Lexical noun phrases in texts written by deaf children and adults with different proficiency levels in sign language

Liesbeth Maria van Beijsterveldt [a]; Janet van Hell [ab]

[a] Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, The Netherlands [b] Department of Psychology, Pennsylvania State University, University Park, PA, USA

PLEASE SCROLL DOWN FOR ARTICLE

Routledge
Taylor & Francis Group

Lexical noun phrases in texts written by deaf children and adults with different proficiency levels in sign language

Liesbeth Maria van Beijsterveldt[a]* and Janet van Hell[a,b]

[a]*Behavioural Science Institute, Radboud University Nijmegen, Montessorilaan 3, PO Box 9104, Nijmegen, The Netherlands;* [b]*Department of Psychology, Pennsylvania State University, University Park, PA, USA*

We report an analysis of lexical noun phrases (NPs) in narrative and expository texts written by Dutch deaf individuals from a bimodal bilingual perspective. Texts written by Dutch deaf children and adults who are either proficient in Sign Language of the Netherlands (SLN) or low-proficient in SLN were compared on structures that either overlap in Dutch and SLN (presence of overt subject and object NPs, NP modifiers, and NP-internal agreement), or are absent in SLN (articles). We found that deaf participants experienced significant difficulty with lexical NPs. Further, deaf proficiently signing children (but not adults) more often omitted obligate articles than deaf low-proficiently signing children. Deaf proficiently signing children and adults did not differ from low-proficiently signing children and adults, however, in the use of NP modifiers, NP-agreement errors and omissions of obligatory NPs. We conclude that proficiency in sign language seems to affect particularly those aspects that differ substantially across sign language and oral language, in this case, articles. We argue that adopting a bimodal bilingual approach is important to understand the writing of deaf children.

Keywords: bilingualism; education of deaf children; language transfer

Consider the following two fragments of narratives dealing with social conflicts between people, written by an 11-year-old boy who is deaf and highly proficient in sign language, and an 11-year-old boy with typical hearing, respectively.

(1) Fiets gaat bijna laat vallen. [obligate article before 'Fiets' is missing]
'Bike is almost going to fall'
dan buurmevrouw had gezien. [obligate article before 'buurmevrouw' is missing]
'Then neighbourlady had seen'
en boos op jongen. [obligate article before 'jongen' is missing]
'and angry with boy'
mag niet gooien op grond. [obligate article before 'floor' is missing]
'cannot throw on floor'
en jongen was weg. [obligate article before 'jongen' is missing]

*Corresponding author. Email: L.vanbeijsterveldt@pwo.ru.nl

'and boy was gone'
[11-year-old deaf boy]

(2)   We waren op een morgen een belangrijke toets aan het doen.
'Once a morning we were making an important test.'
 De toets was best moeilijk.
'The test was pretty difficult.'
Een meisje uit onze klas had duidelijk een spiekbriefje.
'A girl from our class obviously had a cheat sheet.'
De juf zag het maar ze zei dat ze het niet had.
'The teacher saw it but she said that she didn't have it.'
Dat was best wel oneerlijk.
'That was pretty unfair.'
[11-year-old boy without hearing impairment]

For people with typical hearing, morphological and syntactic rules with respect to nominal phrases (NP) usually do not cause much trouble. For example, when writing *De toets was best moeilijk* 'The test was pretty difficult', a hearing writer of Dutch does not need to think thoroughly about whether an article must be produced or not. For people who are deaf, however, this is one of the many challenges they have to face when writing. We hypothesize that the errors observed in the writing of deaf individuals, like these in the above story fragment written by the 11-year-old deaf boy (omission of obligatory articles), can be explained by differences in morpho-syntax between sign language and written language. Before describing our study in more detail, we will discuss relevant studies on NP morphology and syntax in the writing of deaf children, discuss how variation in sign language proficiency may influence NP-internal errors and syntax in deaf individuals, and outline the bilingual perspective that we adopt to gain more insight into writing of deaf individuals.

Noun phrase morphology and syntax in deaf children's writing

Literacy skills of deaf children and adults have been the subject of an increasing number of studies. The majority of these studies focused on reading. Reading skills are investigated in relation to: phonology (see Transler 2001, for a review); language specific and general language knowledge, and sign language (see Musselman 2000, for a review); cognitive development (see Mayberry 2002, for a review); metacognition (see Strassman 1997, for a review); and working memory (Garrison, Long, and Dowaliby 1997). Further, implications of reading problems for instructional programs have been outlined (see Paul 1997, for a review) and a growing body of research deals with emergent literacy in young deaf children (Mayer 2007; Williams 2004).

In contrast to the acquisition of reading, acquisition of writing skills by deaf children has received relatively little attention in empirical research. Moreover, most of the literature on writing is based on English-speaking deaf children. In the 1970s, a large-scale study was performed in the USA on the morpho-syntactic development of English-speaking, prelingually profoundly deaf children between 10 and 19 years old, and hearing children between 8 and 10 years old (e.g. Quigley and King 1980; Quigley, Power, and Steinkamp 1977; Wilbur and Quigley 1975). The research involved a series of tasks (i.e. sentence completion and sentence correction tasks) and

written language samples to study specific morpho-syntactic structures in English. The results demonstrated that one of the linguistic areas that pose difficulties for deaf children concerns NPs: deaf children used NP patterns that were deviant from those of hearing children. One of the deviant patterns observed involved articles and other determiners. First, deaf children tended to omit an article in a context where it was obligatory. For example, they wrote *Boy is sick* rather than *The boy is sick*. Second, the deaf children showed problems combining different types of determiners. For example, they wrote *The some apple*... A third deviation in the writing of deaf children was the omission of subject and object NPs which are obligatory in English, such as in *John chased the girl and he scared Ø*, instead of *John chased the girl and he scared her*. In these studies, no information is provided about the language backgrounds of deaf children, such as variations in the use of and proficiency in sign language.

Difficulties with NP morphology were also found in deaf children from Hebrew- and Italian-speaking communities. Tur-Kaspa and Dromi (2001) studied NPs in spoken and written language of 13 Hebrew-speaking children who are severely to profoundly deaf and were between 11 and 13 years old. The children were enrolled in schools in which oral language was the instructional language. Written and spoken samples were collected using several elicitation methods. Results demonstrated that Hebrew-speaking deaf children relatively often omitted determiners in obligatory contexts. Second, they committed errors in grammatical agreement between the adjective and noun. Thus, instead of saying *tmuna levana axat* 'one white picture' (picture [feminine] white [feminine] one [feminine]), they said or wrote: *tmuna lavan exad* (picture [feminine] white [masculine] one [masculine]). Finally, they tended to omit whole obligatory NPs (i.e. the subject or the direct object).

Taeschner, Devescovi, and Volterra (1988) compared the writing of 25 Italian deaf children ranging in age between 11 and 15 years with that of children who are hearing ranging in age between 6 and 15 years. The deaf children attended both special and mainstream schools in which oral language was the instructional language, although use of sign language was not precluded. Some children were assumed to know sign language but their level of proficiency was not assessed. In Italian, articles are freestanding morphemes, which, in contrast to English, are marked for gender and number, controlled by phonological characteristics of the following noun (e.g. *il tavalo* 'the table'/*i tavoli* 'the tables'. Results showed that deaf children made errors that were not observed in children with typical hearing: they committed errors in gender as well as in number. For example, for the noun *fucile* (masculine singular), deaf children choose the article *le* (feminine plural) instead of the correct article *il* (masculine singular). Thus, difficulties with NPs have been observed in the writing of English, Hebrew, and Italian deaf children.

Previous studies on NPs in English, Hebrew, and Italian deaf children thus showed that NP morphology and syntax is one of the areas that are particularly difficult for deaf children. The exact linguistic aspects that pose such difficulties, however, are closely related to the typological features of the written language involved. The Dutch NP morphological system differs in complexity from that of English, Italian, and Hebrew (Ravid et al. 2002). English has a rather impoverished system of NP morphology, which does not mark for grammatical gender distinctions. The studies discussed above indeed show that the problems English deaf children have with NPs are not related to gender agreement between modifier and noun, but to the presence or absence of obligatory articles and combinations of articles and

other modifiers. Italian and Hebrew, in contrast, are languages with richer systems of NP morphology: in both Italian and Hebrew, nouns govern NP-internal agreement between a noun and its associated modifiers. Both Italian-speaking and Hebrew-speaking deaf children indeed showed errors in gender agreement, which mirrors the rather complex gender systems in Italian and Hebrew (Taeschner, Devescovi, and Volterra 1988; Tur-Kaspa and Dromi 2001).

Further, English and Dutch generally require overt subject NPs. Italian and Hebrew, in contrast, are null-subject languages. In a null-subject language, subjects may be phonetically absent, but are syntactically present through verb inflection and agreement. In writing, however, Hebrew, Italian, and English deaf children tend to omit subject and object NPs in obligatory contexts (e.g. Quigley and King 1980; Taeschner, Devescovi, and Volterra 1988; Tur-Kaspa and Dromi 2001).

Empirical research on NPs in writing of Dutch deaf children is still lacking. Considering the fact that there are unique typological features for each language, an important objective of the present study was to investigate this linguistic area in Dutch deaf children to provide diagnostic information needed to develop fine-tuned intervention and remediation tools for Dutch.

A bilingual perspective

Deaf children often have either late or limited exposure to Dutch because of their hearing impairment. Moreover, many individuals who are deaf use sign language as their main language of communication, although variation exists among people who are deaf in the use of and proficiency in sign language. Deaf children who use a signed language and an oral/written language thus receive a quantitatively different amount of language input compared to deaf children who hardly ever use sign language and hearing children, as well as a qualitatively different type of language input. The majority of previous studies on writing acquisition of deaf children, however, did not take variations in children's proficiency in sign language into account, and treated deaf children as a single and uniform group in the comparison with children who are hearing. Given the differences in the amount and type of language input among deaf children (with high or low proficiency in sign language) and children who are hearing, it can be expected that the developmental trajectories in learning to write in an oral language will be different for these groups of children. This idea follows from theories and research on bilingualism (e.g. Döpke 2000; Gathercole 2002; Kohnert, Bates, and Hernandez 1999; MacWhinney 2005; Pavlenko and Jarvis 2002; Van Hell and Dijkstra 2002; White 2003).

A central idea in theories on bilingualism is that knowledge of one language can affect performance in another language, which is referred to as *transfer* (e.g. Odlin 1989). Transfer is evidenced in many areas, such as phonology, lexicon, morpho-syntax, and pragmatics. The Competition Model (MacWhinney 2005) makes specific claims with respect to transfer of morpho-syntax. Because morpho-syntax is the most language-specific part of the target language, mappings between languages are difficult to make. It is claimed that there is no transfer of the exact morphological forms, but transfer of the underlying functions expressed by the morphological devices. When the function of a certain structure is absent in the first language, however, these structures are particularly difficult to learn. Article marking, for example, is difficult for learners of English whose native language has a different system, or no system, of marking definiteness (e.g. Jarvis 2002; Johnson and Newport

1989; Robertson 2000; Sharma 2005; White 2003). Chinese, for example, has no articles, but instead uses classifiers and plurals to express only some of the functions marked by the English definite article. Indo-Aryan languages also lack a definite article and mark definiteness via word order and/or case-marking. These differences in marking definiteness across languages seem to place a major obstacle in the learning of English by speakers of Chinese or Indo-Aryan languages. A similar mechanism, but with respect to a different linguistic area, had been found in English learners of German (MacWhinney 2005) and Spanish (Gathercole 2002). In German and Spanish, nouns are marked for grammatical gender, whereas English nouns are not. Consequently, English learners of German or Spanish have a hard time learning the gender marking system because they have no basis for transferring the English gender system to German or Spanish.

Theories and studies on bilingualism and transfer, however, are typically based on the development of spoken languages having written forms. To date, there has been little research looking at bimodal bilingual development, which involves two languages in different modalities: an oral language that is perceived auditorily and produced orally, and a signed language that is perceived visually and produced manually (e.g. Emmorey 2002; see Chamberlain and Mayberry 2000; Padden and Ramsey 2000; Strong and Prinz 1997, for bimodal bilingual perspectives on reading achievement). An important question is whether the processes underlying transfer as observed in individuals who are bilingual in two oral languages also apply to individuals who are bilingual in two languages in different modalities: an oral language and a signed language.

In the present study, we focus on the writing of bilingual deaf children who also use a signed language. Research on this type of bilingualism is still in its infancy. Few empirical studies actually investigated the writing of individuals who are deaf from a bilingual point of view, and addressed the influence of sign language on written language. Mayer and Wells (1996) argued that as a result of the differences in morphological processes between sign language and oral language, there is not always a one-to-one correspondence between a distinct sign and a printed word. They claimed that because certain morphological features of signs are not expressed in the same way in print, these functions are often omitted in the writing of people who are deaf and mainly use sign language.

In a recent study, Singleton et al. (2004) compared the use of vocabulary in the narratives of elementary school deaf children with various levels in proficiency in ASL (as assessed by an ASL proficiency test) with that of second language learners of English who are hearing and monolingual speakers of English who are hearing. Vocabulary analysis included the use of frequent words (following the list of 105 Most Frequent Words Used for Coding Writing Samples, Hillerich 1978, as cited in Singleton et al. 2004), unique words (*type-token ratio*), and function words (i.e. articles, prepositions, pronouns, conjunctions, adverbials, auxiliaries, copula, quantifiers, and negations). They found that narratives written by individuals who were proficient in ASL contained semantically richer vocabulary, and consisted of more non-frequent and unique words, than narratives written by individuals who were low-proficient in ASL and second language learners of English who are hearing. Further, they found that individuals who are proficient in ASL used very few function words. Remarkably, most of the function words that they used had a common ASL sign equivalent.

Van Beijsterveldt and van Hell (2009a) examined another aspect of narrative writing that may be influenced by proficiency in sign language, namely the use of enriching evaluative expressions, which is an extremely important narrative tool in sign language. The researchers assessed sign language proficiency and on the basis of the task scores they divided the deaf children into proficient and low-proficiency groups. From the bimodal bilingual perspective, it can be argued that deaf children who are proficient in sign language use their knowledge of communicative affective expressions from sign language to enrich their written narratives. Van Beijsterveldt and van Hell indeed found that deaf children who are proficient in sign language used more evaluative devices in writing (i.e. evaluations of objects or persons and references to emotional states) than deaf children who are low-proficient in sign language (and than hearing monolingual and bilingual children).

In the present study, we assessed proficiency in SLN and compared the writing of deaf children and adults who had high scores on the SLN task with the writing of their deaf peers who had low scores on the SLN task. As will be explained in more detail in the next section, the NP systems in Dutch and SLN show both overlapping features and differences. If knowledge of (and fluency in) one language affects performance in another language, and if such transfer effects also occur across languages from different modalities, it can be expected that deaf individuals who are proficient in SLN experience more difficulty with linguistic features that are absent in sign language, like the expression of obligate articles in their written Dutch, than deaf individuals who are low-proficient in SLN (and individuals who are hearing). Likewise, it is predicted that deaf individuals who are proficient in SLN experience fewer problems with linguistic features that overlap in signed language and oral language.

The structure of Dutch and Sign Language of the Netherlands

As we explained above, a possible explanation for the problems deaf children experience with morpho-syntax in oral language can be found in differences between sign language structure and oral language structure. Signed languages and oral languages differ in several ways. First, signed languages have a more simultaneous organization as opposed to oral languages that are organized more sequentially. Second, sign languages make linguistic use of the space in front of the body, called the 'syntactic signing space'. For example, when communicating about referents during conversation, signers point to positions in space to refer to them. Third, in sign languages, not only are the hands used for linguistic expression, but also the face, head, and body. For example, in most sign languages, the non-manual grammatical marker 'raised brows' and 'head and shoulders forward' marks yes–no interrogatives. Sentences produced without this marker would be interpreted as a statement (Liddell 1980). Finally, sign languages differ from oral languages in the construction of (morphologically complex) words (e.g. Emmorey 2002). In oral languages, derivations and inflections are most often formed by adding prefixes or suffixes to a stem word, which are directly represented in phonological–graphological mappings between speech and written text. In sign languages, derivational and inflected forms most often result from processes implying a change of the movement direction, orientation, and/or location of the sign stem. For example, in English, nouns can be derived from verbs by adding a suffix (e.g. *move- movement*). American Sign Language (ASL) can derive noun signs by changing the movement pattern.

Below we briefly describe how Dutch and SLN overlap or differ with respect to NPs. SLN and Dutch differ most substantially in the use of articles. In Dutch, as in English, NPs require or do not require an article, depending on the context. In clauses such as *De boeken zitten in de tas* 'The books are in the bag', the presence of the article before *boeken* is obligatory. In clauses such as *Er zitten boeken in de tas* 'There are books in the bag', an article before *boeken* is obligatorily absent. In SLN, the function of definiteness is not present and articles do not exist.

Further, Dutch has a covert gender system: the noun's gender controls the form of various attributive modifiers (i.e. articles, demonstratives, possessives, adjectives, and numerals), but it is not visible in the form of the noun itself. Nouns in Dutch are distributed across two grammatical genders (Haeseryn et al. 1997). Nouns that take the singular definite article *het*, such as *het boek* 'the book', are referred to as having 'neuter' gender. Nouns that take the singular definite article *de* such as *de tas* 'the bag', are referred to as having 'non-neuter' gender. In plural nouns, the article 'de' is used for both neuter and non-neuter gender nouns. (For an overview of the Dutch gender system, see van Berkum 1996.) Table 1 presents an overview of the Dutch-modifying elements, in neuter and non-neuter singular and plural NPs.

The rules for adjective inflection in Dutch are rather complex. Adjectives in indefinite NPs, as in countable nouns, e.g. *een kleine tas* 'a small bag', or in non-countable nouns, e.g. *rode wijn* 'red wine', are marked for gender. That is, a schwa is added to the end of the adjective for non-neuter singular nouns, whereas the citation form is used for neuter singular nouns (e.g. *een klein boek* 'a small book', in countable nouns, and *hard geluid* 'loud noise', in non-countable nouns). For adjectives in definite NPs, as *de kleine tas* 'the small bag', a schwa is added to the end of the adjective for both neuter and non-neuter singular nouns. In plural, a final schwa is added to the adjective in the case of neuter as well as non-neuter nouns. The construction of plural nouns in Dutch requires a modification of the ending of the noun. The modification does not depend on gender but on noun type. Two most common plural markers are -*en* (e.g. *boeken* 'books') and -*s* (e.g. *tafels* 'tables').

In SLN, the function of modifying a noun is present, although modifying elements (i.e. demonstratives, possessives, numerals, and adjectives) are expressed

Table 1. NP modifiers in the Dutch gender and number system.

	Non-neuter gender		Neuter gender		English equivalent	
	Singular	Plural	Singular	Plural	Singular	Plural
Definite article	de tafel	de tafels	het boek	de boeken	the book/table	the books/tables
Demonstrative pronoun	die tafel	die tafels	dat boek	die boeken	that book/table	those books/tables
	deze tafel	deze tafels	dit boek	die boeken	this book/table	these books/tables
Possessive pronoun	onze tafel	onze tafels	ons boek	onze boeken	our book/table	our books/tables
Adjective in definite NP	de grote tafel	de grote tafels	het grote boek	de grote boeken	the large book/table	the large books/tables
Adjective in indefinite NP	een grote tafel	grote tafels	een groot boek	grote boeken	a large book/table	large books/tables
Numeral	één tafel	twee tafels	één boek	twee boeken	one book	two books/tables

and marked differently than in Dutch. The expression of modifiers and the rules that govern agreement with nouns are rather complex and depend on phonological properties of the noun (Schermer 1991). In some cases, adjectives and numerals are expressed by a separate sign, for example, SNEL 'FAST' and MOEILIJK 'DIFFICULT'. In other cases, modifying elements are incorporated in the sign for the noun by changing one of the basic elements, that is, hand form, movement, or the non-manual part of the sign. For example, in signs such as BAL 'BALL' and HUIS 'HOUSE', the size of the sign provides information about the size of the referents. By simultaneously making the sign larger, moving the upper part of the body backwards, opening wide the eyes, and making a chubby face, the meaning of the sign changes to GROTE BAL 'BIG BALL', or GROOT HUIS 'BIG HOUSE'. Also, the rules for expressing plurality are not unambiguous. Plurality can be expressed by reduplicating the sign for the noun, or by using two hands (Harder 2003; Nijhof and Zwitserlood 1990). To refer to large amounts, the sign for GEBIED 'AREA' is also used.

Finally, Dutch requires overt subject NPs. SLN, in contrast, is a pro-drop language: subject and object NPs in SLN need not be expressed overtly or independently when agreement is marked on verbs. SLN has a multiple verbal agreement system: verbs can be marked for subject as well as object (see Bos 1990, for research on verbal agreement in SLN). As a consequence of this, Bos (1993) found that subject NPs are often expressed lexically, and not inflectionally, whereas objects tend to be expressed inflectionally (through agreement with the verb). However, agreement and pro-drop are not necessarily correlated. For instance, both a subject and an object can be expressed independently by a pronoun when they are also marked on the verb, and null arguments also occur in the absence of agreement.

The present study

The present study aimed to provide more insight into the writing of deaf children by studying lexical NPs in written narrative and expository texts. In the analysis of NPs (in function of subject, object, and predicate) in Dutch written texts, we focused on (1) the use of NP modifiers in NPs (i.e. demonstratives, possessives, numerals, and adjectives); (2) NP-internal errors (i.e. presence or absence of obligatory articles, and gender and number agreement between modifier and noun); and (3) omissions of NPs in obligatory contexts.

The main question was to what extent sign language proficiency influences the writing of children and adults who are proficient in sign language and that of children and adults who are low-proficient in sign language. The majority of previous studies on writing skills have attempted to only describe errors in the written language of deaf children. Empirical research that systematically investigated possible explanations for the specificities in the writing of children and adults who are deaf, however, is largely lacking. Specifically, previous research has not taken into account that deaf people may vary in proficiency in sign language. We assessed proficiency in SLN and compared texts written by deaf individuals who were proficient in SLN with those of deaf individuals who were low-proficient in SLN, and hearing age-matched peers who are not familiar with sign language, and examined how variations in sign language proficiency may influence writing. As we explained above, the NP systems in Dutch and SLN show both overlapping features and differences. In both Dutch and SLN, the functions underlying subject and object marking, modifying nouns, and forming agreement between words of different

grammatical classes, are present, although there are differences in the way these are expressed. In contrast, Dutch and SLN differ substantially with respect to the function of marking definiteness: Dutch requires overt articles in definite NPs, whereas SLN marks no definiteness and has no overt articles. If knowledge of (and fluency in) one language affects performance in another language, and if such transfer effects also occur across languages from different modalities, it can be expected that deaf individuals who are proficient in SLN experience more difficulty with linguistic features that are absent in sign language and oral language, like the expression of obligate articles in their written Dutch, than deaf individuals who are low-proficient in SLN (and individuals who are hearing). Likewise, because the functions underlying subject and object marking and of modifying nouns are present in both SLN and Dutch, it is predicted that individuals who are deaf and proficient in SLN experience less problems with agreement, the use of obligatory subject and objects, and NP modifiers in writing; hence, their performance will be largely comparable to that of deaf individuals who are low-proficient in SLN.

Previous studies investigating writing of individuals who are deaf focused on either elementary school students (Quigley and King 1980; Singleton et al. 2004; Taeschner, Devescovi, and Volterra 1988; Tur-Kaspa and Dromi 2001; Van Beijsterveldt and Van Hell 2009b) or adults (Fabbretti, Volterra, and Pontecorvo 1998). The present study aimed to explore the influence of sign language on writing in different age groups. Because narrative and expository writing are parts of later language development (Nippold 2007), we examined writing from the age of 11–12 years onwards, and compared the writing of 11–12-year olds, 15–16-year olds, and adults.

Finally, we examined the influence of sign language on writing in two genres: narratives and expository texts. Previous studies on writing in individuals who are deaf mainly studied one specific genre, written narratives. Written narrative texts and expository texts are characterized by two distinct styles of discourse (e.g. van Hell, Verhoeven, and van Beijsterveldt 2008; van Hell et al. 2005). Narratives focus on actions and motivations and express the unfolding of events in a temporal framework. Expository texts focus on issues and ideas and express the unfolding of claims and argumentation in causal and other logical contexts. Although the writing of formal texts like expository text becomes more important than that of narrative text in later stages of schooling and in work settings, little is known about the development of expository text writing in children, adolescents and adults with typical as well as atypical development (e.g. Nippold, Mansfield, and Billow 2007), including children and adults who are deaf.

Method

Participants

Three age groups of Dutch individuals who are deaf participated in the study: 31 children aged 11–12 years ($M = 11.9$, range $= 11.0–12.11$), 31 high-school students aged 15–16 years ($M = 16.0$, range $= 15.1–16.9$), and 15 adults ($M = 30.7$, range $= 21.0–51.0$). To replicate earlier studies on writing in deaf children, and to compare the writing of deaf individuals with a reference group, we also included age-matched hearing native speakers of Dutch, in particular, 20 children aged 11–12 years, $M = 12.2$, range $= 11.4–12.2$, 20 high-school students aged 15–16 years, $M = 16.2$, range $= 15.3–16.8$, and 20 adults, $M = 25.5$, range $= 18.8–40.3$).

Selection criteria for deaf participant inclusion were pre-lingual, severe to profound deafness (>80 dB hearing loss on the better ear), and no learning disabilities other than those caused by deafness. Eight of the 11–12-year olds, two 15–16-year olds, and one adult had a Cochlear implant. They were implanted after at least 4 years of age and had worn their CI for 2–7 years. The remaining deaf participants wore other types of hearing aids. The deaf children were recruited from schools for deaf students, schools for hard of hearing students, and ambulatory educational services for deaf students enrolled in mainstream schools in the Netherlands. The deaf adults were recruited via advertisements at special schools for deaf students, the Institute of Signs, Language and Deaf Studies at HU University of Applied Sciences, and local welfare foundations.

We administered a detailed questionnaire to deaf participants that included questions about literacy background (i.e. reading and writing), educational background (i.e. type(s) of schooling and language of instruction), and language background (i.e. language use with parents, siblings, and friends). Questionnaires were administered to the participants by an experimenter who was proficient in Dutch and SLN. Information that was unknown to the participants (such as children's audiograms) was looked up in the personal files available at the schools or was provided by teachers. The literacy background questionnaire demonstrated that the deaf participants used written language regularly. Twenty-two percent of the 11–12-year olds, 71% of the 15–16-year olds, and 53% of the adults read newspapers weekly. Eighty-seven percent of the 11–12-year olds, 68% of the 15–16-year olds, and 87% of the adults use books of reference monthly. Eighty-seven percent of the 11–12-year olds, 55% of the 15–16-year olds, and 47% of the adults read at least one novel a month (the remaining participants indicated they read at least one novel a year). Seventy-four percent of the 11–12-year olds, 77% of the 15–16-year olds, and 60% of the adults read magazines monthly. Forty-five percent of the 11–12-year olds, 94% of the 15–16-year olds, and 93% of the adults write in leisure time weekly (e.g. diary, letter, story, and poem).

Below, we give a detailed description of the educational and language backgrounds of deaf participants who were proficient in sign language and deaf participants who were low-proficient in sign language, for each of the three age groups. The justification for dividing deaf participants into proficient and low-proficiency groups is discussed in the Materials and Procedure section.

Proficient signers

The 11–12-year-old and 15–16-year-old proficient signers learned Dutch and SLN in special primary and secondary schools for deaf students. The classroom language of instruction for these children was Sign Language of the Netherlands, which was frequently combined with Sign Supported Dutch. At home, the main language of communication for these children was SLN which was often used in combination with Sign Supported Dutch, with the exception of one 11–12-year-old child and two 15–16-year-old children with deaf parents who only used SLN, and one 15–16-year-old with a deaf brother and sister who also used only SLN at home.

Adults were educated in special primary and secondary schools for deaf students. Before the 1980s, the only language available to deaf children in special schools was oral Dutch without sign language. However, all adults pointed out that they have used sign language at home from an early age. Seven adults were educated in special

primary and secondary schools for deaf students. Three of them had two deaf parents, and four had two hearing parents. One participant (with hearing parents) had a deaf sibling.

Low-proficient signers

The 11–12-year olds and 15–16-year olds learned Dutch in special schools for deaf students (three 11–12-year olds; 11 15–16-year olds), special schools for hard-of-hearing children (five 11–12-year olds) or mainstream schools (seven 11–12-year olds). Seven 15–16-year olds were educated in either special or mainstream primary schools followed by mainstream secondary schools. Children who were educated in mainstream schools were always supported by ambulatory education services. The classroom language of instruction for most children was Dutch, sometimes supported with signs at special schools for deaf students. At home, all children used Dutch.

Eight of the adults were educated in special primary and secondary schools for deaf students, and one adult was educated in mainstream schools. As noted before, before the 1980s, the only language available to deaf children in special schools was Dutch without sign language. At home, during school years, all adults used Dutch, sometimes supported with signs. Some of them learned SLN later in life.

Materials and procedure

Participants were tested individually at different locations. The majority of the children were tested at their schools. Eleven percent of the deaf children were tested at their homes. Hearing adults were tested in the lab and deaf adults were tested at different locations. Participants who were not tested in the lab or at school were tested in a separate room were they could work undisturbed. Below, the procedures for the writing task, the sign language task, and the reading task are described separately in more detail.

Writing task

The procedures for eliciting narrative and expository texts were designed in a large-scale international, interdisciplinary research program on later language development in different contexts and in (seven) different languages (e.g. Berman and Verhoeven 2002; Ragnarsdóttir et al. 2002; Ravid et al. 2002; Reilly et al. 2002; Van Hell, Verhoeven, and Van Beijsterveldt 2008). Participants were asked to write a personal story and an expository text about problems between people/children. To demonstrate what we meant by 'problems between people', participants were shown a three-minute video clip without words that showed fragments with teenagers involved in different social, moral, and physical conflicts. For example: a moral conflict of whether to cheat in an exam or return a purse someone dropped; a social conflict of how to treat a new student who interfered in a conversation; and a physical conflict of fighting during recess. Participants were then asked to write a story about a conflict situation in which they had been involved or an incident of interpersonal conflict they had experienced: ('You have seen all kinds of problems. We are gathering stories about problems between people/children. Write a story about something you experienced yourself of something you have seen, so a situation

in which you or someone else had a problem with someone'). They were specifically instructed not to retell the fragments they had seen in the video, but to write a story about something they had experienced or seen themselves. Participants were also asked to write an expository text discussing the issue of interpersonal conflicts. Specifically, they were asked to write an expository text about problems between people: ('Discuss the subject and give your opinion'). Hearing participants received instructions on paper. The deaf participants received instructions in Dutch or in SLN in line with their preferred way of communication. The instruction in Dutch was on paper. The instruction in SLN was given by a teacher of SLN in an instruction video. We always verified that participants understood the instruction. This means that the experimenter repeated (parts of the) instruction in oral Dutch, SLN or Sign Supported Dutch.[1] The order in which the writing tasks were performed was counterbalanced. The participants were not limited in time when writing their texts. The linguistic coding of written text is described in a separate section below.

Sign language task

To be able to divide the deaf participants into a group that is high proficient in SLN and a group that is low-proficient in SLN, we administered a sign language proficiency task. Children were administered a production task which assesses the use of a variety of SLN structures of syntax and morphology (i.e. verbs of motion, verb agreement, aspect, and number marking on verbs) (Hermans, Knoors, and Verhoeven 2007). Instructions were given by a trained teacher of children who are deaf, who was proficient in SLN and oral Dutch. The instructions were given in SLN, Sign Supported Dutch, or oral Dutch in line with the preferred method of communication. Children first saw an example in which a picture was described in SLN by an SLN-speaker on a laptop screen. Next, children described a comparable picture in SLN themselves, which was recorded. Participants were instructed not to use their voice. The task consisted of 32 items. Scoring included right–wrong assessments on each item. The task was scored by fourth year students who were trained to become a sign language interpreter, and the correlation between their scores was 0.86. On the basis of a visual inspection (box plots) of their test scores, children were classified as proficient or low-proficient in SLN. A proficient rating was assigned to children who scored 15 or above ($M = 19.00$, SD $= 2.66$, $n = 15$, range $= 15$–22), and a low-proficient rating was assigned to children who scored below 11 ($M = 3.69$, SD $= 4.30$, $n = 16$, range $= 0$–11).

Because this test is designed to measure proficiency in SLN in children in primary education only, we used a different sign language fluency task for 15–16-year olds and adults. We asked participants (via a written instruction, similar to the instruction for the written narratives) to sign a short narrative in front of a camera. A native SLN speaker of SLN (who is deaf) assessed the quality of the narratives on the use of morpho-syntax (i.e. hand configurations, verb inflection, word order, and non-manual components), on a scale from 0 to 5. A proficient rating was assigned to 13 students aged 15–16 years and seven adults who scored 3 or higher ($M = 3.76$, SD $= 0.97$) and a low-proficiency rating was assigned to 18 students aged 15–16 years and eight adults who scored 2 or lower ($M = 0.54$, SD $= 0.76$). To ensure reliability of scoring, a second rater (who was a trained teacher of SLN) scored the same narratives using the same procedure. Cohen's Kappa's coefficient was 0.66, indicating substantial agreement between raters (Landis and Koch 1977).

Reading comprehension

To obtain more insight into proficient signers' and low-proficient signers' oral literacy skills, we compared proficient and low-proficient signers' levels of reading comprehension. Reading Comprehension Tests scores (Aarnoutse 1996) were obtained for the 11–12-year-old and the 15–16-year-old children (for 46 of the 62 children) in previous research (see also, Wauters, van Bon, and Tellings 2006). The Reading Comprehension Tests include different tests for each grade in elementary school, all consisting of 10 reading texts and a total of 25–30 multiple choice questions. Classroom teachers judged which test was appropriate for each child. The tests were administered by the classroom teacher. In the case of deaf students in mainstream education, the Reading Comprehension Tests were administered by the special teacher who offered ambulatory educational service. No time limits were set for completing the tests.

Linguistic coding of written texts

All texts were transcribed and coded using the CLAN program of the CHILDES International Child Language Data Base (MacWhinney 1995). Texts were coded for basic measures of writing (number of clauses, number of abstract nouns, and lexical density) and for the distribution of lexical NPs, NP modifiers, NP-internal errors, and omissions of obligatory NPs.

Basic measures of text writing

Text length. Texts were divided into clauses, following Berman and Slobin's (1994) definition of a clause as: 'any unit that contains a unified predicate'. Predicate is defined as follows: 'a predicate expresses a single situation (activity, event, state), including finite and nonfinite verbs, as well as predicate adjectives'. Texts were divided into clauses by two raters and the proportion of agreement between raters was 0.99 for expository texts and 0.99 for narrative texts.

Lexical density. For each text, lexical density was calculated. Lexical density was defined as the proportion of content words (nouns, verbs, adjectives, and adverbs) in relation to total words (Strömqvist et al. 2002). Content words were scored by two raters and the proportion of agreement between raters was 0.97 for expository texts and 0.97 for narrative texts.

Abstract nouns. For coding abstract nouns, we used The Noun Scale developed by Ravid (2006) for ranking and classifying nouns in their textual context. Abstract nouns were scored by two raters and the proportion of agreement between raters was 0.78 for expository texts and 0.69 for narrative texts. The number of abstract nouns in each text was divided by total words in that text.

Lexical NPs

Each text was scored for total number of lexical NPs to obtain insight into the frequency of use of this structure. Lexical NPs can function as subject, object and predicate, and are distinguished from pronominal NPs (e.g. personal pronouns, impersonal pronouns, and other pronouns, such as demonstrative pronouns and possessive pronouns). An example of a lexical NP in subject function is: *Het feest*

werd voortgezet in de flat van Jan z'n vader ('The party was continued in the apartment of Jan's father') [Berend, hearing, Adult, narrative]. The mean numbers of lexical NPs per text for each group are presented in Table 5. Lexical NPs were scored by two raters and the proportion of agreement between raters was 0.90 for expository texts and 0.90 for narrative texts.

NP modifiers. Lexical NPs were scored for the number of times an NP modifier (i.e. demonstratives, possessives, numerals, and adjectives) was used. NP modifiers were scored by two raters and the proportion of agreement between raters was 0.80 for expository texts and 0.74 for narrative texts. In each text, the percentages of total modifiers, that is, demonstratives, possessives, adjectives, and numerals, were calculated out of the total number of lexical NPs to control for differences in the amounts of lexical NPs in the texts.

NP-internal errors. Each text was scored for the number of times a specific NP-internal error occurred. Table 2 presents an overview of types of morphological errors

Table 2.   Types and descriptions of NP-internal errors.

Type of NP morphological error	Description and example
Omission of obligatory article	Omission of article (or other modifier) in an obligatory context Example *Ik pestte haar zelfs totdat < - > lerares ingreep [deaf female adult, narrative] Ik pestte haar zelfs totdat <de > lerares ingreep *[I teased her even until < - > teacher intervened] [I teased her even until <the > teacher intervened]
Addition of article	Addition of article in NP where article is not allowed Example *Hierdoor worden de anderen buitengesloten of ontstaat er **een** geweld. [deaf female adult, expository text] Hierdoor worden de anderen buitengesloten of ontstaat er geweld *[Because of this the others will be excluded, or **a** violence comes up] [Because of this the others will be excluded, or violence comes up]
Gender disagreement	Gender agreement error between modifier and noun Example *In de aula kan ik niet veel volgen omdat ik **de** enige dove meisje ben. [deaf girl, 15 years old, narrative] In de aula kan ik niet veel volgen omdat ik **het** enige dove meisje ben [In the lunchroom I can't follow much because I am **the** only deaf girl]
Number disagreement	Number agreement error between modifier (i.e. numeral) and the noun Example *Drie meisje-ø durven niet naar huis [deaf girl, 16 years old, narrative] Drie meisje <s > durven niet naar huis *[Three girl-ø are afraid to go home] [Three girl <s > are afraid to go home]

that were scored, with examples from the written texts. In each text, the percentages of total morphological errors, omissions of obligatory articles, additions of articles, gender agreement errors, and number agreement errors were calculated out of the total number of lexical NPs. NP internal errors in narratives were scored by two raters. The proportion of agreement between raters was 0.83 for omissions of obligatory articles, 0.85 for addition of obligatory articles, 0.79 for gender agreement errors, and 0.89 for number agreement errors.

Omission of obligatory NPs. Each text was scored for the number of times an NP was missing. An example of a missing direct object in a clause is: Wij vinden Ø niet leuk ('We don't like Ø') [deaf boy, 11 years old, narrative]. An example of a missing subject is: Je moet geen ruzie maken anders wordt Ø nog erger ('you must not fight or else Ø gets even worse') [deaf girl, 11 years old, expository]. Finally, in each text, the percentage of omissions of obligatory NPs in obligatory context, in subject and direct object position, was calculated out of the total number of clauses. Omissions of obligatory NPs in narratives were scored by two raters, and the proportion of agreement was 0.76.

Results

We compared deaf individuals who are proficient in SLN and deaf individuals who are low-proficient in SLN with hearing age-matched peers on: (1) reading comprehension level; (2) basic measures of text writing (text length, lexical density, number of abstract nouns); and (3) lexical NPs (use of NP modifiers, NP internal errors, omissions of obligatory NPs).

Reading comprehension

A sign language proficiency (deaf proficient signers vs. deaf low-proficient signers) × Age (11–12 years old vs. 15–16 years old) ANOVA showed that proficient and low-proficient signers did not differ significantly from each other in their levels of reading comprehension.[2] Means and SDs are presented in Table 3. The effect of Age indicated a developmental pattern in reading comprehension level: 15–16-year olds had higher scores on the reading comprehension test than the 11–12-year olds, $F(1,42) = 10.36$, $p < 0.01$, $\eta^2 = 0.25$. There was no significant interaction effect between Sign language proficiency and Age.

Table 3. Mean reading comprehension scores in deaf participants who are proficient in SLN and deaf participants who are low-proficient in SLN.

	Deaf participants			
	Proficient in SLN		Low-proficient in SLN	
	11–12-year olds	15–16-year olds	11–12-year olds	15–16-year olds
Reading comprehension				
Mean	17.63	23.75	20.57	22.91
SD	1.93	6.29	3.26	4.30

Basic measures of text writing

We compared narrative and expository texts written by deaf individuals who are proficient in SLN and deaf individuals who are low proficient in SLN with hearing age-matched peers on text length, lexical density, and percentage of abstract nouns in texts. We performed three-way ANOVAs: Group (deaf-proficient signers vs. deaf low-proficient signers vs. hearing) × Age (11–12 years old vs. 15–16 years old vs. adult) × Text genre (narrative vs. expository), treating Group and Age as between-subjects variables and Text genre as within-subjects variable, on the mean numbers of clauses, percentages of content words, and percentages of abstract nouns. In this and all following ANOVAs, alpha was set at 0.05 and post hoc analysis was used if appropriate. The corresponding means and SDs are presented in Table 4.

Text length

A 3 (Group) × 2 (Text genre) ANOVA on the mean number of clauses for each age group separately showed significant main effects of Group for the 15–16-year olds, $F(2,48) = 21.73$, $p < 0.0001$, $\eta^2 = 0.48$, and for the adults, $F(2,32) = 4.39$, $p < 0.05$, $\eta^2 = 0.22$. The remaining effects were not significant. Post hoc tests showed that hearing 15–16-year olds wrote longer texts than both deaf proficient and low-proficient signing 15–16-year olds (both p's < 0.0001), and that hearing adults wrote longer texts than low-proficiently signing adults ($p < 0.0001$). (The remaining differences were not significant.)

Lexical density

A 3 (Group) × 2 (Text genre) ANOVA on the mean number of content words for each age group separately showed a significant main effect of Group for the 11–12-year olds, $F(2,48) = 13.11$, $p < 0.0001$, $\eta^2 = 0.36$. The remaining effects were not significant. Post hoc tests showed that hearing 11–12-year olds used more content words than deaf-proficient signers ($p < 0.0001$). (The remaining effects were not significant.)

The analysis on the 15–16-year olds showed a significant main effect of Text genre, $F(1,48) = 47.38$, $p < 0.0001$, $\eta^2 = 0.50$, and Group, $F(2,48) = 7.52$, $p < 0.001$, $\eta^2 = 0.24$. The remaining effects were not significant. Post hoc tests showed that 15–16-year olds used more content words in expository texts than in narratives, and that deaf proficiently signing 15–16-year olds used more content words than hearing 15–16-year olds ($p < 0.001$) and deaf low-proficient signers ($p < 0.05$). (The remaining differences were not significant.) The analysis on the adults showed no significant effects.

Use of abstract nouns

A 3 (Group) × 2 (Text genre) ANOVA on the mean number of abstract nouns for each age group separately showed a significant main effect of Text genre for all age groups (11–12-year olds: $F(1,48) = 19.06$, $p < 0.0001$, $\eta^2 = 0.28$; $F(1,48) = 1.39$, $p < 0.0001$, $\eta^2 = 0.60$; $F(1,23) = 44.86$, $p < 0.0001$, $\eta^2 = 0.58$. The remaining effects were not significant. All participant groups used more abstract nouns in expository texts than in narratives.

Table 4. Mean numbers (and SDs) of clauses, mean percentage (and SDs) of lexical density, and abstract words in writing of deaf participants who are proficient in SLN, deaf participants who are low-proficient in SLN, and hearing participants.

	Deaf writers												Hearing writers					
	Proficient in SLN						Low-proficient in SLN											
	11–12-year old		15–16-year old		Adult		11–12-year old		15–16-year old		Adult		11–12-year old		15–16-year old		Adult	
	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar
Text length (in clauses)																		
Mean	22.60	22.20	16.46	18.92	31.14	23.14	12.88	16.00	18.72	15.72	21.00	27.00	19.30	19.25	41.80	36.35	37.50	34.85
SD	10.84	12.66	6.55	10.51	12.51	10.81	5.69	4.38	17.83	8.80	8.49	7.29	8.76	13.67	19.79	17.67	16.68	15.76
Lexical density (in percentages)																		
Mean	45.27	42.54	42.37	34.97	37.73	38.61	38.50	38.56	37.53	32.53	38.47	39.40	31.24	32.84	35.29	31.71	38.82	34.59
SD	9.36	10.56	5.65	4.03	4.58	14.92	9.26	7.49	5.80	5.16	2.23	5.88	3.73	4.76	2.81	4.12	3.68	5.16
Abstract words (in percentages)																		
Mean	37.54	26.37	54.75	21.72	60.62	32.42	27.05	12.52	53.51	27.19	48.01	35.06	43.17	19.93	44.03	18.92	55.09	34.45
SD	26.64	23.67	13.70	12.61	14.13	9.94	26.38	11.52	27.56	16.54	15.91	13.74	24.77	17.83	16.60	11.90	13.24	19.02

Lexical NPs

We compared narrative and expository texts written by deaf individuals who are proficient in SLN and deaf individuals who are low-proficient in SLN with hearing age-matched peers on NP modifiers, NP-internal errors (including the four subcategories) and omissions of obligatory NPs. We performed three-way ANOVAs: Group (deaf-proficient signers vs. deaf low-proficient signers vs. hearing) × Age (11–12 years old vs. 15–16 years old vs. adult) × Text genre (narrative vs. expository), treating Group and Age as between-subjects variables and Text genre as within-subjects variable, on the mean percentages of NP modifiers, omitted obligatory articles, incorrect addition of articles, errors of gender agreement between modifier and noun, errors of number agreement between modifier and noun, and omissions of obligatory NPs of clauses, respectively.[3] In this and all following ANOVAs, alpha was set at 0.05 and post hoc analysis was used if appropriate. The corresponding means and SDs are presented in Table 5.

Use of NP modifiers

The three-way ANOVA first of all showed significant main effects of Group, $F(2,126) = 6.04$, $p < 0.01$, $\eta^2 = 0.10$, Age, $F(2,126) = 21.48$, $p < 0.0001$, $\eta^2 = 0.25$, and Text genre, $F(1,126) = 35.61$, $p < 0.0001$, $\eta^2 = 0.28$. As can be seen in Table 4, and as was confirmed in the post hoc analysis, individuals who are proficient in SLN and individuals who are low-proficient in SLN did not differ on the use of NP modifiers, which confirmed our predictions. Individuals who are hearing appeared to use more NP modifiers than individuals who are low-proficient in SLN ($p < 0.001$), but not more than individuals who are proficient in SLN. Further, the main effect of Age indicated that the 15–16-year olds and the adults used more NP modifiers than the 11–12-year olds (both p's < 0.0001). The adults and 15–16-year olds did not differ significantly from each other. Finally, NP modifiers were used more often in narratives than in expository texts ($p < 0.0001$).

The effects of Text genre and Age were qualified by a significant interaction, $F(2,126) = 9.59$, $p < 0.0001$, $\eta^2 = 0.13$. Subsequent one-factor ANOVAs of Text genre for each age group separately showed that only 15–16-year olds and adults used more NP modifiers in narratives than in expository texts, $F(1,50) = 43.72$, $p < 0.0001$, $\eta^2 = 0.87$, and $F(1,34) = 4.35$, $p < 0.05$, $\eta^2 = 0.13$, respectively. The remaining interactions were not significant.

Omission of obligatory articles

The analysis showed significant main effects of Group, $F(2,126) = 17.10$, $p < 0.0001$, $\eta^2 = 0.21$, and Age, $F(2,126) = 10.37$, $p < 0.0001$, $\eta^2 = 0.14$. The main effect of Text genre was not significant.

The main effect of Group indicated that individuals who are proficient in SLN and individuals who are low-proficient in SLN omitted obligatory articles more often than individuals who are hearing ($p < 0.0001$ and $p < 0.001$, respectively), who hardly ever omitted obligatory articles. More importantly, individuals who are proficient in SLN omitted obligatory articles more often than individuals who are low-proficient in SLN ($p < 0.001$). The main effect of Age indicated that 15–16-year olds and adults made fewer errors than 11–12-year olds ($p < 0.05$ and $p < 0.001$, respectively).

Table 5. Mean numbers (and SDs) of lexical NPs, mean percentage (and SDs) of NP modifiers, NP-internal errors and omissions of obligatory NPs in writing of deaf participants who are proficient in SLN, deaf participants who are low-proficient in SLN, and hearing participants.

	Deaf writers												Hearing writers					
	Proficient in SLN						Low-proficient in SLN											
	11–12-year old		15–16-year old		Adult		11–12-year old		15–16-year old		Adult		11–12-year old		15–16-year old		Adult	
	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar	Exp	Nar
Use of lexical NPs																		
Mean	11	11	10	8	21	12	6	8	9	6	11	10	7	7	20	14	24	18
SD	9	7	5	4	10	4	3	4	8	4	5	6	5	5	9	12	11	11
Total NP modifiers																		
Mean	7.7	14.5	24.2	72.4	41.8	49.9	3.8	28.7	16.3	52.2	16.5	43.5	32.4	29.2	30.8	69.6	41.3	43.4
SD	11.5	16.0	27.0	36.4	25.0	24.5	7.1	32.7	19.1	37.9	9.3	17.0	30.5	36.3	10.4	47.7	21.4	18.9
Total NP-internal errors																		
Mean	35.4	48.3	30.5	35.4	5.7	15.0	26.3	20.2	18.0	16.7	14.6	13.4	0	2.1	0	0	0	0
SD	31.9	36.0	24.7	28.3	10.5	12.9	26.5	18.1	19.9	23.8	20.7	17.4	0	6.5	0	0	0	0
Omission of obligatory article																		
Mean	25.2	40.1	20.1	15.8	0	1.3	15.3	12.4	9.5	9.1	1.8	5.8	0	2.1	0	0	0	0
SD	28.2	36.6	26.9	21.0	0	3.4	17.3	15.7	15.8	16.3	5.1	8.2	0	6.5	0	0	0	0
Addition of article																		
Mean	1.3	1.7	3.7	3.6	1.9	1.3	5.8	1.5	4.0	1.1	3.9	1.1	0	0	0	0	0	0
SD	5.2	6.5	6.1	7.5	5.0	3.4	19.4	3.1	9.9	4.7	6.2	3.2	0	0	0	0	0	0
Gender agreement error																		
Mean	7.8	2.2	6.3	9.3	2.9	12.4	4.1	5.1	3.0	2.5	7.7	6.5	0	0	0	0	0	0
SD	11.8	4.2	12.8	11.2	5.3	12.9	8.7	10.4	5.6	5.9	14.4	10.5	0	0	0	0	0	0
Number agreement error																		
Mean	1.1	4.3	0.4	6.8	1.0	0	1.1	1.2	1.5	4.0	1.1	0	0	0	0	0	0	0
SD	4.3	7.6	1.4	17.1	2.5	0	4.3	3.2	4.5	9.8	3.2	0	0	0	0	0	0	0
Omissions of obligatory NPs																		
Mean	17.7	16.9	14.2	9.9	3.9	2.1	14.7	11.2	10.7	11.1	3.1	0	0	0	0	0	0	0
SD	9.6	12.7	21.1	10.3	4.4	2.1	16.3	14.1	11.6	11.1	3.6	0	0	0	0	0	0	0

Further, the main effects of Group and Age were qualified by a significant interaction, $F(4,126) = 4.52$, $p < 0.01$, $\eta^2 = 0.13$. To gain more insight into this interaction effect, we performed subsequent one-factor ANOVAs for each age group separately (collapsed across genre). These analyses showed a significant effect of Group in the 11–12-year olds, $F(2,46) = 15.35$, $p < 0.0001$, $\eta^2 = 0.40$. Deaf-proficient signers omitted more obligatory articles that deaf low-proficient signers ($p < 0.01$) and hearing children ($p < 0.0001$). Deaf low-proficient signers omitted more obligatory articles than hearing children ($p < 0.05$). Also the analyses on the 15–16-year olds showed a significant effect of Group, $F(2,48) = 6.72$, $p < 0.01$, $\eta^2 = 0.22$. Deaf-proficient signers omitted more obligatory articles than deaf low-proficient signers ($p < 0.05$) and hearing 15–16-year olds ($p < 0.01$).

The analyses on the adults also showed a significant effect of Group, $F(2,32) = 9.84$, $p < 0.0001$, $\eta^2 = 0.38$. This effect, however, demonstrates a pattern opposite to the one observed in the 11–12-year olds and the 15–16-year olds: deaf low-proficiently signing adults omitted more obligatory articles than deaf-proficient signers ($p < 0.05$) and hearing adults ($p < 0.0001$). Thus, the relatively high percentage of omissions of obligatory articles in the proficiently signing deaf 11–12-year-old and 15–16-year-old children was not observed in the adults who are proficient in SLN. The remaining effects were not significant.

Addition of articles

The analysis showed only a significant main effect of Group, $F(2,126) = 4.34$, $p < 0.05$, $\eta^2 = 0.06$. Deaf proficient and low-proficient signers did not differ significantly on the incorrect addition of articles. Deaf low-proficient signers incorrectly added more articles than hearing individuals ($p < 0.05$). However, as can be seen in Table 5, this error was hardly made.

Gender agreement errors

The analysis showed a significant main effect of Group, $F(2,126) = 19.61$, $p < 0.0001$, $\eta^2 = 0.24$. As can be seen in Table 5, and as confirmed in the post hoc analysis, deaf individuals who are proficient in SLN and deaf individuals who are low-proficient in SLN did not differ significantly on the number of gender agreement errors. Both deaf individuals who are proficient in SLN and low-proficient in SLN made more gender agreement errors than hearing individuals, who made no errors (both p's < 0.0001).

Number agreement errors

The analysis showed only a significant main effect of Group, $F(2,126) = 3.39$, $p < 0.05$, $\eta^2 = 0.05$. Post hoc tests revealed that, as we expected, deaf individuals who are proficient in SLN and deaf individuals who are low-proficient in SLN did not differ significantly on the use of number agreement errors. Further, deaf-proficient signers made more number agreement errors than hearing individuals, who made no errors ($p < 0.01$).

Omissions of obligatory NPs

The ANOVA showed significant main effects of Group, $F(2,128) = 28.67$, $p < 0.0001$, $\eta^2 = 0.31$, and Age, $F(2,128) = 11.19$, $p < 0.0001$, $\eta^2 = 0.15$. Post hoc analysis

indicated that, as was expected, individuals who are proficient in SLN and individuals who are low-proficient in SLN did not differ significantly in omissions of obligatory NPs. Deaf individuals who are proficient in SLN and deaf individuals who are low-proficient in SLN omitted obligatory NPs more often than their hearing peers, who never omitted an obligatory NP (both p's <0.0001). The main effect of Age indicated that adults omitted fewer obligatory NPs than both 11–12-year olds ($p <0.0001$) and 15–16-year olds ($p <0.001$).

The interaction between Group and Age was significant, $F(4,128) =3.76$, $p < 0.01$, $\eta^2 =0.11$. Subsequent one-factor ANOVAs showed an effect of Group in the 11–12-year olds, $F(2,48) =17.64$, $p <0.0001$, $\eta^2 =0.42$, and the 15–16-year olds, $F(2,48) =13.05$, $p <0.0001$, $\eta^2 =0.35$, $F(2,32) =17.44$, $p <0.0001$, $\eta^2 =0.52$. Hearing individuals omitted fewer NPs than both deaf individuals who are proficient (all p's <0.0001) and deaf individuals who are low-proficient in SLN (all p's <0.0001). The remaining effects were not significant.

Discussion

We studied lexical NPs in two text genres (i.e. expository and narrative texts) written by Dutch individuals who are deaf, from a developmental and bimodal bilingual perspective. In the analysis of the texts, we focused on the use of NP modifiers (i.e. demonstratives, possessives, numerals, and adjectives), NP-internal errors (i.e. the obligatory presence or absence of articles, gender, and number agreement errors between modifier and noun), and omissions of NPs in obligatory contexts.

NPs in deaf and hearing individuals

The present study served to gain more insight into the writing of deaf and hearing children and adults. We found that deaf individuals (both proficient and low-proficient in SLN) used fewer NP modifiers than hearing individuals. In both hearing and deaf individuals, however, the number of NP modifiers increased with age. This developmental pattern in the use of NP modifiers corresponded with results found in a cross-linguistic study on subject NPs in spoken and written narratives and expository texts produced by Dutch-, Hebrew-, English-, and Spanish-speaking hearing children with typical hearing, aged 9–10 years, and adults with typical hearing (Ravid et al. 2002). These authors observed that in all four languages, the adults' texts contained more complex lexical NPs than the children's texts. The present study showed that this development in NP complexity, observed in hearing individuals, was also present in deaf individuals.

Although deaf individuals used fewer NP modifiers than hearing individuals, deaf individuals committed many NP-internal errors. Moreover, deaf individuals often omitted obligatory NPs. The numbers of NP-internal errors and omissions of obligatory NPs, however, decreased with age, although deaf adults did not seem to reach the level of hearing adults, who did not make any NP-internal errors and who never failed to use an obligatory NP. This suggests that NP morphology and obligatory use of NPs is difficult to master for deaf individuals. Eleven of the 15 deaf adults still made errors in both of these structures.

So far, these results parallel the findings of previous studies in which deaf individuals demonstrated problems with NPs and NP morphology, in proportion to the typological characteristics and morphological complexity of the target language

(e.g. Quigley and King 1980; Taeschner, Devescovi, and Volterra 1988; Tur-Kaspa and Dromi 2001). Quigley and King (1980) reported that the English written language samples of deaf children (English, like Dutch, requires overt subject NPs) also contained clauses in which obligatory NPs were omitted. Moreover, these children, who do not have to deal with a gender system when writing in English, showed errors with respect to the obligatory presence or absence of articles. The studies by Taeschner, Devescovi, and Volterra (1988) on Italian writing and by Tur-Kaspa and Dromi (2001) on Hebrew writing showed that children who are confronted with rather complex morphological systems when writing in Italian or in Hebrew, made errors in gender and number agreement, which reflects the morphological complexity of Italian and Hebrew.

Whereas previous studies on writing in deaf individuals only examined narrative texts, we also examined a more formal discourse genre: expository texts. We found that deaf individuals, just like hearing individuals, found narratives the favored genre for using NP modifiers, but the amount of errors in NPs and NP morphology was comparable for the two genres.

Influence of sign language knowledge on writing

It can hardly be surprising that deaf individuals have difficulty with highly complex morpho-syntactic aspects of a language they have not been able to perceive auditorily from birth onwards. Deaf children often have limited exposure to oral language and consequently received quantitatively different language input compared to children with typical hearing. However, there is also a major variation in the language backgrounds among children who are deaf. Some deaf children use sign language as their main language of communication, whereas others are less frequently exposed to sign language and use mainly spoken language.

In the majority of earlier studies, the language backgrounds of deaf children varied or were not always described completely, and variation in children's sign language proficiency was not taken into account. The main purpose of the present study was to gain more insight into how sign language proficiency influences writing of children and adults who are proficient in sign language and children and adults who are low-proficient in sign language. The examination of how sign language proficiency influences writing in an oral language allows a fine-grained account to supplement what has already been found in studies on cross-language interactions and transfer processes between languages in the same modality. Specifically, we hypothesized that the relatively high number of morpho-syntactic errors in children who are proficient in sign language actually reflects the structure of sign language. This assumption is based on theories of bilingualism that propose that knowledge of one language can affect performance in another language (e.g. Döpke 2000; Gathercole 2002; Kohnert, Bates, and Hernandez 1999; MacWhinney 2005; Pavlenko and Jarvis 2002; van Hell and Dijkstra 2002; White 2003). If knowledge of sign language indeed influences writing in an oral language, then NPs in the writing of children who are proficient in sign language should reflect the structure of sign language more than NPs in the writing of children who are not proficient in sign language, particularly with regard to those aspects that differ substantially across sign language and oral language, in particular articles (see section *NPs in Dutch and SLN* for a detailed description of the structure of NPs in SLN and oral Dutch).

Results showed that deaf children who are proficient in sign language indeed more frequently omitted obligatory articles than children who are low-proficient in sign language. The two groups of children did not differ in the use of other NP modifiers (i.e. numerals, demonstratives, and possessives), gender and number agreement errors, and omissions of obligatory NPs. (See Appendix 1 for an example of a text produced by an 11–12-year-old deaf child who is proficient in SLN.)

These results can be explained in light of the Competition Model (Bates and MacWhinney 1989), a model that describes first and second language acquisition and emphasizes competition and transfer between languages. In the case of morphology, this theory presumes that the underlying functions expressed by certain morphological devices can be transferred when learning another language (MacWhinney 2005). When certain functions are absent in one language, however, these functions are difficult to learn in the target language (MacWhinney 2005). Mayer and Wells (1996) also argued that deaf people who mainly use sign language tend to express only those elements that have a sign equivalent in writing. People who are deaf and mainly use sign language cannot use their knowledge of sign language to acquire definiteness in Dutch because sign language has no articles. Indeed, deaf children who are proficient in sign language frequently omitted obligate articles in NPs, in contrast to deaf children who are low-proficient in sign language.

The functions expressed by the other structures that were examined in the present study (i.e. use of NP modifiers, agreement, and omissions of obligatory NPs) are present in SLN. In light of the Competition Model, it was then expected that these functions can be learned relatively easily by bilinguals, and smaller differences between proficient and low-proficiency signers were expected. The results indeed showed that deaf children who are proficient in sign language did not differ from deaf children who are low-proficient in sign language in the use of NP modifiers, gender and number agreement and omissions of obligatory NPs.

Our study further shows that proficient and low-proficient signers did not differ with respect to basic measures of text writing (text length, lexical density, and the use of abstract nouns) or the level of reading comprehension. This finding differs from correlational studies that focus on deaf individuals' sign language skills and another aspect of literacy, reading comprehension, and reported a positive correlation between reading comprehension and sign language skills (Chamberlain and Mayberry 2000; Hofmeister 2000; Strong and Prinz 1997).

We found that proficiency in sign language affected particularly the written production of those linguistic forms that differ substantially across sign language and oral language: in this case, articles that are absent in sign language. Such a cross-language interaction effect is referred to as transfer, as discussed in the Introduction. Other evidence for transfer comes from a recent study on the use of enriching evaluative expressions in writing (Van Beijsterveldt and Van Hell 2009a). Sign language and written language also differ substantially with respect to evaluative expression, a narrative tool in both sign language and oral language. Sign language has more communication channels and devices for conveying evaluation than written language has. It was found that deaf children who are proficient in SLN used more evaluative devices in writing (i.e. evaluations of objects or persons and references to emotional states) than deaf children who are low-proficient in SLN, suggesting that children use their knowledge of narrative techniques from sign languages to enrich their written narratives. In this case, transfer entails a beneficial effect.

Our findings further suggest that the influence of sign language proficiency on writing with respect to articles differs for different age groups. The differences in writing between proficient and low-proficient signers were largest in the children. The difficulty with using articles, as observed in the 11–12-year-old deaf children who are proficient in sign language, was not found in the adults. Given the cross-sectional design of our study, and possible background differences between the children and adults participating in our study, we cannot make strong claims on differences in the developmental trajectories of low-proficient and proficient signers. Obviously, given the scarcity of empirical studies on writing in deaf children with different language backgrounds, there is a need for research that tracks children over time to gain insight into the developmental patterns of deaf children with different language profiles. Our study does indicate, however, that it is important to take sign language proficiency into account, and also structural differences (and similarities) between signed and oral languages to gain better insight into the writing performance of children and adults who are deaf.

Implications for theories on bilingualism

Difficulty with marking definiteness is not an isolated finding, and has also been observed in bilingual speakers of oral languages. For learners of English whose native language has a different system, or no system, of marking definiteness, article marking in English is extremely difficult (e.g. Jarvis 2002; Johnson and Newport 1989; Robertson 2000; Sharma 2005). Our findings and those of studies on bilinguals speaking two oral languages imply that the mechanisms underlying transfer and development in bilinguals who use two languages in the same modality also apply to bilinguals who use two languages in different modalities: a signed language and an oral language. Moreover, it can be expected that the present pattern of results obtained with bimodal bilingual learners of Dutch and SLN generalizes to bimodal bilingual learners who deal with different oral and signed languages. But, clearly, given the few empirical studies on variations in sign language proficiency and writing, more research is necessary to gain more insight into the details of the cross-language interactions and transfer processes between languages from two different modalities.

Implications for educational practice and research

The relatively high number of omissions of obligate articles in proficiently signing deaf children may hint at a developmental stage in which children mix the morpho-syntactic systems of written language and signed language. More exposure to both languages, and a skilled teacher who can make the differences between the grammatical systems explicit and explain to children how each of the grammars of the languages operates, may support children going through this stage. On the other hand, skills developed in signed language (such as discourse skills) can and should be used to support learning to read and write. However, we still have shallow understanding of how signed language works to support writing and reading development in deaf children (Mayer 2007). This needs to be investigated in future research and it involves thinking about ways in which signed language can be used to give access to oral/written language.

We took into account variations in sign language proficiency in unraveling which factors may play a role in deaf children's writing skills. As discussed in the

Introduction, the potential influence of sign language knowledge on writing in an oral language has largely been neglected in related studies on writing by deaf children and adults. A factor that may also play a role in deaf children's acquisition of writing is oral language skills. Our group of low-proficiency signers was rather heterogeneous in terms of their educational background (regular schools vs. special school for deaf students). Variation in education may imply variation in oral skills, and writing (and reading) development is likely different for children who have good oral skills and those who do not. However, assessing oral skills reliably is not easy. As a result of their hearing loss, many deaf children have speech difficulties, which makes it difficult to separate the effects of sensory and motor processes from language and cognitive processes (Blamey 2003).

The present study contributes to our current knowledge on writing in deaf children by providing empirical evidence that underlines the importance of taking variations in language backgrounds into account: deaf children who are proficient in sign language and deaf children who are low-proficient demonstrate different patterns of writing, in particular on aspects that differ substantially across sign language and oral language, such as articles.

Acknowledgements

Notes

1. Variations in language of instruction did not lead to differences in quantitative measures of text writing, as is shown in the statistical analyses of text length and lexical density in texts.
2. As we were unable to obtain reading scores of all children, we performed additional three-way Group (3) × Age (3) × Text genre (3) ANOVAs on total NP modifiers, NP-internal errors, and missing NPs in which we excluded the deaf children from whom we did not have reading scores. These analyses showed the same pattern of results as the analyses based on all participants.
3. We analyzed our data using multiple factor ANOVAs. Because there is discussion of whether or not ANOVAs can be performed in cases where sample sizes are not equal, we also performed non-parametric tests to be on the safe side. These non-parametric tests yielded the same pattern of results.

References

Aarnoutse, C.J.A. 1996. *Begrijpend Leestests* [Reading comprehension tests]. Lisse, Amsterdam, The Netherlands: Swets & Zeitlinger.

Bates, E., and B. MacWhinney. 1989. Functionalism and the competition model. In *The crosslinguistic study of sentence processing*, ed. B. MacWhinney and E. Bates, 3–73. Cambridge: Cambridge University Press.

Berman, R.A., and D.I. Slobin, eds. 1994. *Relating events in narratives: A crosslinguistic developmental study*. Hillsdale, NJ: Erlbaum.

Berman, R.A., and L. Verhoeven. 2002. Cross-linguistic perspectives on the development of text-production abilities: Speech and writing. *Written Language and Literacy* 5, no. 1: 1–29.

Blamey, P.J. 2003. Development of spoken language by deaf children. In *Oxford handbook of deaf studies, language, and education*, ed. M. Marschark and P.E. Spencer, 232–46. Oxford: Oxford University Press.

Bos, H.F. 1990. Person and location marking in Sign Language of the Netherlands: Some implications of a spatially expressed syntactic system. In *Current trends in European sign language research*, ed. S. Prillwitz and T. Vollhaber, 231–46. Hamburg: Signum.

Bos, H.F. 1993. Agreement and prodrop in Sign Language of the Netherlands. In *Linguistics in the Netherlands 1993*, ed. F. Drijkoningen and K. Hengeveld, 37–48. Amsterdam, Philadelphia, PA: John Benjamins.

Chamberlain, C., and R.I. Mayberry. 2000. Theorizing about the relationship between ASL and reading. In *Language acquisition by eye*, ed. C. Chamberlain, J.P. Morford, and R.I. Mayberry, 221–60. Mahwah, NJ: Lawrence Erlbaum.

Döpke, S. 2000. *Cross-linguistic structures in simultaneous bilingualism*. Amsterdam, Philadelphia, PA: John Benjamins.

Emmorey, K. 2002. *Language, cognition and the brain: Insights from sign language research*. Mahwah, NJ: Lawrence Erlbaum.

Fabbretti, D., V. Volterra, and C. Pontecorvo. 1998. Written language abilities in deaf Italians. *Journal of Deaf Studies and Deaf Education* 3, no. 3: 231–44.

Garrison, W., G. Long, and F. Dowaliby. 1997. Working memory capacity and comprehension processes in deaf readers. *Journal of Deaf Studies and Deaf Education* 2, no. 2: 78–94.

Gathercole, V.C.M. 2002. Grammatical gender in bilingual and monolingual children: A Spanish morphosyntactic distinction. In *Language and literacy in bilingual children. Child language and child development*, ed. D. Kimbrough Oller and R.E. Eilers, 207–19. Clevedon, UK: Multilingual Matters.

Haeseryn, W., K. Romijn, G. Geerts, J. de Rooij, and M.C. van den Toorn. 1997. *Algemene Nederlandse Spraakkunst* [A modern grammar of Dutch]. Groningen, The Netherlands: Martinus Nijhoff.

Harder, R. 2003. *Meervoud in de NGT* [Pluralization in SLN]. Unpublished manuscript. Dutch Centre for Sign Language.

Hermans, D., H. Knoors, and L. Verhoeven. 2007. *T-NGT: Testbatterij voor de Nederlandse Gebarentaal* [T-NGT: Test battery for Sign Language of the Netherlands]. Viataal, Sint-Michielsgestel, The Netherlands.

Hofmeister, R. 2000. A piece of the puzzle: ASL and reading comprehension in deaf children. In *Language acquisition by eye*, ed. C. Chamberlain, J.P. Morford, and R.I. Mayberry, 143–64. Mahwah, NJ: Lawrence Erlbaum.

Jarvis, S. 2002. Topic continuity in L2 English article use. *Studies in Second Language Acquisition* 24, no. 3: 387–418.

Johnson, J.S., and E.L. Newport. 1989. Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology* 21, no. 1: 60–99.

Kohnert, K.J., E. Bates, and A.E. Hernandez. 1999. Balancing bilinguals: Lexical-semantic production and cognitive processing in children learning Spanish and English. *Journal of Speech, Language and Hearing Research* 42, no. 6: 1400–13.

Landis, J.R., and G.G. Koch. 1977. The measurement of observer agreement for categorical data. *Biometrics* 33, no. 1: 159–74.

Liddell, S.K. 1980. *American sign language syntax*. The Hague, The Netherlands: Mouton.

MacWhinney, B. 1995. *The CHILDES project*. Hillsdale, NJ: Lawrence Erlbaum.

MacWhinney, B. 2005. A unified model of language acquisition. In *Handbook of bilingualism: Psycholinguistic approaches*, ed. J.F. Kroll and A.M.B. de Groot, 49–67. Oxford: Oxford University Press.

Mayberry, R.I. 2002. Cognitive development in deaf children: The interface of language and perception in neuropsychology. In *Handbook of neuropsychology.* ed. S.J. Segalowitz and I. Rapin. 2nd ed., vol. 8, Part II, 71–107. Amsterdam: Elsevier.

Mayer, C. 2007. What really matters in the early literacy development of deaf children. *Journal of Deaf Studies and Deaf Education* 12, no. 4: 411–31.

Mayer, C., and G. Wells. 1996. Can the linguistic interdependence theory support a bilingual-bicultural model of literacy education for deaf students? *Journal of Deaf Studies and Deaf Education* 1, no. 2: 93–107.

Musselman, C. 2000. How do children who can't hear learn to read an alphabetic script? A review of the literature on reading and deafness. *Journal of Deaf Studies and Deaf Education* 5, no. 1: 9–31.

Nijhof, S., and I. Zwitserlood. 1999. Pluralization in Sign Language of the Netherlands. In *OTS Yearbook 1998–1999*, ed J. Don and T. Sanders, 58–78. Utrecht: Uil OTS.

Nippold, M.A. 2007. *Later language development: School-age children, adolescents, and young adults.* 3rd ed. Austin, TX: Pro-Ed.

Nippold, M.A., T.C. Mansfield, and J.S. Billow. 2007. Peer conflict explanations in children, adolescents, and adults: Examining the development of complex syntax. *American Journal of Speech-Language Pathology* 16, no. 2: 179–88.

Odlin, T. 1989. *Language transfer: Cross-linguistic influence in language learning*. Cambridge: Cambridge University Press.

Padden, C., and C. Ramsey. 2000. American sign language and reading ability in deaf children. In *Language acquisition by eye*, ed. C. Chamberlain, J.P. Morford, and R.I. Mayberry, 221–60. Mahwah, NJ: Lawrence Erlbaum.

Paul, P. 1997. Reading for students with hearing impairments: Research review and implications. *Volta Review* 99, no. 2: 73–87.

Pavlenko, A., and S. Jarvis. 2002. Bidirectional transfer. *Applied Linguistics* 23, no. 2: 190–214.

Quigley, S.P., and C.M. King. 1980. Syntactic performance of hearing-impaired and normal hearing individuals. *Applied Psycholinguistics* 1, no. 4: 329–56.

Quigley, S.P., D.J. Power, and M.W. Steinkamp. 1977. The language structure of deaf children. *Volta Review* 79, no. 2: 73–84.

Ragnarsdóttir, H., M. Aparici, D. Cahana-Amitay, J.G. van Hell, and A. Vigué-Simon. 2002. Verbal structure and content in written discourse: Expository and narrative texts. *Written Language and Literacy* 5, no. 1: 95–126.

Ravid, D. 2006. Semantic development in textual contexts during the school years: Noun scale analyses. *Journal of Child Language*, 33, no. 4: 791–821.

Ravid, D., J.G. van Hell, E. Rosado, and A. Zamora. 2002. Subject NP patterning in the development of speech and writing. *Written Language and Literacy* 5, no. 1: 69–93.

Reilly, J.S., H. Jisa, E. Baruch, and R.A. Berman. 2002. Propositional attitudes: The development of modality. *Written Language and Literacy* 5, no. 2: 183–218.

Robertson, D. 2000. Variability in the use of the English article system by Chinese Learners of English. *Second language Research* 16, no. 2: 135–72.

Schermer, T. 1991. Gebarentalen [Sign languages]. In *De Nederlandse Gebarentaal* [Sign Language of the Netherlands], ed. T. Schermer, C. Fortgens, R. Harder, and E. de Nobel, 29–46. Twello, The Netherlands: Van Tricht.

Sharma, D. 2005. Language transfer and discourse universals in Indian English article use. *Studies in Second Language Acquisition* 27, no. 4: 535–66.

Singleton, L., D. Morgan, E. DiGello, J. Wiles, and R. Rivers. 2004. Vocabulary use by low, moderate, and high ASL-proficient writers compared to ESL and monolingual speakers. *Journal of Deaf Studies and Deaf Education* 9, no. 1: 86–103.

Strassman, B. 1997. Metacognition and reading in children who are deaf: A review of the research. *Journal of Deaf Studies and Deaf Education* 2, no. 3: 140–9.

Strömqvist, S., V. Johansson, S. Kriz, H. Ragnarsdottír, R. Aisenman, D. Ravid, R.A. Berman, and L. Verhoeven. 2002. Toward a cross-linguistic comparison of lexical quanta in speech and writing. *Written Language and Literacy* 5, no. 1: 45–68.

Strong, M., and P.M. Prinz. 1997. A study of the relationship between American Sign Language and English literacy. *Journal of Deaf Studies and Deaf Education* 2, no. 1: 37–46.

Taeschner, T., A. Devescovi, and V. Volterra. 1988. Affixes and function words in the written language of deaf children. *Applied Psycholinguistics* 9, no. 4: 385–401.

Transler, C. 2001. The origins of the phonological representations in severe and profoundly deaf children: A critical review of recent research. Approche Neuropsychologique des Apprentissages chez l. *Enfant* 13, no. 4: 176–86.

Tur-Kaspa, H., and E. Dromi. 2001. Grammatical deviations in the spoken and written language of Hebrew-speaking children with hearing impairments. *Language Speech and Hearing Services in Schools* 32, no. 2: 79–89.

Van Beijsterveldt, L.M., and J.G. Van Hell. 2009a. Evaluative expression in deaf children's narratives. *International Journal of Language and Communication Disorders* 44, no. 5: 675–92.

Van Beijsterveldt, L.M., and J.G. Van Hell. 2009b. Structural priming of adjective–noun structures in hearing and deaf children. *Journal of Experimental Child Psychology* 104, no. 2: 179–96.

Van Berkum, J.A. 1996. The psycholinguistics of grammatical gender: Studies in language comprehension and production. Doctoral diss., Max Planck Institute for Psycholinguistics, The Netherlands.

Van Hell, J.G., and T. Dijkstra. 2002. Foreign language knowledge can influence native language performance in exclusively native contexts. *Psychonomic Bulletin & Review* 9, no. 4: 780–9.

Van Hell, J.G., L. Verhoeven, M. Tak, and M. Van Oosterhout. 2005. To take a stance: A developmental study of the use of pronouns and passives in spoken and written narrative and expository texts in Dutch. *Journal of Pragmatics* 37, no. 2: 239–73.

Van Hell, J.G., L. Verhoeven, and L.M. van Beijsterveldt. 2008. Pause time patterns in writing narrative and expository texts by children and adults. *Discourse Processes* 45, nos. 4–5: 406–27.

Wauters, L.N., W.H.J. Van Bon, and A.E.J.M. Tellings. 2006. Reading comprehension of Dutch deaf children. *Reading and Writing: An Interdisciplinary Journal* 19, no. 1: 49–76.

White, L. 2003. Fossilization in steady state L2 grammars: Persistent problems with inflectional morphology. *Bilingualism: Language and Cognition* 6, no. 2: 129–41.

Wilbur, R.B., and S.P. Quigley. 1975. Syntactic structures in the written language of deaf children. *Volta Review* 77, no. 3: 195–203.

Williams, C. 2004. Emergent literacy of deaf children. *Journal of Deaf Studies and Deaf Education* 9, no. 4: 352–65.

Appendix 1. Fragment of a narrative written by a 12-year-old proficiently signing deaf boy

The fluent gloss-translation is presented in a clause-by-clause fashion. All lexical subject and object NPs we scored are underlined, and NP modifiers are in italics. Omitted articles are marked with Ø. Gender and number agreement errors are indicated between parentheses right after the site at which they occur. Omitted obligatory subject and object NPs are indicated between parentheses at the end of each clause. When a clause was ungrammatical in Dutch because of errors other than the errors we focused on in our manuscript (e.g. word order errors and verb inflection errors), the clause is preceded by *.

*vroeger ik en *mijn* klas ruzie met ander klas.

*'in the past me and *my* class argument with other class'

dat is niet leuk

'that is not funny'

Ø *ander* kind zegt

'Ø *other* child says'

Jan is stom

'Jan is stupid'

en altijd Ø bass

'and always Ø bass'

*dan Jan zegt

*'then Jan says'

*dat jij bent zelf

*'that you are yourself'

*dan beginen Ø ruzie

*'than Ø argument starts'

*dan *ander* [number agreement error] kinderen helpen op Ø *ander* [gender agreement error] kind [although a preposition 'op' is added incorrectly, 'ander kind' has the function of direct object and has therefore been scored]

*'then *other* [number agreement error in Dutch] children help Ø *other* [gender agreement error] child'

*dan *mijn* klas helpen op Jan

*'then *my* class help on Jan'

*later wij gaan binnen

*'later we go inside'

*dan *ander* [number agreement error] kinderen zeggen op ze [it is not clear what the writer meant with 'ze' and it has therefore not been scored and translated] leraar [direct object is missing]

*'then *other* [number agreement error] children tell teacher' [direct object is missing]

*Ø leraar van Ø *ander* [number agreement error] kinderen zegt op onze leraar

*'Ø teacher of Ø *other* children says on our teacher'

*dan wij moeten niet ruize maken

*'then we must not fight'

en ook Ø *ander* [number agreement error] kinderen

'and Ø *other* [number agreement error] children too'

*dan wij zeggen sorry

*'than we say sorry'

en ook Ø *ander* [number agreement error] kinderen zeggen sorry

'and *other* [number agreement error] children say sorry too'

*nu wij maken niet ruize

*'now we do not argue'

*nou beetje niet erg
*'well little not much'
wij kunnen [direct object is missing] wel goedmaken
'wij can make up' [direct object is missing]