 5.1: Test booth for Preferential Listening Procedure viewed from above. The infant is seated on the caregiver's lap and facing the central panel with the green light. Source: Kemler Nelson et al. (1995)

The experiment consisted of four familiarization trials and twelve test trials. The familiarization trials preceded the test trials and acquainted the infants with the stimuli and working of the lights. During the familiarization phase, all infants heard the same set of stimuli (two grammatical and two ungrammatical passages) in the same order. During the test phase, each infant heard both kinds of stimuli from both sides of the test booth. The test trials were presented randomly. Computer software determined the limits of the randomization: The maximum number of successive same type trials and the maximum number of successive same side trials were both set at two. This was because I did not want the infants to get habituated to the same type of stimuli and develop a preference for either the right or the left side. All infants were seen for a single experimental session.

5.3.4 Procedure

The infants came with their parent(s) to the laboratory, where they were first allowed to play with some toys. While the infant played, the experimenter explained the experimental procedure to the parent and took a short interview. After this intake interview, an experimenter verified the information obtained about the child through the web form or the first phone contact (see Section 5.3.1). Whenever relevant, information concerning the physical and/or emotional condition of the child on the day of testing was added. After the intake, the parent and the child were seated in the test booth opposite to the green light as depicted in Figure 5.1. For the successful course of the experiment, the experimenter instructed the parent to sit on a chair facing forward with uncrossed legs and to keep his or her child centered on the lap and not to speak to the child during the experiment. When the infant asked for attention, the parent was permitted to respond by smiling or stroking. The experimenter then darkened the testing booth and started the experiment. Each trial began with the blinking of a green light on the front wall, in order to draw the infant's attention to the centre. When the infant's attention was centered, the green light stopped blinking and the red light on one of the two side panels started blinking, indicating the availability of an auditory stimulus on that side. Once the infant made a head turn to that side, the auditory stimulus began to play. The stimulus continued and the red light kept blinking until the infant turned away for a continuous period of two seconds or until the entire stimulus for that trial had been played.

The infant's looking behavior was monitored on a television. A button-box was used to begin the experiment and score the infant's looking behavior. The button-box had two buttons, one black and one red. The experimenter started every experiment by pressing the black button. This resulted in the blinking of the green light. Once the infant's attention was centered, the experimenter pressed the black button a second time. This resulted in a blinking red light on one of the sidewalls of the booth. When the infant made a head-turn to that direction, the experimenter pressed the black button for the third time and the auditory stimulus started playing. This marked the beginning of the infants listening time. When the infant turned away from the stimulus, the experimenter pressed the red button. This response stopped the computer timer, however the auditory stimulus continued to play. If the infant turned back to the auditory stimulus, the experimenter again pressed the black button.

With this response, the timer continued counting from where it last stopped. However, if the infant failed to look back to the auditory stimulus within two seconds, the computer was programmed to stop the sound and the light. The experimenter initiated the next trial by pressing the black button, which, once again activated the green light.

The procedure was repeated for each new trial. Both the parent and the observer listened to masking music over headphones to prevent them from influencing their infants' behavior. The computer accumulated the total looking time towards each test passage. Immediately after the experiment was completed, the parent was invited to see the video recording of the experimental session and to ask any questions regarding the study and the experiment.

5.3.5 Data analysis

Computer software created an online data file for each of the participating infants. This online data file contained information about the progress of the experiment (i.e. amount of time an infant was orientated to the sound source while a stimulus played, the direction from which the stimulus was played and the order in which the stimuli was presented). A SONY DVD recorder was used to provide a permanent record of the test sessions, which permitted us to carry out reliability checks. All recordings were first scored online and then (after the infant's visit), they were scored off-line. In order to ensure reliability, the off-line scoring was done by a second experimenter. The off-line experimenter scored the videotapes with the sound turned off using the same response box as the on-line experimenter. The computer program GATHER⁷ was created in order to compare the online and off line scored files and to calculate the (mean) listening times per condition. Reliability in judging the timing of the head-turn for 29 infants was 0.91 on the scale of Alpha. Comparable results were reported by Gerken, Jusczyk and Mandel (1994) for the inter-observer agreement. For the data-analysis I used the online scored recordings unless the online file contained an error such as the button was pressed unintentionally during the live observation. In this case, the online file was replaced by a corrected off-line file and included in the data-analysis.

⁷ I am grateful to Alexander Kaiser who developed GATHER for the purpose of this study.

5.4 Results

Means and standard errors of listening times for overall grammatical discrimination, i.e. between grammatical 3SG/3PL and ungrammatical 3SG/3PL passages, are presented in Figure 5.2. The mean listening time was 7.6 seconds for the grammatical passages and 8.4 seconds for the ungrammatical passages across all infants. The paired difference between the mean listening times was 0.8 seconds. The difference is not significant: $t(28) = -1.387$, $p = .17$, which means that, in this condition, the infants showed no listening preference for either grammatical or ungrammatical passages.

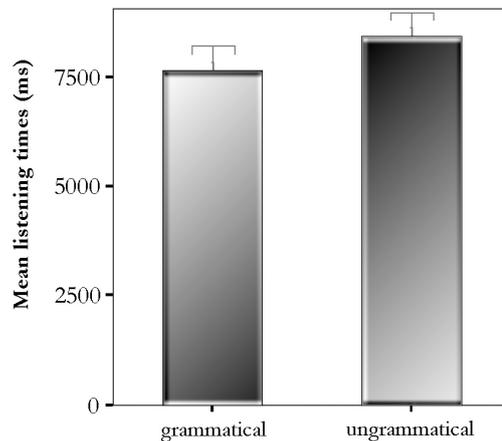


Figure 5.2: Mean listening times for grammatical and ungrammatical passages in both 3SG and 3PL conditions.

Similarly, a paired t-test revealed no significant difference in mean listening times with respect to phonological discrimination between the *-t* and the *-en* suffix. The mean listening time across all infants in conditions where the verb was suffixed by *-t* (i.e. grammatical 3SG and ungrammatical 3PL) was 7.6 seconds whereas, in conditions where the verb was suffixed by *-en* (i.e. grammatical 3PL and ungrammatical 3SG), the mean listening time was 8.4 seconds. The paired difference between the mean listening time was 0.8 seconds (see Figure 5.3). The infants showed no preference in terms of phonological contrasts.

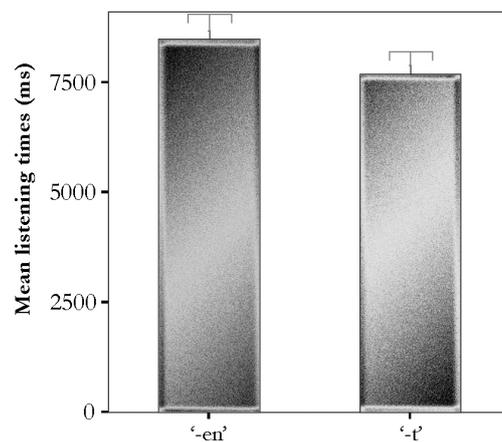


Figure 5.3: Mean listening times for passages containing *-en* and *-t* morpheme.

Thus far, there is no evidence that Dutch infants differentiate grammatical from ungrammatical sentences. Nor is there any evidence that they prefer one phonological form over the other. To verify whether this finding applied in both the singular and plural conditions, another analysis was carried out which looked into the constructions individually.

As illustrated in Figure 5.4, infants did have a form preference in the 3SG condition. Specifically, the infants listened significantly longer to the ungrammatical passages. The mean listening time across all infants in 3SG was 7.1 seconds for grammatical passages and 8.6 seconds for ungrammatical passages. The paired difference between the mean listening times was 1.5 seconds. This difference is significant: $t(28) = 2.151, p < .05$. Of the 29 infants in this condition, 19 listened longer to ungrammatical passages.

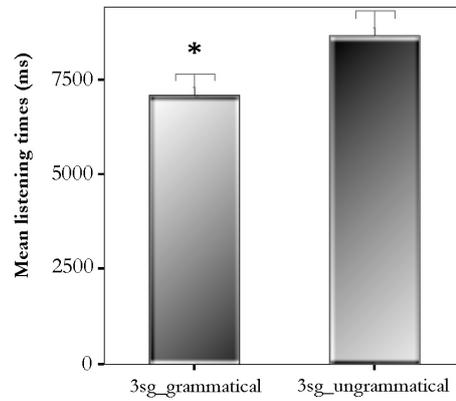


Figure 5.4: Mean listening times for grammatical and ungrammatical passages in 3SG.

In 3PL, infants showed no listening preference for grammatical or ungrammatical passages (see Figure 5.5). The mean listening time across all infants was 8.2 seconds for grammatical passages and 8.2 seconds for ungrammatical passages. The paired difference between the mean listening times was 0.0 seconds, which, needless to say, did not reveal any significant difference: $t(19) = 0.005$, $p = .99$.

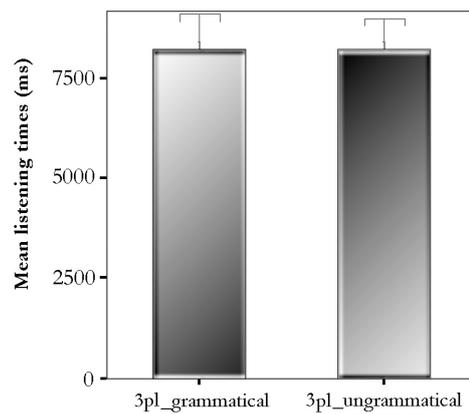


Figure 5.5: Mean listening times for grammatical and ungrammatical passages in 3PL.

The results demonstrate that Dutch infants at 18 and 19 months differentiate between grammatical and ungrammatical passages in 3SG. There was no evidence, however, that infants are sensitive to subject-verb agreement violations in 3PL.

Recall from Section 5.3.1, that the results reported above are based on data from infants with three different behavior profiles (labeled ‘green’, ‘blue’ and ‘yellow’ in Table 5.2). The main criterion for including infants in these three categories was that they completed the testing. It is possible, however, that differences in infants’ behavior during testing might have influenced the outcome of the experiment. In order to examine whether this was the case, a follow-up analysis was carried out with data from the infants who were placed in the green category. This specific group of infants matched the requirements of the HPP experimental setting the best: The infants sat still on the caregiver’s lap, reacted adequately to the lights and finished the experiment without any signs of fatigue or boredom. It is thus, possible that the data from these particular children is more valid than data from the other children.

This analysis included data from 20 infants. Means and standard errors of listening times in 3SG are shown in Figure 5.6. For the ‘green’ infants, the mean listening time was 7.0 seconds for the grammatical passages and 9.7 seconds for the ungrammatical passages. The paired difference between the mean listening times was 1.7 seconds, which reaches significance $t(19) = 3.684$, $p < .005$. Of the 20 infants in this condition, 15 preferred the ungrammatical passages.

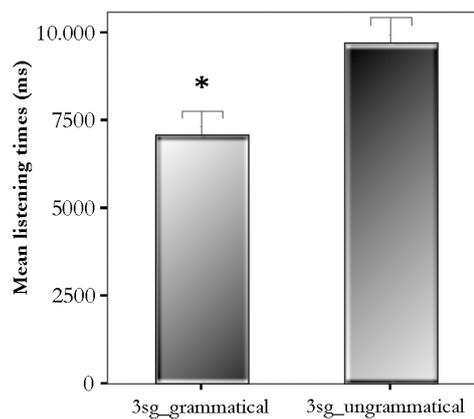


Figure 5.6: Mean listening times for grammatical and ungrammatical passages in 3SG (the ‘green’ infant group)

When I compare the results of the ‘green’ infants with the results from infants in all three categories combined, it becomes clear that there are differences between the groups. Although both groups demonstrated a significant difference for looking times between grammatical and ungrammatical passages, for the 3rd person singular, it should be noted that the p-value is much higher for the ‘green’ infants than for the mixed group ($p < .005$ and $p < .05$, respectfully).

I also performed additional analyses on the other conditions in order to test whether the ‘green’ infants might perform differently when their data are combined with children in the other behavior profiles. Results from all other tests, however, did not differ from the original tests which included the three groups of infants.

5.5 Interpretation of the results

The goal of the preceding experiment was to determine whether 18- and 19-month-old infants acquiring Dutch are able to detect violations in finite verbal inflection. Production data suggests that Dutch children at three years are quite accurate with finite verbal inflection. The results of the experiment demonstrate that Dutch infants develop sensitivity to verbal inflection much earlier, by around 18 months. Moreover, the experiment furthers our understanding of what young children know about inflection by offering insight into a language other than English, which, as mentioned earlier, does not have a very rich verbal paradigm, and thus, is not an ideal language to study agreement inflection.

In my perception experiment, the infants were tested in four different conditions. Doing so made it possible to determine whether infants discriminated on the basis of grammaticality or phonology. I predicted that if infants discriminate on the basis of grammaticality, then they would listen significantly longer to either the grammatical or ungrammatical passages. If, however, they discriminate on the basis of phonology, then one would expect a significant difference in the listening times between passages containing different suffixes, i.e. between passages where the verb is suffixed by *-t* and passages where the verb is suffixed by *-en*. Our findings did not support the hypothesis that infants discriminate on the basis of phonological patterns: Dutch infants did not prefer to listen to the passages with *-t*, nor did they prefer the passages with *-en*.

When all four experimental conditions were analyzed together, the experiment did not provide evidence that infants detect agreement violations. However, when the analysis focused on singular and plural conditions separately, I found that Dutch infants differentiated between grammatical and ungrammatical passages in 3SG whereas they did not in 3PL. This means that infants discriminated between the *-t* and the *-en* suffixes in (8) but they did not discriminate between the *-t* and the *-en* suffixes in (9). As such, the fact that infants did not show a difference in their listening behavior in 3PL cannot be ascribed to the experiment. As reported in previous sections, the experiment contained both 3SG and 3PL grammatical and ungrammatical conditions which were presented in a pseudo-randomized order.

(8) *De wind waait door het bos.*
‘The wind blows through the forest’

**De wind waaien door het bos.*
‘The wind blow through the forest’

(9) *De liedjes klinken mooi.*
‘The songs sound nice’

**De liedjes klinkt mooi.*
‘The songs sounds nice’

The findings obtained from the perception experiment are consistent with the findings obtained from the elicited production experiment. The error-analysis in 4.6.4 indicates that Dutch children do not overuse the plural *-en* suffix in subject-verb-object utterances with singular subjects. In the current perception experiment, Dutch infants detected this agreement error. That is, they discriminated grammatical sentences from ungrammatical sentences in 3SG (for example, see [8]). The error analysis on the plural context also revealed that children sometimes substituted the *-t* suffix in 3PL. In the perception experiment, infants appeared to ignore this agreement error: Their listening times did not differ when listening to sentences in 3PL (as in [9]). In accordance with this result, Leonard et al. (2002) reported that, before the age of three, Italian children replace 3PL with 3SG. Children, however do not do the reverse.

Both the findings from the perception experiment and from the production experiment suggest that Dutch children's early grammars do not allow for the use of the *-en* suffix in the singular context. However, they do allow for the use of the *-t* suffix in the plural. Further research is needed, however, to verify whether or not 18- to 19-month- old infants can detect agreement violations in other inflectional contexts within the Dutch verbal paradigm. More specifically, it needs to be established whether or not infants at this age can discriminate between *-t* and *-ø* as well as between *-ø* and *-en* finite suffixes.

One of the aims of the experiment was to test the claim that children have early knowledge of inflection. The outcome of my experiment shows that the infants' sensitivity to finite verbal inflection is not fully developed at 18 months. Whereas the infants showed sensitivity to agreement violations in 3SG, they did not detect the agreement violations in 3PL. Thus, whereas the Dutch infants seemed to be aware of the restricted use of the *-en* suffix, they did not show any awareness of the limited use of the suffix *-t*. VEKI, which is interpreted to claim that children have full knowledge of agreement inflection at the age of 18 months, is therefore not supported by the perception data of Dutch infants.

On the basis of the form-feature specification for verbal inflection presented in Chapter 3, and repeated here in (10) for convenience, I can conclude that, within the set of finite morphemes, the *-en* suffix is mapped earlier to its corresponding features than the *-t* suffix. By implication, the infants know the constraints on the *-en* earlier than those on the *-t* suffix.

(10)	/t/	↔	[+FINITE;-SPEAKER;-PLURAL]
	/en/	↔	[+FINITE;+PLURAL]
	/ø/	↔	[+FINITE]
	/en/	↔	[-FINITE]

Furthermore, the experiment supports the claim that *-en* has two feature representations in Dutch (Haeseryn et al., 1997; Aalberse, 2009): The experiment shows that infants are sensitive to subject-verb agreement violations when a singular subject is followed by a verb in a *-en* form. Given the feature representation in which the *-en* suffix is completely underspecified and is considered the default (Wexler et al., 2004; Bennis and MacLean, 2006), a different outcome would be expected: In case of *-en* underspecification, children's grammar would allow for *-en* with the singular subject, resulting in no differences in listening behavior.

To what extent can the observations be explained by salience factors? With respect to finite morphemes, I predicted that there would be no considerable variation in children's acquisition. However, it turned out that variation occurs: 18- and 19-month-old infants were sensitive to agreement violations when *-en* followed the singular subject but not when *-t* followed the plural subject. In Chapter 3, I already explained why the method for calculating salience should be taken with caution when no developmental variation is predicted. I stated that, if my observations were not compatible with the predictions, it would not be possible to refute the claim that salience plays a role in the acquisition of inflection. Instead, it would be necessary to reconsider the initial assumption: that all salience factors have equal weight. It is possible, for example, that some factors are weighted heavier than others. In order to gain insight into the actual weights of the factors, I compare the results from the perception experiment within the individual factors.

In Chapter 3, I presented an overview of form-feature pairs within the verbal paradigm and the scores that they received for each salience factor. This overview is repeated here in Table 5.3.

Table 5.3: Overview of scores assigned within each salience factor in Dutch verbal inflection.

Form – Feature pair	Phonological salience	Positional salience	Feature salience	Feature complexity	Input frequency	SUM
<i>-t</i> [+FIN;-SP;-PL]	3	3	3	2	3	14
<i>-en</i> [+FIN;+PL]	4	3	2	3	2	14
<i>-θ</i> [+FIN]	2	3	3	4	2	14
<i>-en</i> [-FIN]	4	4	4	4	4	20

The result of the experiment is consistent with predictions yielded by phonological salience and feature complexity. The results are inconsistent with predictions made by feature salience and input frequency, since these factors predict that the *-t* suffix is more salient than the *-en* suffix, and thus, would be expected to be acquired earlier. It should be noted, however, that the interpretation of the outcome is highly dependent on the form-feature specification in (10). I will return to this in more detail in the final chapter.

5.6 Note on HPP and the listening preference

The findings of the present experiment are consistent with findings reported by Soderstrom (2002) and Soderstrom et al. (2002) because the English-acquiring infants also showed sensitivity to verbal inflection in similar contexts. However, whereas the English infants listened longer to the grammatical passages, the Dutch infants listened longer to the ungrammatical passages. Regardless of the direction, it is clear that 18- and 19-month-old learners of English- and Dutch are able to discriminate between grammatical and ungrammatical sentences. Similar reversals in preference have been reported in other studies using HPP (e.g. Gomez and Maye, 2005; Soderstrom and Morgan, 2007). As mentioned before, the main objective of the HPP is to establish whether infants discriminate between two incoming stimuli. This shows that they are sensitive to a certain (linguistic) stimulus. The direction of the preference is secondary to the discrimination. It has been suggested that the direction of listening preference is likely to be influenced by various factors such as age, length of experiment and/or the complexity of the stimuli (Hunter and Ames, 1988). However, since the design of our experiment matched Soderstrom's design with respect to age and length of the experiment, these factors cannot account for the reverse preference. A closer look at the linguistic phenomenon verified in the experiments, however, may shed a light on this apparent cross-linguistic difference.

While the present study examined whether or not there is variation in the development of finite morphemes, Soderstrom et al's (2002) study focused on the optional infinitive stage in English speaking infants. In this stage, infinitival verbs optionally appear in finite matrix clauses where target grammars require finite (i.e. agreement- and/or tense-marked) verbs. Production data show that English children do not view the 3rd person singular as obligatory until at least three years (Harris and Wexler, 1996; Gülzow, 2003). In this respect, the infinitival form in 3rd person singular may, in fact, be a well-formed sentence for 18 and 19-months old English infants. Similarly, the fact that overuse of the *-en* in the singular context does not seem to be allowed in Dutch children's grammar may influence Dutch infants' attention: The *-en* in the 3SG may sound more awkward to the Dutch infants than the *-∅* to the English infants. Moreover, as I already mentioned in Section 5.1, it is possible that the distinct acoustic properties of the suffix *-s* may cause an attentional bias in infants acquiring English.

5.7 Conclusion

The findings obtained in the perception experiment demonstrate that 18- and 19-month old infants are developing sensitivity to finite verbal inflection. The detection of grammatical violations is limited to the 3rd person singular, suggesting that, at this age, infants still do not have full knowledge of verbal inflection. Consequently, the findings do not support the empirical generalization based on VEKI, which states that children have full knowledge of agreement inflection at the age of 18 months. Based on the form-feature specification in (10), the findings are not compatible with the predictions yielded by salience, namely that there would be no variation regarding the development of the finite morphemes. Comparison of the findings with the predictions yielded by individual salience factors suggested that infants' attention was drawn to a finite morpheme, which scored relatively high on phonological salience and feature complexity, and relatively low on feature salience and input frequency. Finally, the pattern obtained in the perception experiment provided further support for the claim that, in the Dutch system of verbal inflection, the *-en* suffix has two underlying representations.