

Grammatical Gender and Early Word Recognition in Dutch

Elizabeth K. Johnson, Max Planck Institute for Psycholinguistics

1. Introduction

At the onset of speech production, children typically omit closed-class function words such as *a* and *the* from their utterances (Brown, 1973). Children's failure to produce these items could be taken as evidence that they do not attend to function words in speech comprehension. Indeed, it has been argued that during the earliest stages of language acquisition, infants and toddlers do not produce function words because they are more focused on the perceptually salient stressed syllables occurring in content words (Echols & Newport, 1992). However, multiple studies have revealed that English-learning infants perceive and process unstressed syllables and function words long before they begin producing them. By eleven months of age, infants attend to and encode fluently produced unstressed syllables in phonetic detail (Johnson, 2004). At this same age, English-learning infants discriminate between stories containing real functors (e.g. *the*) and stories containing nonsense functors (e.g. *guh*; Shady, 1996; Shafer, Gerken, Shucard, & Shucard, 1992). Moreover, English-learners who fail to produce function words in their own speech nonetheless comprehend utterances more readily when they include function words. For example, 2-word speakers comprehend utterances that include function words (e.g. *Get me the ball*) better than the utterances that omit function words (e.g. *Get ball*; Petretic & Tweeney, 1977; Shipley, Smith, & Gleitman, 1969). Furthermore, 21- to 28-month-olds understand instructions containing function words used in linguistically appropriate contexts (*Find the dog for me*) better than instructions containing function words used in linguistically inappropriate contexts (*Find was dog for me*; Gerken & McIntosh, 1993). Thus, there is abundant evidence that English-learners are tuned into and processing function words from a very early age.

It has been argued that infants' early sensitivity to function words could play an important role in language acquisition by facilitating the categorization and labeling of words and phrases (Christophe, Guasti, Nespor, Dupoux, & Van Ooyen, 1997; Morgan, 1986). For example, the determiner *the* marks the beginning of a noun phrase in English. Likewise, auxiliary verbs such as *was* mark verb phrases. If infants were sensitive to the distribution of functors such as *the* and *was*, then they could begin to bootstrap their way to syntactic competency by categorizing the different types of phrases they hear in their

input. Knowledge of function words could also help infants further parse their input into word-sized constituents (see Christophe et al. for a discussion of the function word stripping strategy) as well as assign those word-forms to word classes (Brown, 1957; Landau & Gleitman, 1985). The categorization of words into word classes (syntactic bootstrapping) could in turn constrain the possible number of semantic interpretations for a newly encountered word, thus lessening the severity of Quine's (1960) classic gavagai problem in language acquisition.

The omission of unstressed grammatical morphemes from early utterances is not unique to English (Crisma & Tomasutti, 2000; Guasti, Lange, Gavarro & Caprin, 2003; Mills, 1986; Wijnen, Krikhaar, & Den Os, 1994). In order to assess the extent of determiner omission in Dutch-learners, we asked parents of Dutch-learning toddlers who visited our lab to fill out a survey regarding their toddlers' determiner production. If parents reported that their children were producing determiners, we asked whether they were doing so correctly. According to this survey, toddlers continue to have difficulties with determiners long after their second birthday (see Figure 1; see also Guasti et al.; Wijnen et al.). More strikingly, production studies have revealed that Dutch-learners are still making frequent errors of omission and substitution with definite determiners when they begin school (van der Velde, 2002). To date, despite the widespread observance of article omission across languages, the bulk of research examining toddlers' sensitivity to grammatical items in comprehension has been carried out with English-learning infants (see Hoehle & Weissenborn, 2003, for an exception).

Given the important role that function words play in recent theories of language acquisition, it would be beneficial to examine how toddlers learning languages other than English perceive and process function words. In particular, it would be useful to examine the acquisition of function words in a language such as Dutch, which differs from English in that it has gender-marked definite determiners. The acquisition of determiners in a language containing gender-marked determiners could possibly be more difficult than the acquisition of determiners in a language such as English because when a language has two or more forms of a determiner, this in turn decreases the frequency of each individual form. From a distributional-learning point of view, this could delay toddlers' mastery of certain functors. Recent work on infants' sensitivity to functors support the hypothesis that less frequent functors are learned later in development than highly frequent functors (Hoehle & Weissenborn, 2003; Shi, Werker & Cutler, 2003). In short, learners of languages containing gender-marked determiners might lag behind English learners in their knowledge of the linguistically appropriate use of determiners. This in turn could have important implications for those theories of syntactic and semantic development that place an important role on toddlers' knowledge of function morphemes.

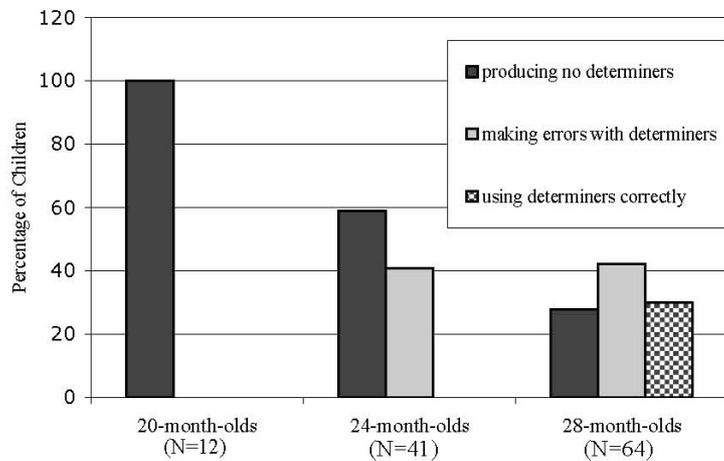


Figure 1. The production of definite determiners by Dutch-learning toddlers displayed as a function of age (according to parental report). Children were counted as making errors if they made substitution and/or omission errors.

Dutch has a two gender system in which the definite determiner *de* is used to mark common gender singular nouns (e.g. *de bal* ‘the ball’) and the definite determiner *het* is used to mark neuter gender singular nouns (e.g. *het boek* ‘the book’). Plural nouns take the determiner *de* irrespective of gender (*het boek* becomes *de boeken* and *de bal* becomes *de ballen*). In addition, Dutch speakers often use the diminutive form in both adult- and child-directed speech (van de Weijer, 1998). When nouns are produced in the diminutive, they take the determiner *het* irrespective of gender (*de bal* becomes *het balletje*). Thus, all singular *de*-words essentially become *het*-words when they are produced in the diminutive. Dutch has a rich system of gender marking that affects many other functors besides definite determiners. Other agreement targets include demonstrative pronouns (*deze/dit*), possessive pronouns (*onze/ons*), and some adjectives (*een kleine bal/ een klein boek*), etc. Indefinite determiners, however, are not gender-marked. A few additional characteristics of the Dutch gender system may make it difficult to acquire. In contrast to many Romance languages (e.g. Spanish), there are no strong phonological predictors of noun gender in Dutch. Semantic properties of nouns are also not an effective cue for predicting noun gender. Finally, bare singular nouns are somewhat more acceptable in Dutch than in many other languages (e.g. Italian; Guasti et al., 2003).

In the current study we will investigate toddlers’ perception of definite determiners. This study differs from past studies in this area in two important ways. First, we will be testing toddlers who are learning Dutch rather than

English. The presence of gender-marking on Dutch definite determiners allows us to test toddlers' sensitivity to gender-appropriate versus gender-inappropriate functors. Toddlers' acquisition of the gender system of many languages has been heavily studied in production (see Corbett, 1991, for review), but we know very little about toddlers' sensitivity to gender-marking in perception. Given results demonstrating that English-learners process functors long before they produce them, we may find evidence that Dutch toddlers are sensitive to gender-marking in comprehension. At the same time, gender-marking is a fairly complex phenomenon. And production and corpus studies suggest that the gender system of Dutch is acquired late relative to the acquisition of gender systems in other languages (Guasti et al., 2003; van der Velde, 2002). Thus, it is possible that Dutch toddlers may have difficulties with gender-marking in comprehension as well as production.

The second important difference between this study and past studies is methodological in nature. Nearly all past studies looking at toddlers' comprehension of grammatical morphemes have used offline measures of comprehension (see Zangl & Fernald, 2003, for an exception). Instead, we use the Split-screen Preferential Looking Paradigm to obtain an online measure of toddlers' processing of definite determiners (Hollich, Rocroi, Hirsch-Pasek & Golinkoff, 1999). In the Split-screen Preferential Looking Paradigm, toddlers sit on their parent's lap while pairs of familiar objects are displayed on a large TV monitor. The images on the screen are accompanied by spoken utterances referring to one of the two objects. If the utterance refers to the object that the toddler is fixated on, then children tend to continue to fixate the same object. If, on the other hand, the object mentioned in the spoken utterance does not match the object that the child is fixated on, then children tend to rapidly shift their gaze away from the object. Past studies using this procedure have measured the speed of children's shifts to and from target objects relative to the onset of a spoken target. This analysis has provided a very fine-grained measure of toddlers' word recognition abilities (Swingley & Aslin, 2000; Swingley et al., 2003). In the current study we will use a very similar technique, however, toddlers' shift latencies will be measured relative to the onset of the determiner preceding the target words rather than relative to the target word itself.

2. Method

Participants:

39 normally developing Dutch-learners participated (Age Range 26-30 months; 18 girls). Participants were randomly assigned to one of two orders.

Procedure:

Toddlers were tested using the Split-screen Preferential Looking Paradigm. Four words commonly known by 26- to 30-month-olds were chosen for use as target items: *de bal* 'the ball', *de boom* 'the tree', *het boek* 'the book',

and *het bed* ‘the bed.’ We chose four targets starting with the same stop consonant for two reasons. First, this facilitated splicing and acoustic measurements because stop consonant onsets are relatively easy to identify in fluent speech. Second, since toddlers process speech in a continuous manner, they tend to be slower to shift their gaze to a named target if all pictured targets begin with the same sound (e.g. toddlers are faster to shift their gaze to a picture of a dog when they are shown a dog and a tree on the screen than when they are shown a dog and a doll; Swingley, Pinto & Fernald, 1999). Thus, by using words that have matching onsets, we increase the span of time during which the spoken target cannot be identified without access to gender information.

Table 1 outlines the three different types of trials in this experiment: 1) Correct Trials (two target items of different gender were displayed on the screen and toddlers heard grammatical instructions to look at one of the two targets), 2) Incorrect Trials (these trials differed from Correct trials in that toddlers heard a gender-inappropriate determiner preceding the target item), and 3) Uninformative Trials (these trials differed from Correct trials in that both targets shown on the screen were of the same gender). Note that Uninformative Trials were uninformative because determiner gender alone could not help you determine which target object the speaker was referring to. In addition, filler trials picturing farm animals were included to help maintain toddlers’ interest in the video.

A female recorded the speech materials in a slow child-directed manner. In order to avoid asking the speaker to produce an ungrammatical utterance, the sentences containing both gender-appropriate and gender-inappropriate determiners were created by splicing together grammatical utterances. The resulting hybrid utterances were checked by native speakers and judged to sound natural. The experiment contained 16 trials in total (4 trials of each type), and lasted approximately 4 minutes. All testing sessions were taped with a digital video camera and analyzed offline. Participants’ eye movements were coded frame-by-frame without sound.

	Video	Audio
Correct Trials (4X)	ball & book	<i>Kijk eens naar de bal (het boek).</i> ‘look at the ball (the book)’
Incorrect Trials (4X)	ball & book	<i>Kijk eens naar *het bal (*de boek).</i> ‘Look at the ball (the book).’
Uninformative Trials (4X)	ball & tree	<i>Kijk eens naar de bal (de boom).</i> ‘Look at the ball (the book).’
Filler Trials (4X)	cow & pig	<i>Kijk eens naar het varken (de koe).</i> ‘Look at the pig (the cow).’

Table 1. Examples of the 4 trial types used in the experiment. Asterisks mark gender-inappropriate determiners.

3. Results

Toddlers' mean proportion of looking time to the target picture before and after the acoustic onset of the target word was measured for all 4 target words (trials in which toddlers were not looking were excluded from the analysis). As Figure 2 illustrates, toddlers' mean proportion of looking time to target reliably increased after target word onsets, indicating that toddlers readily recognized the target words. Paired t-tests revealed that this effect was significant for all 4 words: *de bal*: $t(103)=6.5$, $p < .001$; *het bed*: $t(105)=4.6$, $p < .001$; *het boek*: $t(99)=2.4$, $p < .05$; *de boom*: $t(109) = 2.3$, $p < .05$).

Next we examined participants' mean latency to shift from the distractor to the target. The window of analysis included shifts made between 240 ms and 2000 ms after the onset of the determiner. Only trials where toddlers were focused on the distractor item at the beginning of this window of interest were included in the analysis. Shifts occurring less than 240 ms or greater than 2000 ms after the onset of the determiner were not included in the analysis because they were deemed unlikely to reflect toddlers' reaction to the determiner (see Swingley & Aslin, 2000). Trials involving de-words were analyzed separately from trials involving het-words. For the de-words, a one-way ANOVA revealed a significant effect of trial type, $F(2, 100)=6.5$, $p < .005$. Planned comparisons revealed significant differences in toddlers' shift to target on Incorrect versus Correct Trials, $t(58) = 4.5$, $p < .001$. Planned comparisons also revealed a significant difference in toddlers' shift to target on Uninformative versus Correct Trials, $t(67)=2.8$, $p < .01$. There was, however, no significant difference between infants' speed to shift on Incorrect versus Uninformative Trials, $t(69)=.06$, $p > .05$. As Figure 3 illustrates, these effects were due to faster shifting to the target on Correct Trials than Incorrect or Uninformative Trials. For the het-words, a one-way ANOVA revealed no significant effect of trial type, $F(2, 80) = 1.16$, $p > .05$. Thus, gender information only affected infants' behavior on de-word trials.

Finally, using the same sized window of analysis, we examined participants' mean latency to shift from the target to the distractor. Only trials where toddlers were focused on the target item 240 ms after the onset of the determiner were included in this analysis. Once again, trials involving de-words were analyzed separately from trials involving het-words. For the de-words, a one-way ANOVA revealed a significant effect of trial type, $F(2, 83)=3.17$, $p < .05$. Planned comparisons revealed significant differences in toddlers' shift to distractor on Incorrect versus Correct Trials, $t(58) = 4.5$, $p < .001$. Planned comparisons also revealed a significant difference in toddlers' shift to distractor on Uninformative versus Incorrect Trials, $t(67)=2.8$, $p < .01$. There was, however, no significant difference between Correct and Uninformative Trials, $t(69)=.06$, $p > .05$. As Figure 4 illustrates, these effects were due to faster shifting away from the target on Incorrect Trials than on Correct or Uninformative Trials. For the het-words, a one-way ANOVA once again

revealed no significant effect of trial type, $F(2, 105) < 1$. Once again, gender information only affected infants' behavior on de-word trials.

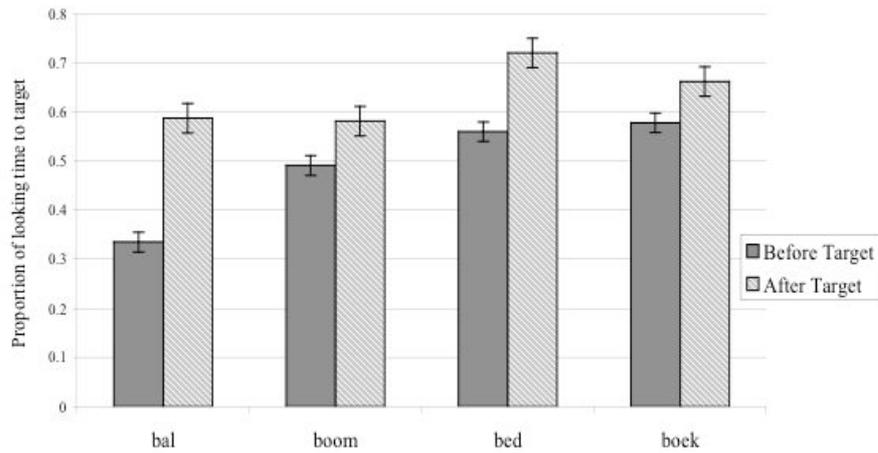


Figure 2. Toddlers' proportion of looking time to target before and after the acoustic onset of the target word.

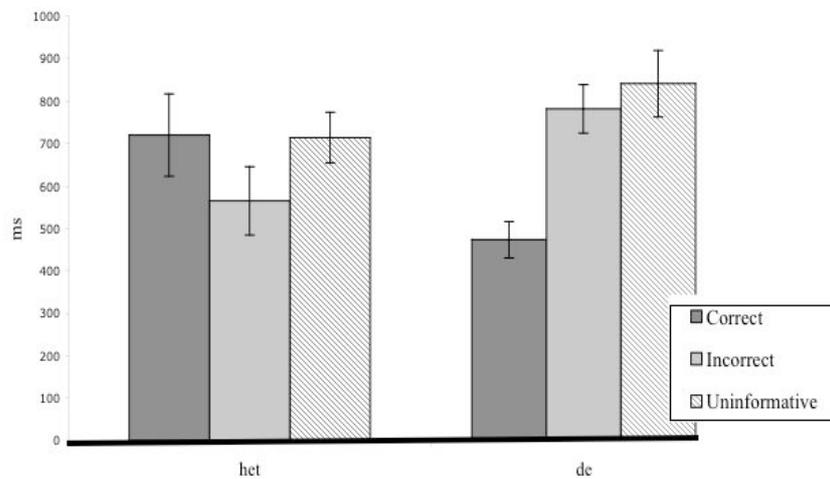


Figure 3. Toddler's latency to shift from the distractor to the target on het- and de-word trials.

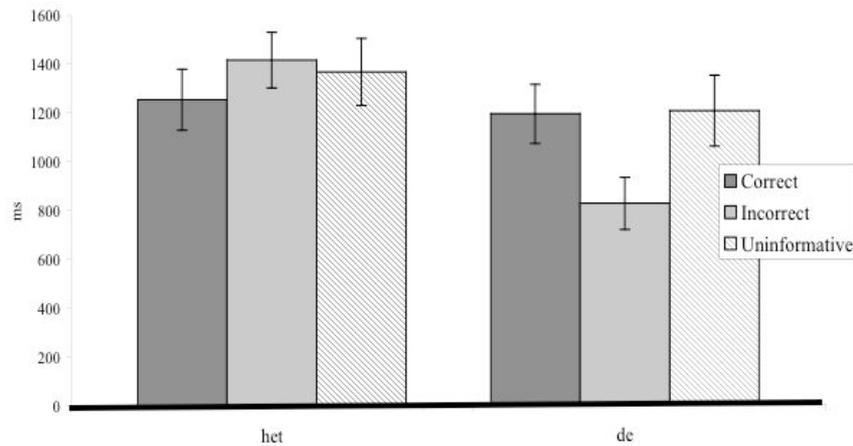


Figure 4. Toddler's latency to shift from the target to the distractor on het- versus de-word trials.

4. Discussion

The goal of the current study was to examine 28-month-old Dutch-learners' knowledge of gender agreement between determiners and nouns. Recognition of familiar nouns was tested in three different contexts: correct and informative gender (the picture was accompanied by a spoken description using correct gender and the other picture on the screen would require different gender), correct but uninformative gender (both pictures on screen have same gender), and incorrect gender. We predicted that if toddlers have knowledge of the linguistically appropriate use of gender-marked determiners, then they should recognize target words faster when they are provided with correct and informative gender as opposed to incorrect or uninformative gender. This hypothesis was examined by comparing how quickly toddlers shifted from the distractor to the target during Correct, Incorrect, and Uninformative Trials. On de-word trials, toddlers were faster to shift from the distractor to the target on Correct Trials than on Incorrect or Uninformative Trials. Toddlers were equally slow to shift on Incorrect and Uninformative Trials. Thus, on de-word trials, toddlers' behavior supported the hypothesis that Dutch-learning 28-month-olds are sensitive to gender-marking on definite determiners. On het-word trials, however, toddlers shifted from the distractor to the target with equal speed regardless of trial type. Thus, on het-word trials, we found no evidence that Dutch-learning 28-month-olds are sensitive to gender-marking on definite determiners.

In a second analysis, toddlers' latency to shift from the target to the distractor was examined. We predicted that if toddlers have knowledge of the linguistically-appropriate use of gender-marked determiners, then they would be faster to shift off of the target during Incorrect Trials than during Correct or Uninformative Trials because the determiner carried misleading information on the Incorrect Trials. For *de*-words, toddlers were indeed faster to shift to the distractor on Incorrect Trials than on Correct or Uninformative Trials. For *het*-words, however, participants once again showed no effect of trial type on shifting behavior. Thus, once again, toddlers' performance on *de*-word versus *het*-word trials varied.

The results of the current study confirm the hypothesis that Dutch-learning 28-month-olds are sensitive to the agreement between gender-marked determiners and nouns, however this sensitivity seems to be limited to common gender nouns. On *de*-word trials, toddlers shifted to targets fastest when targets were preceded by a gender-appropriate determiner. And a gender-inappropriate determiner caused toddlers to shift quickly away from the target. In contrast, no effect of trial type was observed during *het*-word trials.

At the outset of this experiment, we did not predict an asymmetry in infants' behavior on *het*- versus *de*-word trials. However, there are many potentially important differences between the distribution and use of *het* and *de*. These differences could impact how readily toddlers acquire *het* and *de*. First, *de*-words are far more frequent than *het*-words (van Berkum, 1996). Second, any *de*-word can become a *het*-word when it is produced in the diminutive. Third, the word *het* serves more than one grammatical function in Dutch. In some contexts, the word *het* means *it* (e.g. *het regent* 'it rains'). It seems that some or all of these factors could explain why the toddlers' in the current study showed sensitivity to gender-marking on common but not neuter gender nouns. The hypothesis that there is an asymmetry in the way Dutch children acquire *de* and *het* is supported by production studies showing that 4-year-olds routinely substitute *de* for *het*, but not vice versa (van der Velde, 2002).

There is a sizeable body of research demonstrating that English-learning toddlers perceive and process grammatical morphemes long before they begin producing them. This research has had a strong influence on theories of language acquisition. The current study has extended earlier work in this area by looking at the acquisition of grammatical morphemes in a language other than English. More specifically, we used an online measure to examine Dutch toddlers' processing of gender-marked definite determiners. Our results demonstrate that Dutch toddlers have at least some knowledge of the linguistically appropriate use of gender-marked determiners. Future work will need to further explore this issue in Dutch as well as in other languages. It is likely that very different patterns of acquisition will be discovered in different languages. For example, phonological predictors of noun gender are much stronger in Spanish than in Dutch. Therefore, one might predict that Spanish-learning toddlers would become sensitive to gender-marking earlier than Dutch-learning toddlers.

Endnotes

* Support for this research was provided by an NWO Spinoza Grant awarded to Anne Cutler. EKJ thanks all of the members of the Baby Research Center in Nijmegen for their research advice as well as their assistance in running and recruiting subjects. Tania Zamuner deserves thanks for helpful comments made on an earlier draft of this paper, and Paul Trilsbeek deserves thanks for his excellent technical assistance.

References

- Brown, R. (1957). Linguistic determinism and the part of speech. *Journal of Abnormal and Social Psychology*, 55, 1-5.
- Brown, R. (1973). *A first language: the early stages*. Cambridge, MA: Harvard University Press.
- Christophe, A., Guasti, T., Nespor, M., Dupoux, E., & van Ooyen, B. (1997). Reflections on phonological bootstrapping: its role for lexical and syntactic acquisition. *Language and Cognitive Processes*, 12, 585-612.
- Corbett, G. (1991). *Gender*. Cambridge: Cambridge University Press.
- Crisma, P., & Tomasutti, E. (2000). Phonological effects on article omission in the acquisition of Italian. *Proceedings of the 27th BUCLD*. Somerville: Cascadilla Press, 288-298.
- Echols, C.H., & Newport, E.L. (1992). The role of stress and position in determining first words. *Language Acquisition* 10, 127-142.
- Gerken, L.A., & McIntosh, B.J. (1993). Interplay of function morphemes and prosody in early language. *Developmental Psychology*, 27, 204-216.
- Guasti, M.T., de Lange, J., Gavarro, A., Caprin, C. (2003). Article omission: across child languages and across special registers. *Proceedings of the 27th GALA Conference in Utrecht, The Netherlands*.
- Hoehle, B., & Weissenborn, J. (2003). German-learning infants' ability to detect unstressed closed-class elements in continuous speech. *Developmental Science*, 6, 122-127.
- Hollich, G., Rocroi, C., Hirsch-Pasek, K. & Golinkoff, R. (1999). Testing language comprehension in infants: introducing the Split-screen Preferential Looking Paradigm. Poster Presented at The Society for Research on Child Development, New Mexico.
- Johnson, E.K. (in press). English-learning infants' representations of word-forms with iambic stress. *Infancy*.
- Landau, B. & Gleitman, L. (1985). *Language and experience: evidence from the blind child*. Cambridge, MA: Harvard University Press.
- Maratsos, M. (1974). Preschool children's use of definite and indefinite articles. *Child Development*, 45, 446-455.
- Mills, A.E. (1986). *The acquisition of gender: a study of English and German*. Berlin: Springer.
- Morgan, J. (1986). *From simple input to complex grammar*. Cambridge, MA: The MIT Press.
- Petretic, P.A. & Tweney, R.D. (1977). Does comprehension precede production? The development of children's responses to telegraphic sentences of varying

- grammatical adequacy. *Journal of Child Language*, 4, 201-209.
- Quine, W. (1960). *Word and Object*. Cambridge, MA: The MIT Press.
- Shady, M. (1996). Infants' sensitivity to function morphemes. Unpublished doctoral dissertation, SUNY Buffalo.
- Shafter, V.L., Shucard, D.W., Shucard, J.L., & Gerken, L. (1998). An electrophysiological study of infants' sensitivity to the sound patterns of English speech. *Journal of Speech, Language, and Hearing Research*, 41, 874-886.
- Shipley, E., Smith, C., & Gleitman, L. (1969). A study in the acquisition of language. *Language*, 45, 322-342.
- Shi, R., Werker, J., & Cutler, A. (2003). Function words in early speech perception. In M.J. Sole Recasens, & F. Romero (Eds.), *Proceedings of the 15th International Conference on Phonetic Sciences*, Barcelona, 3009-3012.
- Swingley, D., & Aslin, R.N. (2000). Spoken word recognition and lexical representations in very young children. *Cognition*, 76, 147-166.
- Swingley, D., Pinto, J.P., & Fernald, A. (2001). Continuous processing in word recognition at 24 months. *Cognition*, 71, 73-108.
- van Berkum, J.J. (1996). *The psycholinguistics of grammatical gender: studies in language comprehension and production*. Nijmegen University Press, The Netherlands.
- van der Velde, M. (2002). Determiner acquisition in Dutch and in French. *Proceedings of TIN-dag (Linguistics in The Netherlands)*.
- van de Weijer, J. (1999). Language input for word discovery. *MPI Series in Psycholinguistics*, 9.
- Wijnen, F., Krikhaar, E., & Den Os, E. (1994). The (non)realization of unstressed elements in children's utterances: evidence for a rhythmic constraint. *Journal of Child Language*, 21, 59-83.
- Zangl, R. & Fernald, A. (2003). Sensitivity to function morphemes in on-line processing: developmental changes from 18 to 36 months. Presented at the biennial meeting of the BUCLD, Boston, MA, October 2003.