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Written language production in deaf children and adults

Een wetenschappelijke proeve op het gebied van de Sociale Wetenschappen

Proefschrift

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Studies of language acquisition have shown that typically developing children have acquired basic grammatical rules governing their language by the age of five (Brown, 1973; Berman & Slobin, 1994). Most five-year old children use complex sentences, such as subordinate clauses, make few grammatical errors, and their sentences have a mean length of utterances of six morphemes (Miller, 1981). During the school years and adolescent years, language development continues and school-aged children acquire more advanced rules of written language: They begin to use more complex linguistic structures and learn to tune their use of linguistic structures to different communicative situations (e.g., Berman, 2004; Berman & Slobin, 1994; Nippold, 2007).

Consider the following two fragments of narratives dealing with social conflicts between people, written by a hearing, typically developing child and a child who is deaf, respectively. Both children are 11 years old.

1) *Mijn vriendin word buitengesloten. Ik vind haar aardig maar mijn andere vriendinnen niet. Als ik even weg ben, of ik ben er niet, sluiten ze haar buiten. Het liefst willen ze dat ze niet mee doet waar zij aan meedoen.*

'My friend is shut out. I think she is nice but my other friends don't. When I am away for a little while, or when I am not there, they shut her out. They prefer that she doesn't take part in something they take part in.'


'Chantal says: stupid asks. I say: please stop okay or I say teacher. Chantal says: slimeball. I am mad. Chantal my pull hair. I back kick then teacher comes. Teacher says you constantly argue please keep never argue. I and Chantal say okay. I promises never argue but nice'

Fragment (1), written by a hearing, typically developing 11-year-old child, demonstrates good control over linguistic forms and their functions. As can be seen in Fragment (2), the deaf child who is as old as his hearing peer, struggles with the use of many linguistic aspects, including word order, verb morphology, and the use of determiners and prepositions. I examined written language production in deaf children and adults to gain more insight into deaf children's development of writing skills.

Children who are deaf often have either late or limited exposure to oral language because of their hearing impairment. Many individuals who are deaf use sign language as their main language of communication, although variation exists among deaf people in the use of and proficiency in sign language. Deaf children who develop using a signed language and an oral/written language, therefore, do not only receive a quantitatively different amount

*An adapted version of the chapter has been submitted for publication*
of language input compared to deaf children who hardly ever use sign language or hearing children, but also receive a qualitatively different type of language input. Given the differences in the amount and type of language input among deaf children with different language profiles, and hearing children, it can be expected that the developmental trajectories in learning to write in an oral language for these different groups of children are different. In the present thesis, two main questions are examined. The first question entails the development of writing in deaf children in comparison to that of hearing peers. Specifically, we examined whether deaf and hearing children follow different or similar developmental trajectories in writing. The second question pertains to the influence of proficiency in sign language on writing in deaf children and adults. Specifically, we adopt a bimodal bilingual perspective to study if, and if so how, proficiency in sign language influences writing.

In the remainder of this introductory chapter, I give an overview of earlier studies on written language production in deaf children. Generally, four foci in research on writing in deaf children can be distinguished, and these four foci are used to organize the literature review. First, studies are reviewed that focused on syntactic structures in isolated contexts, and that described the types of errors deaf children typically make. Second, I review studies that adopted a cognitive-functional perspective on writing, and that emphasized the communicative function of language by focusing on meaning and coherence in writing. Third, studies are reviewed that examined deaf children's writing from a bimodal bilingual perspective, and explored the role of sign language knowledge on oral/written language skills. Finally, I discuss how the investigation of temporal markers of writing, such as pause times and writing rates, linked to a coding of linguistic characteristics of a written text can provide insight into the temporal patterning of cognitive processes involved in written language production.

*Research on syntactic structures in isolated contexts*

Early studies on deaf children's written language aimed to describe the types of errors they make. In general, deaf students were exposed to visual stimuli, such as pictures or short films, and were asked to write a story. The written stories were analyzed for basic measures such as story length and sentence length, sentence complexity, and syntactic errors. Myklebust (1964), for example, studied the written narratives of deaf and hearing students between 7 and 17 years old. Myklebust found that deaf children wrote shorter narratives than their hearing peers at every age level except at seven years of age. Further, the deaf children wrote shorter and simpler sentences than their hearing peers. Although narratives of both hearing and deaf children increased in sentence and story length as well as sentence complexity, the rate of growth appeared much slower in the deaf children. Myklebust also categorized the types of errors observed in deaf children's narratives. The most common error appeared to be omission of obligatory words (e.g., *A boy playing*, in which the auxiliary verb is omitted). Other frequently observed errors were substitutions of words (e.g., *A boy have playing*), addition of unnecessary words (e.g., *A boy is be playing*), and word order violations (e.g., *A boy playing is*).

Deaf children's syntactic difficulties in written language production (and comprehension) were studied more extensively in a large research program performed in the 1970's by Quigley, Wilbur, and colleagues (e.g., Power & Quigley, 1973; Quigley & King, 1980; Quigley, Power, & Steinkamp, 1977; Wilbur, Montanelli, & Quigley, 1976; Wilbur & Quigley, 1975; Wilbur, Quigley, & Montanelli, 1975). Four hundred and fifty English-
speaking, prelingually, profoundly deaf students between 10 and 19 years old, and 60 hearing children between 8 and 10 years old, participated in this study, and wrote a story. No information was provided about the deaf children's language backgrounds, such as variations in the use of and proficiency in sign language. Stories were analyzed on several syntactic structures, including negation, conjunction, question formation, pronominalization, complementation, relativization, and the verb system. The analyses demonstrated that deaf students made errors that rarely or never appeared in hearing students' writing. The most difficult syntactic structure for deaf children appeared to be pronominalization. In their written samples, deaf children tended to confuse pronominal categories, for example they wrote *Her is going home rather than She is going home. Further, they made errors in gender, such as in Sue is wearing his new dress today. Another difficult syntactic structure for deaf students, related to the use of pronouns, was conjunction. A conjunction combines two or more sentences into one compound, complex sentence. If two sentences contain identical parts, repetition of these parts is not necessary and elements can be deleted or replaced by pronouns. For example, the sentences She is ready and She goes home can be combined into She is ready and goes home. Deaf students seemed to be familiar with the rules of pronominalization and deletion in case of conjunction, but they were unable to apply these rules correctly in their narratives.

Conjoined structures and pronouns were more closely examined in two follow-up studies (Wilbur, Montanelli, & Quigley, 1976; Wilbur, Quigley, & Montanelli, 1975). For example, in Wilbur et al. (1976), children had to produce conjoined sentences out of two separate sentences. In some cases, the sentences had either the object or the subject in common. In other cases, the sentences had no elements in common. The deaf students performed relatively well when the sentences had no elements in common. In case of sentences with identical subjects or objects, performance was worse. For example, the sentence *The boy hit the girl and hit him back was produced out of the separate sentences The boy hit the girl and The girl hit him back. Further, deaf children made many errors in the production of relative clauses, for example, they tended to omit a relative pronoun such as in *The dog chased the girl ∅ had on a red dress and *The boy helped the girl's mother ∅ was sick. Finally, deaf children demonstrated problems with verbs. Deaf students omitted and confused auxiliary verbs in sentences. For example, they wrote *John ∅ sick instead of John is sick, and *Jim have sick instead of Jim is sick. They also made many errors in verb inflection, for example, they wrote *John goes to fishing, rather than the correct sentence John goes fishing. Or they wrote *Bill liked to played football rather than Bill liked to play football. This type of error decreased with age, although the eldest deaf students did not reach the level of their hearing peers.

Quigley and King (1980) argued that the errors in deaf students' writing resulted from the use of certain strategies. Subsequently, the Test of Syntactic Abilities was designed to detect these patterns underlying the syntactic errors observed in deaf children and to seek strategies that would account for the patterns. One of the strategies that was examined is overgeneralization of the standard word order for active main clauses (in English), that is, subject-verb-object (SVO). It was claimed that deaf students tend to use this word order in both appropriate and inappropriate contexts. An inappropriate context for SVO-order is the passive voice or a relative clause. For example, The boy was helped by the girl tended to be interpreted as The boy helped the girl. The passive markers, was, -ed and by were often not understood by many deaf children.

In a more controlled experiment, Power and Quigley (1973) examined word order in passive constructions in hundred prelingually and severely deaf children between 9 and 18...
years old. The children were presented with a picture and an incomplete sentence. The sentence consisted of the subject and the object displayed in the picture in the passive word order. For example, the sentence underneath a picture of a boy pushing a girl was *The girl ... the boy*. The children were asked to fill the gap by answering a question such as "What happened to the girl?" and thereby applying the correct set of passive markers. A set of words and markers was provided, for example, was, V-ed, by, V-ing, and did. Deaf children often only used the by-phrase as the marker for passive voice, or made errors in the verb phrase, for example, *The girl was pushing by the boy* or *The girl pushed by the boy*. Only 40% of the deaf 17-18 year olds produced completely correct passive sentences.

Quigley and King (1980) mentioned another strategy that could account for many errors in deaf students' writing, in particular, the tendency to connect the nearest noun phrase to the verb phrase. This tendency may lead to misinterpretation of embedded clauses such as *The boy who kissed the girl ran away*. Deaf children tend to interpret this as *The girl ran away*. According to Quigley and King (1980), this strategy leads to errors in the production of relative clauses. In their written language, deaf children used sentences such as *I helped the boy's mother was sick* instead of the presumably intended sentence *I helped the boy whose mother was sick*.

Another study which aimed to describe syntactic structures in deaf children's writing was conducted by Ivimey and Lachterman (1980). Eleven English-speaking severely deaf children between 9 and 10 years old participated in this study. One child had deaf parents and used sign language at home. The other ten children used a mixture of oral communication and sign language. The study focused on several linguistic domains, including temporal reference marking, negotiation, noun phrase structure, and prepositional phrase structure. Children were asked to describe a picture. Then, the children were first asked to indicate the time reference of their written sentence, and were subsequently asked to change the time reference of the sentence, for example, from present to simple past. Results demonstrated that the majority of deaf children wrote sentences in which tense agreement between the temporally marked verb and the temporal adverb was violated, for example *Yesterday, Peter and Jane watch television*. The children were also asked to produce a negative sentence. Most children formed negative sentences by adding 'not' between the subject and the verb, for example, *The little boy not push her* and *Tomorrow the little boy not kick*. Finally, an examination of the noun phrases and prepositional phrases deaf children used in their sentences revealed that they incorrectly omitted and included determiners, and that they confused and omitted prepositions.

Studies on languages other than English demonstrate that the patterns in syntactic structures observed in deaf children's writing in English were not only observed in deaf children from English-speaking communities. Taeschner, Devescovi, and Volterra (1988), for example, compared the writing of 25 deaf children from Italian-speaking communities between 11-15 years with that of hearing children ranging between 6-15 years. The deaf children, from both special and mainstream schools, were educated via the oral method, 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, and are controlled by phonological characteristics of the following noun (e.g., *il tavolo* 'the table' / *i tavoli* 'the tables'). In a first experiment, children had to insert articles to singular and plural nouns. Results showed that deaf children made errors that were not observed in the hearing children: 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). A second experiment examined plural marking of
real and nonsense nouns, and deaf children appeared to perform similarly to hearing peers:
deaf and hearing children did not differ on both the amount and type of errors.

Tur-Kaspa and Dromi (2001) examined morpho-syntactic structures in the written
and spoken language of deaf children from Hebrew-speaking communities. Thirteen
severely to profoundly deaf children between 11 and 13 years old, who were orally
educated, participated in this study. Spoken and written samples were collected using
several elicitation methods, including nine open-ended questions referring to the child's
background and daily activities, four open-ended questions about past and future events, a
colored poster, the wordless picture book *Frog where are you?* (Mayer, 1969), and a set of
colored pictures depicting a sequence of events. The analysis of the samples focused on ten
different syntactic deviations, e.g., omission of major constituents (i.e., noun or verb phrase),
omission or substitution of morphological markers, violation of rules of grammatical
agreement, and word order violation. The most frequently occurring errors in deaf students'
written language samples were errors in morphological markers, including grammatical
agreement. Hebrew verbs have to agree with the head nouns in terms of gender, number
and person, for example, *ha-yeled oxel* 'The boy (is) eat(ing)', *ha-yalda oxelet* 'The girl (is)
eat(ing)', *ha-yeladim oxlim* 'The boys/children (are) eat(ing)', and *ha-yeladot oxlot* 'The girls
(are) eat(ing)'. Deaf children, however, were likely to say and write: *ha-yeladim oxel* 'The
children (is) eating', instead of *ha-yeladim oxlim* 'The children (are) eating'. Agreement errors
also occurred within noun phrases. In Hebrew, adjectives must agree with nouns in gender
and number. Results demonstrated that deaf Hebrew children 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 omitted determiners in obligatory contexts and whole obligatory NPs (i.e., the subject or
the direct object in a sentence).

Research focusing on writing abilities of deaf adults indicated that morpho-syntactic
difficulties of children who are deaf tend to endure beyond the elementary and high school
years (e.g., Fabbretti, Volterra, & Pontecorvo, 1998; McAfee, Kelly, Samar, 1990). Fabbretti,
Volterra and Pontecorvo (1998) for example compared the writing skills of Italian deaf adults
with that of hearing adults who have had poor schooling. They focused on a wide range of
morpho-syntactic, lexical en spelling skills related to noun and verb phrases, in four different
writing tasks, and showed that deaf adults still make many morpho-syntactic errors (and
more than hearing adults who have had poor schooling).

In sum, studies that examined deaf children and adults from different linguistic
communities, in particular English-, Italian- and Hebrew-speaking communities,
demonstrated that deaf children's writing performance with respect to a wide range of
morpho-syntactic structures is different from that of hearing children. In general, these
studies were mainly interested in describing the type of errors, and emphasize the correct
way to use words in isolated sentences. In this view, the focus was on the correct linguistic
form, often in isolated sentences, and not on the communicative function of language.

A cognitive-functionalistic approach to writing

Already in 1977, Wilbur argued for a more communicative approach to the study of
writing in deaf children. He reanalysed the data of the studies by Quigley, Wilbur and
colleagues and noted that: '[...] the focus is on the structure of the single sentence, and not
on the sentence’s use within its larger environment. As long as the modifications in syntax that arise from pragmatic context are ignored in language programs, deaf students' facility with English will continue to be stilted and stereotyped' (Wilbur, 1977, p. 91). Wilbur argued that deaf children's writing cannot be adequately explained in terms of their syntax without reference to the context in which the utterances occur. An increasing number of researchers acknowledge the communicative function of language, and relate linguistic structures to their communicative functions (Tomasello, 1998). These communicative functions and the forms chosen are sensitive to variations in communicative contexts. From this view, language processing, including writing, is seen as a social process whose form and function vary across different contexts. Studies within this cognitive-functionalistic framework are interested in the relationship between linguistic forms, e.g., morpho-syntactic structures, and their function, i.e., the way such forms are used to express content. Subsequently, the focus is on communicative competence and how texts are made coherent and meaningful, instead of focusing on isolated sentence structures.

It took around 10 years since Wilbur's original proposal that researchers, interested in writing by deaf children and adults, took up a communicative approach in their empirical work. A study by Gormly and Sarachan-Deilly (1987) illustrates this shift to the communicative approach to writing. They performed an in-depth analysis on persuasive texts written by deaf high school students with either poor or good levels of writing competence. The assignment of students to their respective groups was based upon teachers' ratings, as well as one of the investigators' ratings of children's classroom samples. The texts were analysed on content, linguistic aspects, and surface mechanics. Gormly and Sarachan-Deilly found that deaf good and poor writers did not differ much on the number of linguistic errors (i.e., word order violations, omissions of subjects and main verbs, and violations of semantic relations) and surface mechanics (i.e., spelling, punctuation, and capitalization errors), but differences were particularly pronounced in content. Good writers wrote more cohesive persuasive texts, and were more likely to include introductions, suggestions, reasons and conclusions than poor writers. Thus, this study showed that the most striking difference between good and poor deaf writers is at the content level.

Another study within the cognitive-functionalistic perspective that examined deaf children's discourse skills was conducted by Yoshinago-Itano, Snyder, and Mayberry (1996). Participants in this study were forty-nine prelingually, moderately to profoundly deaf children between ten and fifteen years of age. Forty-nine age-matched hearing peers served as control group. Twenty-seven deaf children were educated via oral methods, and twenty-two children were educated in Total Communication programs. Yoshinago-Itano et al. studied deaf children's narratives by means of cohesion and propositional analyses. The propositional analysis deals with the organization of meaning by analyzing how information is represented within the sentence. A major proposition includes a subject and a predicate. The major propositions for the sentence, *The big brown dog is running very quickly*, would be *dog, run*. A minor proposition includes a modifier or connective and action or agent. For example, the minor propositions for the sentence above are: [dog, big], [dog, brown], [run, quickly], and [quickly, very]. Yoshinago-Itano et al. found that deaf children used a greater number of major propositions and a fewer number of minor propositions in their written narratives than hearing children did, which suggests that deaf children introduced more topics in their narratives than hearing children did, but elaborated less on them. The analysis of text cohesion in this study was based on categories of cohesion proposed by Halliday and Hasan (1976). The types of cohesive devices were categorized as follows: 1) reference devices (i.e., pronouns, demonstratives, and comparatives), 2) lexical repetitions,
3) collocations (nouns, verbs, superordinates, synonyms, and antonyms), and 4) conjunctions. Results showed that although the quantity of cohesive devices in the narratives of deaf and hearing children was similar, the deaf children used a smaller variety of cohesive devices. They primarily used pronouns, demonstratives and lexical repetitions. For example, the boy was repeatedly referred to as the boy rather than as Johnny or the child, and they predominantly used the conjunction device and.

Comparable research on text cohesion in deaf and hearing children's narratives that parallels these findings was conducted by Maxwell and Gordon-Fallick (1992). Twenty severely to profoundly deaf children and twenty hearing children between grade four and eight, who used sign language as their primary mode of communication, were asked to write about two questions: 1) What is your favorite movie? and 2) What is the most exciting thing you have ever seen on TV or in real life?. Halliday and Hasan's (1976) framework for analyzing cohesion in narratives was used. Results showed that whereas hearing children found new ways to express semantic repetition, deaf children simply repeated words and phrases to connect parts of the story. Moreover, the variety of different connectors was small in deaf children's narratives. For example, regardless of grade level, the deaf writers almost exclusively used the connectors and, then and because. Hearing children, in contrast, used a wider variety of connectors, including too, also, or, nor, after that, suddenly, just then, after that, finally, in the end, for, for instance. Moreover, a qualitative analysis of coherence demonstrated that the deaf children, in spite of using conjunctions, failed to create a coherent text. The meaning or goal of the texts was often ambiguous, and appropriate informative details about certain topics and themes were often lacking. Similar difficulties with text cohesion were found in studies on spoken narratives of deaf children (e.g., Griffith & Ripich, 1988; Griffith, Ripich, & Dastoli, 1990).

Marschark, Mouradian and Halas (1994) performed a causal network discourse analysis of written narratives of 18 deaf children between 7 and 15 years old and 16 hearing children, and found different results than previous studies. All deaf children were educated in a Total Communication program, and used sign language as their primary mode of communication both at school and at home. A causal network discourse analysis describes the organization of stories in terms of goals, actions, and outcomes (GOA), which serve as the foundation of the storyline (Trabasso & Nickels, 1992). A GOA sequence is composed of a clearly defined goal, actions or attempts to achieve the goal, and outcomes. In addition to the GOA analysis, a linguistic analysis (including grammatical and stylistic rules, sentence structure, use of modifiers) was carried out. Surprisingly, the discourse analysis demonstrated similar use of discourse structures in deaf and hearing children. The linguistic analysis, in contrast, demonstrated impeded performance in deaf children: deaf children used fewer modifiers, infrequent words, and complex syntactic structures than their hearing peers did. The researchers suggest that deaf children are indeed aware of discourse rules, but lack the linguistic skills necessary for written text production.

The majority of studies examined deaf children's writing in narratives, and only few explored other text genres. Different genres of writing, such as narratives, expository texts, letters, argumentative texts, and reports entail different social and communicative conventions, which are expressed in specific forms and expressions. These conventions have to be learned as part of the process of learning to write, and the ability to communicate in different genres by considering communicative conventions is a marker of language competence (e.g., Kress, 1994; Berman & Verhoeven, 2002). Many researchers emphasize the importance of studying different genres of writing for language performance to be
One of the very few studies that examined deaf person's writing in different genres was conducted by Musselman and Szanto (1998). They found that also deaf writers' language performance varies with genre. They compared narratives (based on a picture) and letters (on the subject of deaf education) written by 69 severely and profoundly deaf adolescents from 14 to 19 years of age. Some deaf adolescents used oral language as predominant mode of communication; others used sign language predominantly. All stories and letters were analyzed for basic measures, in particular, number of words, number of different words, number of t-units (a main clause together with a subordinate clause), number of words per t-unit, and functional skills. Functional skills were defined as the ability to make appropriate use of linguistic form in conveying meaning, and were scored using a general scoring scale from 0 to 5. A level of 0 indicated that writing was highly unintelligible, with a high number of grammatical, word order, and spelling errors. In this level, writing consists of sentences without particular order or plan. A level of 5 indicated that writers used vocabulary and grammar fluently and accurately. The level of 5 indicated that writers wrote on the assigned topic with clarity, imagination, originality, and sophistication, and their ideas were logically organized. Analyses of the texts showed that deaf writers used more words in general, more words in t-units, more different words and more t-units, and attained higher scores on the functional scale in the letters than in the narratives. This study demonstrates that in deaf children, writing performance is sensitive to genre in a way that more formal, cognitively challenging tasks enhance performance.

A bilingual approach to writing

The majority of the studies reviewed above considers deaf people as a uniform group and compared deaf children with hearing peers. However, due to varying kinds and amounts of language input deaf children receive during childhood, deaf individuals differ considerably in their language backgrounds, particularly in the use of and proficiency in sign language and spoken language (Mayberry, 2002). Some deaf children receive signed language input (in the form of manually coded oral language, or sign language) early in life at school and/or at home. Other children are predominantly exposed to oral language, for example, deaf children who are educated in mainstream schools. Many deaf individuals who use sign language as predominant mode of communication also learn and use the spoken language of the surrounding community, and, hence, are considered to be bilingual1. The majority of previous studies on deaf children's writing skills did not take differences in deaf children's linguistic backgrounds into account, in particular, differences in proficiency in sign language. Differences in sign language proficiency, however, potentially have profound effects on writing in an oral language. This idea follows from theories on bilingualism.

A common idea in theories on bilingualism is that knowledge of one language can affect performance in another language, a notion often captured by the term transfer (e.g., Cummins, 1989, 1991; Gass & Selinker, 1993; Kecskés & Papp, 2000; MacWhinney, 2005; Odlin, 1989; note that scholars differ considerably in their interpretation of transfer). Kecskés and Papp (2000) define transfer as follows: '[[...] the word transfer denotes here any kind of movement or influence of concepts, knowledge, skills, or linguistic elements (structures, forms), in either direction between the L1 and the subsequent language(s)' (Kecskés & Papp, 2000, p. xvi).
Transfer, or cross-language interaction, is evidenced in many aspects of language, such as phonology, semantics, and pragmatics. Knowledge or skills acquired through one language become ready to be used in the other language (e.g., Cummins, 1991; Kecskés & Papp, 2000). Specific claims can be made 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. When certain grammatical structures in the first language are absent (or are substantially different from those in the second language), these structures are difficult to learn in the second language. Article marking, for example, is difficult for learners of English whose native language has a different system, or has no system of marking definiteness (e.g., Jarvis, 2002; Johnson & Newport, 1989; Robertson, 2000; Sharma, 2005).

Theories on bilingualism and transfer are typically based on the development of spoken languages having written forms. An important question is whether language interaction and cross-language transfer, as observed in unimodal bilingual speakers of two spoken languages, also appear in bimodal bilinguals who use languages from two different modalities, that is a spoken language which is expressed in the aural-oral modality, and a sign language which is expressed in the visual-gestural modality (e.g., Emmorey, Borinstein, Thompson, & Gollan, 2008). Sign languages and oral languages differ in at least four aspects (e.g., Emmorey, 2002). First, sign languages have a more simultaneous organization as opposed to oral languages that are organized more sequentially. Second, sign language makes linguistic use of the space in front of the signer's 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 language, not only are the hands used for linguistic expression, but also the face, head and body. For example, in most sign languages, the nonmanual grammatical marker 'raised brows' and 'head and shoulders forward' marks yes-no interrogatives. Sentences produced without this marker would be interpreted as a statement. Finally, sign languages differ from oral languages in the construction of (morphologically complex) words and sentences. In oral languages, inflected words are most often formed by adding prefixes or suffixes to a word stem, that are directly represented in phonological-graphological mappings between speech and written text. In sign languages, 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 nouns by changing the movement pattern. The movement of the noun repeats and shortens the movement of the verb. As a result of these 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. Finally, in contrast to most spoken languages, sign languages do not have a writing system. When writing, deaf people who mainly use sign language thus have to revert to both a different grammatical system and a different modality.

Research has only begun to investigate interactions between sign language and oral language in bimodal bilinguals. Strong and Prinz (2000) investigated the relation between ASL proficiency and English literacy skills in deaf children. Hundred and fifty-five severely and profoundly deaf children, ranging in age from 8 to 15 years old, were tested on their proficiency in both ASL and English. 40 children had deaf mothers and 115 children had hearing mothers. Level of proficiency in ASL was measured by a test designed for the study, which measures narrative comprehension and production, comprehension and production of classifiers, comprehension of temporal concepts, and spatial ability. On the basis of these
tests, the children were assigned to a low-, medium- or high-proficiency group. English reading and writing was measured using subtests of the Woodcock Johnson Psycho-Educational Test Battery Revised (Taylor, 1989), and the narrative production task of the Test of Written Language (TOWL) (Hammill & Larsen, 1983). The results of this study demonstrated that ASL proficiency and English proficiency were highly correlated. Such a correlational study, however, does not reveal whether there is interaction and transfer between ASL proficiency and performance in English.

Singleton, Morgan, DiGello, Wiles, and Rivers (2004) examined the effects of ASL proficiency on narrative writing in deaf bimodal bilinguals. They compared the use of vocabulary in the narratives of 72 deaf elementary school children who were either low, moderately, or highly-proficient in ASL with that of 60 age-matched hearing second language learners of English and 60 hearing monolingual speakers of English. The vocabulary analysis included the following measures: total words, frequent words, unique words (also known as type-token ratio) and function words. Results showed that the high- and moderate-proficiency signers wrote longer narratives than low-proficiency signers. Further, high- and moderate-proficiency signers used fewer function words, but more non-frequent words (at rates similar to that of monolingual speakers). The fact that high-proficiency signers used many non-frequent words in their narratives, and more so than low-proficiency signers resulted in much more creative and diverse written narratives. The researchers suggest that high-proficiency signers drew upon their semantic understandings in ASL and therefore have an advantage over low-proficiency signers.

This study suggests that the basic patterns of development and transfer in hearing bilinguals also apply to bimodal bilinguals who use languages from different modalities. This study also shows that in order to gain more insight into deaf people’s writing, it is important to take variations in sign language proficiency into account. However, given the low number of empirical studies that examined how variations in sign language proficiency may explain deaf people’s writing, more research is necessary to gain a profound insight into the details of the cross-language interaction and transfer processes in bilinguals using languages from two different modalities.

A process-oriented approach to writing

The studies we reviewed so far have provided rich information on linguistic characteristics of the final written products of deaf children. Little, however, is known about how the texts written by deaf children come about, and the cognitive processes involved in writing. Theories on written text production assume that writing involves different cognitive activities: Writers plan what they are going to write, they translate these plans into written symbols, and they review and revise what they have written (Flower & Hayes, 1980; Kellogg, 1996). Text production, therefore, is considered a complex and cognitively demanding process (e.g., Torrance & Jefferey, 1999). A growing number of researchers have recognized the complex nature of writing and have examined cognitive activities and resources related to the writing process in proficient writers (e.g., Chanquoy, Foulin, & Fayol, 1996; Rijlaarsdam, van den Bergh, & Couzijn, 1996; Torrance & Jeffery, 1999).

Several studies along this line of research have focused on the temporal organization of writing processes, and how writers temporally organize planning, translating and revising activities when writing a text. Temporal management of writing can be studied by analyzing pause duration (e.g., between consecutive words), and production rate of a
linguistic unit (e.g., a word or a clause) (e.g., Chanquoy, Foulin, & Fayol, 1990; Matsuhashi, 1987; Schilpberoord, 1996; van Hell, Verhoeven, & van Beijsterveldt, 2008). Specifically, pauses during writing provide observable and measurable cues of a person's cognitive activities during writing, and variations in pausing can be interpreted as variations in the cognitive demands of writing. Analyses of temporal markers in combination with a coding of linguistic aspects of the written text, therefore, can provide deeper insight into the linguistic and cognitive processes involved in text writing.

When studying temporal management in deaf children's writing, two situations can occur. One is that, in line with the analysis of morpho-syntactic structures, the temporal patterning exhibited by deaf children differs from that of hearing peers; this difference should be particularly large at those sites that are problematic for deaf children. The latter pattern would also suggest that deaf children are able to monitor and control their writing. An alternative prediction states that a fundamental problem for deaf children is the absence of monitoring and control skills. In that case, temporal markers should be similar at both correct and problematic sites (e.g., mean pause duration before incorrectly and correctly inflected verbs is similar).

Such a combined study of the written product and the writing process has rarely been conducted in deaf writers. Kelly (1987), in a single case study, studied a deaf adult's writing. This writer first viewed two short stories on videotape (both signed and spoken) and produced two written stories. In a later session, she reviewed and revised her texts and made changes that she thought would improve the grammar of the first version. Pause times were monitored and recorded during writing by means of a camera and a pressure-sensitive electronic writing tablet that was connected to a computer. An error analysis showed that the deaf writer made many errors that have also been observed in the literature, that is, errors in pronouns, conjunctions, determiners and verbs. She altered half of the errors during the revision process. The combined analysis of errors and pauses suggested that the pauses during writing were not associated with the correctness of what was written. For example, the writer made many grammatical errors that were not coupled with relatively long pauses. This study, however, did not statistically compare the lengths of pauses associated with correctly and incorrectly written words, so it is difficult to draw any firm conclusions on the basis of this (single case) study.

Outline of the thesis

The present thesis embodies five empirical studies on written language production in Dutch deaf children and adults, using different methods. Chapter 2 reports a study on the development of lexical noun phrases (NPs) in narrative and expository texts written by deaf and hearing children and adults. A first question is whether deaf and hearing children follow different developmental trajectories in writing lexical NPs. Secondly, we examined if, and if so how, proficiency in sign language affects the writing of lexical NPs, and compared texts written by deaf children and adults who are proficient in Sign Language of the Netherlands (SLN) with texts written by deaf children and adults who are low-proficient in SLN. As discussed before, the majority of previous studies on deaf people's writing skills did not take sign language proficiency into account. The analyses of the written texts focused on the presence of overt subject and object NPs, the presence of NP articles and modifiers, and gender and number agreement errors between article or modifier and noun. Dutch and SLN have both overlapping features and differences in their NP systems. In both Dutch and SLN,
the functions underlying subject and object marking, modifying nouns, and form 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 sign language proficiency influences written language in deaf proficiently signing children, it is predicted that deaf children who are proficient in sign language and deaf children who hardly use sign language show differences in the use of articles in lexical NPs.

The above questions are examined in two genres: narratives and expository texts. Previous studies on writing in individuals who are deaf mainly studied one specific genre, written narratives. 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. However, 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, & Billow, 2007), including children and adults who are deaf.

The study reported in Chapter 3 adopts a similar developmental and bimodal bilingual framework, and focuses on temporal reference marking in narrative and expository texts written by Dutch deaf children and adults. Texts written by deaf children (i.e., 11-12-year olds and 15-16-year olds) and adults who are either proficient in SLN or low-proficient in SLN, and hearing age-matched peers were compared on grammatical and lexical marking of temporal reference. Dutch and SLN differ with respect to temporal reference marking, with Dutch having a wide range of inflected verb forms (e.g., werkte 'worked', had gewerkt 'had worked') and lexical expressions of time to refer to states, actions or events that happened in the past (e.g. gisteren 'yesterday', drie weken geleden 'three weeks ago', toen 'then') and SLN having only lexical markers of temporal reference. If sign language proficiency influences temporal reference marking in deaf proficient signers, it is predicted that deaf children who are proficient in sign language and deaf children who hardly use sign language, will differ in temporal reference marking on verbs, but not in lexical marking of temporal reference. Temporal reference marking is examined in both narrative and expository texts, to explore the effect of variations in genre on temporal reference marking in deaf (and hearing) children and adults.

The study reported in Chapter 4 adopts a more communicative approach to writing and focuses on evaluative expression in written narratives. Evaluative expression refers to a writer's reaction to the narrated events and actions, and the writer's attitude towards the characters, actions, and events in the story. Enriching narratives through evaluative devices is an important narrative tool in both oral languages and sign languages. Narratives written by 11-12-year old deaf children who are proficient in SLN and deaf children who are non-proficient in SLN were analyzed for the presence of eight different evaluative devices (and grammatical measures: use of complex sentences and morpho-syntactic errors). Their data were also compared to evaluative expression in narratives written by hearing bilingual and monolingual children. Sign language, in contrast to oral language, has many channels to convey emotion and evaluation (i.e., lexical signs, eye gaze, body shifts, modifications of sign speed and movement, facial expression, and gesture). It can thus be expected that proficient signers transfer knowledge of sign language to evaluative expression in, and that proficiently signing children use their knowledge of communicative skills in sign language to enrich their narratives through evaluation, and more so than low-proficiently signing deaf children and hearing children with no knowledge of SLN. If true, proficiency in sign language
would enhance writing in an oral language (rather than leading to more errors on syntactic structures).

The studies reported in Chapters 2, 3, and 4 focused on the development of narrative and expository text writing. In such free production tasks, children can choose to use and avoid certain grammatical structures. Chapters 5 and 6 report more controlled experiments on deaf and hearing children's use of morpho-syntactic structures.

The study reported in Chapter 5, a structural priming experiment, explored whether deaf children's use of particular syntactic structures, that is adjective-noun structures, can be affected by prior exposure to these structures, and whether deaf children possess abstract representations of adjective-noun structures. Deaf children aged 11-12-years were compared with hearing children who had the same age, and with hearing children (aged 7-8-years) who had just learned to read and write. By including two hearing comparison groups, we can explore whether the observed pattern in deaf children's writing is qualitatively different from that of hearing children, or whether the observed results in deaf children are due to a developmental delay in the acquisition of Dutch writing (in this case, performance of the deaf children is comparable to that of the younger hearing children).

Children were primed by having them read three types of adjective-noun structures: 1) prenominal structures, in which the adjective (here, color) precedes the noun to which it refers, as in De blauwe bal [The blue ball], 2) relative clause structures, in which the adjective follows the noun, as in De bal die blauw is [The ball that is blue], and 3) main clause structures, as in De bal is blauw [The ball is blue]. Half of the primes contained the same noun as the target picture, and the other half contained a different noun than the target picture, to examine the potential influence of lexical repetition. After reading the prime structures, children described a picture in written Dutch. If the use of a particular structure is affected by prior exposure, the children, when describing a picture, should be more likely to use a similar structure as the one they had read before in the prime.

Moreover, it was examined whether the production of adjective-noun structures in deaf children differs from that of hearing children, and whether deaf children's production is affected by knowledge of sign language. In SLN, the sign for a color typically follows the sign for the noun to which it refers, whereas in Dutch adjectives can either occur before the noun (prenominal adjective-noun structures) or after the noun (main clause structure and relative clause structure). So, Dutch and SLN overlap in post-nominal constructions, but do not overlap in prenominal constructions. Given these structural differences between SLN and Dutch, it can be expected that deaf children's production of adjective-noun structures in Dutch differs from that of hearing children who have no knowledge of sign language.

Chapter 6 reports an experiment on verb inflection in deaf 11-12-year old children and hearing 7-8-year olds and 11-12-year olds, and investigated the influence of sign language knowledge on verb inflection. Dutch and SLN differ with respect to verb inflection, with Dutch having similar inflection rules (for first and third person singular subjects) for all verbs, and SLN having different rules for two types of verbs (i.e., inflected verbs and uninflected verbs). We focused on two types of errors, i.e., omission of inflections and other inflection errors in two types of verbs: verbs that are inflected in SLN and verbs that are typically uninflected in SLN. Given the different systems of verb inflection in Dutch and SLN, it can be expected that deaf children tend to omit inflection, in particular in verbs that are typically uninflected in SLN.

In Chapter 6, a process-oriented approach to writing is adopted. By analyzing inflection errors in combination with location and duration of pauses and writing rates, we aimed to gain insight into the cognitive processes during writing and whether deaf and
hearing children have developed metacognitive knowledge of verb inflection. Specifically, the duration of pauses before and after verb inflection, and writing rates of incorrectly inflected verbs are compared with pause durations and writing rates related to correctly inflected verbs. If deaf and hearing children monitor their writing, and are aware of the difficulty of verb inflection and the correctness of inflection, they should pause longer before and after incorrectly inflected verbs than before and after correctly inflected verbs, and should write incorrectly inflected verbs slower than correctly inflected verbs. If children have not yet developed these metacognitive skills for writing in Dutch, then pause durations and writing rates are expected to be similar for incorrectly and incorrectly inflected verbs.

Finally, Chapter 7 provides a summary of the main results of the experimental chapters and a general discussion. The focus of the general discussion will be on the consequences of the experimental results for understanding deaf children's writing performance and development. I specifically discuss the development of writing in deaf and hearing children, the influence of sign language knowledge on the development of writing in deaf children, implications for theories on bilingualism, and implications for educational practice and research.
References


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

Chapter 2

Abstract

Purpose: We report an analysis of lexical noun phrases (NPs) in narrative and expository texts written by Dutch deaf individuals, from a developmental and bimodal bilingual perspective.

Method: Texts written by Dutch children and adults with deafness 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). Their data were also compared to a reference group of age-matched peers who are hearing.

Results: Participants who are deaf had major problems with the morpho-syntactic structure of lexical NPs, in contrast to participants who are hearing. Further, children (but not adults) who are deaf and proficient in SLN more often omitted obligate articles than children who are deaf and low-proficient in SLN. Children and adults who are deaf and proficient in SLN did not differ from children and adults who are low-proficient in SLN in the use of NP modifiers, NP-agreement errors and omissions of obligatory NPs. The number of errors in the children who are proficient in sign language decreased strongly with age, but this developmental pattern was not found in the children who are low-proficient in sign language.

Conclusions: Children who are deaf and proficient in SLN and children who are deaf and low-proficient in SLN follow different developmental trajectories in writing lexical NPs. We argue that adopting a bimodal bilingual approach is important to understand the writing development of children who are deaf.

* This chapter has been submitted for publication
Introduction

Consider the following two fragments of narratives dealing with social conflicts between people, written by a 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 last 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]
   '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 individuals who are deaf, like these in the above story fragment written by the 11-year-old boy who is deaf (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 children who are deaf, discuss how variation in sign language proficiency may influence NP-internal errors and syntax in individuals who are deaf, and outline the bilingual perspective that we adopt to gain more insight into writing of individuals who are deaf.

**Noun phrase morphology and syntax in deaf children’s writing**

Literacy skills of people who are deaf have been the subject of an increasing number of studies. The majority of these studies focused on reading acquisition. 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, & Dowaliby, 1997). Further, implications of reading problems for instructional programs have been outlined (see Paul, 1997, for a review).

In contrast to the acquisition of reading, acquisition of writing skills by children who are deaf has received relatively little attention in empirical research. Moreover, most of the literature on writing is based on English-speaking children who are deaf. In the 1970's, a large-scale study was performed in the USA on the morpho-syntactic development of English-speaking, prelingually profoundly children who are deaf between 10 and 19 years, and children who are hearing between 8 and 10 years old (e.g., Quigley & King, 1980; Quigley, Power, and Steinkamp, 1977; Wilbur & Quigley, 1977). 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 children who are deaf concerns NPs: children who are deaf used NP patterns that were deviant from those of children who are hearing. One of the deviant patterns observed involved articles and other determiners. First, children who are deaf 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 children who are deaf showed problems combining different types of determiners. For example, they wrote *The some apple.... A third deviation in the writing of children who are deaf 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 children who are deaf, such as variations in the use of and proficiency in sign language.

Difficulties with NP morphology were also found in children who are deaf from Hebrew- and Italian-speaking communities. Tur-Kaspa and Dromi (2001) studied NPs in spoken and written language of thirteen Hebrew-speaking children who are severely to profoundly deaf between 11 and 13 years, who were educated via the oral method. Written and spoken samples were collected using several elicitation methods. Results demonstrated that Hebrew-speaking children who are deaf 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 children who are deaf ranging in age between 11 and 15 years with that of children who are hearing ranging in age between 6 and 15 years. The children who are deaf attended both special and mainstream schools, and were educated via the oral method, 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 children who are deaf 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), children who are deaf 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 children who are deaf.
Previous studies on NPs in English, Hebrew, and Italian children who are deaf thus showed that NP morphology and syntax is one of the areas that are particularly difficult for children who are deaf. 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, van Hell, Rosado, & Zamora, 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 children who are deaf 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 children who are deaf indeed showed errors in gender agreement, which mirrors the rather complex gender systems in Italian and Hebrew (Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & 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, Dutch, Hebrew, Italian, and English children who are deaf tend to omit subject and object NPs in obligatory contexts (e.g., Quigley & King, 1980; Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001).

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

A bilingual perspective

Children who are deaf 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. Children who are deaf and 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 children who are deaf, however, did not take variations in children’s proficiency in sign language into account, and treated children who are deaf 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 children who are deaf (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, & Hernandez, 1999; MacWhinney, 2005; Pavlenko & Jarvis, 2002; van Hell & 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. Transfer is evidenced in many areas, such as phonology, lexicon, morphosyntax, and pragmatics. The
Lexical NPs

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 & 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 play 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 and Spanish have a hard time learning the gender marking system because they have no basis for transferring the English gender system to German and 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 & Mayberry, 2000; Padden & Ramsey, 2000; Strong & 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.

Research on bimodal bilingualism is still in its infancy. Few empirical studies actually investigated 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 translated into print in a direct way, these functions are often omitted in the writing of people who are deaf and mainly use sign language.

In a recent study, Singleton, Morgan, DiGello, Wiles, and Rivers (2004) compared the use of vocabulary in the narratives of elementary school children who are deaf with various levels in proficiency in ASL 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, negations). They found that narratives written by individuals who are proficient in ASL contained semantically richer vocabulary, and consisted of more non-frequent and unique words than narratives written by individuals who are 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 (in press) 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. From the bimodal bilingual perspective, it can be argued that children who are deaf and 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 children who are deaf and proficient in sign language use more evaluative devices in writing (i.e., evaluations of objects or persons and references to emotional states) than children who are deaf and low-proficient in sign language (and than monolingual and bilingual children who are hearing).

In the present study, we compared children and adults who are deaf and proficient in signed language with their peers who are deaf and low-proficient in signed language. 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 individuals who are deaf and 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 individuals who are deaf and low-proficient in SLN (and individuals who are hearing). Likewise, it is predicted that individuals who are deaf and proficient in SLN experience less 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 children who are deaf 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 nonmanual 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 nouns 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', 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, de Rooij, & van den Toorn, 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 2.1 presents an overview of the Dutch modifying elements, in neuter and non-neuter singular and plural NPs.

### Table 2.1

**NP Modifiers in the Dutch Gender and Number System**

<table>
<thead>
<tr>
<th></th>
<th>Non-neuter gender</th>
<th>Neuter gender</th>
<th>English equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Plural</td>
<td>Singular</td>
</tr>
<tr>
<td>Definite article</td>
<td>de tafel</td>
<td>de tafels</td>
<td>het boek</td>
</tr>
<tr>
<td>Demonstrative pronoun</td>
<td>die tafel</td>
<td>deze tafel</td>
<td>die tafels</td>
</tr>
<tr>
<td>Possessive pronoun</td>
<td>onze tafel</td>
<td>onze tafels</td>
<td>ons boek</td>
</tr>
<tr>
<td>Adjective in definite NP</td>
<td>de grote tafel</td>
<td>de grote tafels</td>
<td>het grote boek</td>
</tr>
<tr>
<td>Adjective in indefinite NP</td>
<td>een grote tafel</td>
<td>grote tafels</td>
<td>een groot boek</td>
</tr>
<tr>
<td>Numeral</td>
<td>één tafel</td>
<td>twee tafels</td>
<td>één boek</td>
</tr>
</tbody>
</table>
Chapter 2

The rules for adjective inflection in Dutch are rather complex. Adjectives in indefinite NPs, as in countable nouns, *een kleine tas* 'a small bag', or in non-countable nouns, *rode wijn* 'red wine' are marked for gender. That is, a schwa is added to the ending 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 ending 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 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 nonmanual 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 & 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 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 aimed to provide more insight into the writing of children who are deaf 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 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.

Several questions were examined. The first question entailed the development of lexical NPs in writing of children who are deaf and children who are hearing. Specifically, we examined to what extent individuals who are deaf and individuals who are hearing follow different (or similar) developmental trajectories in the use of lexical NPs in written Dutch. Previous studies investigating writing of individuals who are deaf focused on either elementary school students (Quigley & King, 1980; Singleton, Morgan, DiGello, Wiles, &
The present study aimed to explore developmental patterns in the influence of sign language on writing by studying different age groups.

The second question entailed the influence of sign language proficiency on writing. The majority of previous studies on writing skills have attempted to only describe errors in the written language of children who are deaf. 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 people who are deaf may vary in proficiency in sign language. We therefore compared texts written by individuals who are deaf and proficient in Sign Language of the Netherlands (SLN) with those of deaf individuals who are low-proficient in SLN and who use oral language predominantly, and age-matched peers who are hearing and 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 form 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 individuals who are deaf and 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 individuals who are deaf and 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 individuals who are deaf and low-proficient in SLN.

Because narrative and expository writing is part of later language development (Nippold, 2007), we examined the language development of individuals who are deaf with different language profiles and individuals who are hearing from the age of 11-12 years onwards, and compared the writing of 11-12 year olds, 15-16-year olds, and adults. Gathercole (2002) studied the acquisition of Spanish gender by English learners of Spanish from 2nd and 5th grade. She found that the influence of English, which has no gender system, on learning the more complex Spanish gender system was strongest in the youngest children and became smaller with development. If transfer of sign language knowledge is also particularly pronounced in the earlier phases of language development, it can be expected that the writing of children who are deaf and proficient in sign language will show more evidence of transfer of sign language knowledge than that of adults who are deaf and proficient in sign language.

Third, we examined the above questions 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, & van Beijsterveldt, in press). 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, & 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 \((M = 11;9, \text{ Range } = 11;0 - 12;11)\), 31 high school students aged 15-16 years \((M = 16;0, \text{ Range } = 15;1 - 16;9)\), and 15 adults \((M = 30;7, \text{ Range } = 21;0 - 51;0)\). Selection criteria for participant inclusion were pre-lingual, severe to profound deafness \((> 80\text{dB hearing loss})\), and no additional learning disabilities.

To replicate earlier studies on writing in children who are deaf, and to compare the writing of individuals who are deaf with a reference group, we also included age-matched hearing native speakers of Dutch, in particular, 20 children aged 11-12 years, \(M = 12;2, \text{ Range } = 11;4 - 12;2\), 20 high school students aged 15-16 years, \(M = 16;2, \text{ Range } = 15;3 - 16;8\), and 20 adults, \(M = 25;5, \text{ Range } = 18;8 - 40;3\).

We divided the participants who are deaf into a group that is high-proficient in SLN and a group that is low-proficient in SLN. To assess sign language proficiency, we administered a sign language fluency test. 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, & Verhoeven, in preparation). Children first saw an example in which a picture was described in SLN by an SLN-speaker on a laptop screen. Next, children were asked to describe a comparable picture in SLN themselves. Instructions were given by a trained teacher of deaf children who was proficient in SLN and oral Dutch. The task consisted of 32 items. The task was scored by fourth year students who were trained to become a sign language interpreter, and the correlation between their scores was .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 nonmanual component), on a scale from 0 to 5. A proficient rating was assigned to 13 students aged 15-16-years and 7 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 8 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. Proportion of agreement between raters was .80.
We administered a detailed questionnaire to participants who are deaf that included questions about literacy background (i.e., reading and writing), educational background (i.e., type(s) of schooling and language of instruction), language background (i.e., language use with parents, siblings, and friends), and hearing loss and hearing aids (i.e., amount of hearing loss, cause of hearing loss, type of hearing aids, and hearing status of parents and siblings). Questionnaires were administered to the participants by the experimenter. 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 remedial teachers.

All participants who were deaf were severely to profoundly deaf (>80dB hearing loss on the best ear). Eight of the 11-12-year olds, two 15-16-year olds, and 1 adult had a Cochlear implant; the other participants who are deaf wore other types of hearing aids. Table 2.2 describes the language and educational backgrounds of the participants who are proficient in sign language and the participants who are low-proficient in sign language in the three age groups. Table 2.2 indicates that the children who were assigned to the proficiently signing group (based on their sign language fluency test scores), use sign language predominantly, and children who were assigned to the low-proficiently signing group use oral Dutch predominantly.

To gain more insight into levels of proficiency in Dutch of the two groups of children who are deaf, we collected three measures based on the written texts from our study (i.e., text length expressed in number of clauses, lexical density1, and number of abstract words) and reading level2. The resulting means and standard deviations are also presented in Table 2.2. One factor ANOVAs comparing deaf proficiently signing participants with low-proficiently signing participants showed that the 11-12-year old children who are proficient in sign language wrote longer texts than children who are low-proficient in sign language \( F(1,29) = 5.68, \ p < .05, \ \eta^2 = .20 \), tended to use more content words \( F(1,29) = 3.17, \ p = .08, \ \eta^2 = .11 \), and tended to use more abstract nouns \( F(1,29) = 2.44, \ p = .13, \ \eta^2 = .08 \). Moreover, the 15-16-year olds who are low-proficient in sign language used more content words than peers who are low-proficient in sign language, \( F(1,29) = 5.27, \ p < .05, \ \eta^2 = .18 \). Reading Comprehension Test scores (Aarnoutse, 1996) were obtained for the 11-12-year old and the 15-16-year old children (for 46 of the 62 children). A Sign language proficiency (deaf proficient signers vs. deaf low-proficient signers) x Age (11-12 years old vs. 15-16 years old) ANOVA showed that individuals who are proficient in SLN and individuals who are low-proficient in SLN did not differ significantly from each other in their level of reading comprehension. (The effect of Age showed a developmental pattern in reading comprehension: 15-16-year olds had higher scores on the reading comprehension test than the 11-12-year olds, \( F(1,42) = 10.36, \ p = .01, \ \eta^2 = .25 \). (There was no significant interaction.)

Taken together, the analyses on assessed reading level and number of abstract nouns showed that individuals who are proficient in SLN and individuals who are low-proficient in SLN did not differ on these measures of oral/written Dutch. The analysis on text length and lexical density, however, showed that proficiently signing children tended to outperform low-proficiently signing children. This parallels Singleton et al’s study (2004), which showed that children who are proficient in ASL outperformed children who are low-proficient in ASL on vocabulary use in writing. In all, these analyses showed that proficiently signing children and adults, even though their sign language skills were better than those of low-proficiently signing children and adults, were not delayed in their skills in Dutch compared to low-proficiently signing children and adults.
Table 2.2  
Language and Educational Background of proficiently signing deaf participants and low-proficiently signing deaf participants

<table>
<thead>
<tr>
<th></th>
<th>Proficient in SLN</th>
<th>Low-proficient in SLN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional language at school</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spoken Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spoken Dutch/Sign Supported Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SLN/Sign Supported Dutch</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Main language used at home</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spoken Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spoken Dutch/Sign Supported Dutch</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>SLN/Sign Supported Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Type of schooling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular schools</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Special schools for hard-of-hearing students</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Special schools for deaf students</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Mean (SD) text length</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>31.57 (17.66)</td>
<td>25.96 (11.07)</td>
</tr>
<tr>
<td>SLN/Sign Supported Dutch</td>
<td>44.57 (21.30)</td>
<td>20.38 (6.28)</td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>34.38 (10.18)</td>
<td>26.53 (19.39)</td>
</tr>
<tr>
<td><strong>Lexical density in written texts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>43.91 (9.36)</td>
<td>38.67 (3.97)</td>
</tr>
<tr>
<td>SLN/Sign Supported Dutch</td>
<td>38.94 (3.18)</td>
<td>38.53 (7.39)</td>
</tr>
<tr>
<td>SLN/Spoken Dutch</td>
<td>38.17 (9.39)</td>
<td>35.03 (4.62)</td>
</tr>
</tbody>
</table>

*Before the 1980's, the only language available to deaf children in special schools was oral Dutch without sign language.*

*These participants were educated in either special or mainstream primary schools followed by mainstream secondary schools.*
Materials and Procedure

Participants first viewed a three-minute video clip without words that showed fragments with teenagers involved in different social, moral and physical conflicts. 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. Then, they were asked to write an expository text discussing the issue of interpersonal conflicts. Participants who are hearing received instructions on paper. The participants who are deaf received instructions in Dutch (on paper) or in SLN, in line with their preferred way of communication. The order in which the writing tasks were performed was counterbalanced. The participants were not limited in time when writing their texts.

Linguistic scoring of texts

All texts were transcribed and 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 then coded using the CLAN program of the CHILDES International Child Language Data Base (MacWhinney, 1995).

The texts were coded for the distribution of lexical NPs, NP modifiers, NP-internal errors, and omissions of obligatory NPs. The dependent measures (NP modifiers, NP-internal errors, and omitted obligatory NPs) were controlled for variations in the amount of lexical NPs the writers used, as we will explain below.

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 2.4.

NP modifiers. Lexical NPs were scored for the number of times an NP modifier (i.e., demonstratives, possessives, numerals, and adjectives) was used. In each text, the percentages of total modifiers, that is, demonstratives, possessives, adjectives, and numerals, was calculated out of the total number of lexical NPs to control for differences in the amount of lexical NPs the writers used, as we will explain below.

NP-internal errors. Each text was scored for the number of times a specific NP-internal error occurred. Table 2.3 presents an overview of types of morphological errors 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. Proportion of agreement between two raters was .83 for omissions of obligatory articles, .85 for addition of obligatory articles, .79 for gender disagreement errors, and .89 for number disagreement errors.
### Table 2.3

**Types, Descriptions and Examples of NP-Internal Errors**

<table>
<thead>
<tr>
<th>NP-internal error</th>
<th>Description and Example</th>
</tr>
</thead>
</table>
| **Omission of obligatory article** | Omission of article (or other modifier) in an obligatory context  
*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  
*Hierdoor worden de anderen buite gesloten of ontstaat er een geweld. [deaf female adult, expository text]*  
Hierdoor worden de anderen buite gesloten 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  
*In de aula kan ik niet veel volgen omdat ik de enige dove meijsje 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  
*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]*) |

**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 proportion of agreement was .76.

Results

To gain insight into how hearing status, sign language proficiency, age and text genre influenced the use of lexical NPs, we compared individuals who are deaf and are proficient in SLN and individuals who are deaf and are low-proficient in SLN with reference groups of hearing age-matched peers on the distribution of NP modifiers, NP-internal errors, and omissions of obligatory NPs in written narrative and expository texts. We performed three-way ANOVAs: Group (deaf proficient signers vs. deaf low-proficient signers vs. hearing) x Age (11-12 years old vs. 15-16 years old vs. adult) x Text genre (narrative vs. expository), treating Group and Age as between-subjects variables and Text genre as within-subjects variable, on the percentage of total NP modifiers (i.e., adjectives, demonstratives, articles, possessives, and numerals), NP-internal errors (i.e., 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, respectively. In this and all following ANOVAs, alpha was set at 5% and post hoc analysis (Bonferroni/Dunn) was used if appropriate. The mean number of lexical NPs, the mean percentage of NP modifiers, NP-internal errors (including the four subcategories) and omissions of obligatory NPs (and corresponding SDs) are presented in Table 2.4.

Use of NP modifiers

The three-way ANOVA first of all showed significant main effects of Group, $F(2,126) = 6.04$, $p < .01$, $\eta^2 = .10$, Age, $F(2,126) = 21.48$, $p < .0001$, $\eta^2 = .25$, and Text genre, $F(1,126) = 35.61$, $p < .0001$, $\eta^2 = .28$. As can be seen in Table 2.4, and 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 ($p = .0004$), but not than individuals who are proficient in SLN. Further, the main effect of Age indicated an overall developmental pattern in the number of NP modifiers: Both the 15-16-year olds and the adults used more NP modifiers than the 11-12-year olds (both $p$'s < .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 ($p < .0001$).

The effects of Text genre and Age were qualified by a significant interaction, $F(2,126) = 9.59$, $p < .001$, $\eta^2 = .15$. 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, $F(1,50) = 43.72$, $p < .0001$, $\text{Eta squared} = .87$, and $F(1,34) = 4.35$, $p < .05$, $\eta^2 = .13$, respectively. The remaining interactions were not significant.
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Table 2.4: Mean Numbers (and SDs) of Lexical NPs, Mean Percentage (and SDs) of NP-internal Errors and Omissions of Obligatory NPs
**Omission of obligatory articles.**
The analysis showed significant main effects of Group, $F(2,126) = 17.10$, $p < .0001$, $\eta^2 = .27$, and Age, $F(2,126) = 10.37$, $p < .0001$, $\eta^2 = .16$. 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 ($p < .0001$ and $p = .0005$ 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 ($p = .0005$). The main effect of Age indicated an overall developmental pattern in the number of omissions of obligatory articles: 15-16-year olds and adults made fewer errors than 11-12-year olds ($p = .0269$ and $p = .0004$, respectively).

Further, the main effects of Group and Age were qualified by a significant interaction, $F(4,126) = 4.52$, $p < .01$, $\eta^2 = .14$. To gain more insight into this interaction effect, we performed subsequent one-factor (Age) ANOVAs for the individuals who are proficient in SLN and the individuals who are low-proficient in SLN, separately. (The hearing writers hardly ever made errors.) These analyses showed a significant effect of Age only in the individuals who are proficient in SLN, $F(2,32) = 4.13$, $p < .05$, $\eta^2 = .26$, and not in the individuals who are low-proficient in SLN. This indicates that only in individuals who are proficient in SLN a developmental pattern could be observed: The relatively high percentage of omissions of obligatory articles in the 11-12-year old children who are proficient in SLN was no longer observed in the adults who are proficient in SLN ($p = .0074$). The remaining differences were not statistically significant.

The overall three-way ANOVA yielded no effect of text genre, indicating that the number of omissions of obligatory articles was not different for narrative and expository text writing. The remaining interactions were not significant.

**Addition of articles**
The analysis showed only a significant main effect of Group, $F(2,126) = 4.34$, $p < .05$, $\eta^2 = .07$. Individuals who are deaf and proficient in SLN and individuals who are low-proficient in SLN did not differ significantly on the incorrect addition of article. Individuals who are deaf and proficient in SLN more often incorrectly added an article than individuals who are hearing ($p < .0001$). As can be seen in Table 2.4, this error was hardly made, however.

**Gender agreement errors**
The analysis showed only a significant main effect of Group, $F(2,126) = 19.61$, $p < .0001$, $\eta^2 = .31$. As can be seen in Table 2.4, and as confirmed in the post hoc analysis, individuals who are deaf and proficient in SLN and individuals who are deaf and low-proficient in SLN did not differ significantly on the number of agreement errors. Both individuals who are deaf and proficient in SLN and individuals who are deaf and low-proficient in SLN made more gender agreement errors than individuals who are hearing who made no errors (both $p$'s < .0001).

**Number agreement errors**
The analysis showed only a significant main effect Group, $F(2,126) = 3.39$, $p < .05$, $\eta^2 = .05$. Post-hoc tests revealed that, as we expected, individuals who are deaf and proficient in SLN and individuals who are deaf and low-proficient in SLN did not differ significantly on the use of number agreement errors. Further, individuals who are deaf and proficient in SLN made more number agreement errors than hearing individuals who made no errors ($p < .0043$).
In summary, individuals who are deaf and proficient in SLN experienced great difficulties with using obligatory articles. This was expected in light of the differences between sign language structure and oral language structure. However, the frequency of omitting obligatory articles as observed in the 11-12-year old children who are proficient in SLN was strongly reduced in the 15-16-year olds, and was no longer observed the adults who are proficient in SLN. Such a developmental pattern was not present in the individuals who are low-proficient in SLN. The number of omissions of obligatory articles was not different for narrative and expository text writing, which indicates that the number of errors was not modulated by text genre.

Omissions of obligatory NPs
The three-way ANOVA showed significant main effects of Group, $F(2,128) = 28.67, p < .0001$, $\eta^2 = .45$, and Age, $F(2,128) = 11.19, p < .0001$, $\eta^2 = .17$. 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. Individuals who are deaf and proficient in SLN and individuals who are deaf and low-proficient in SLN omitted obligatory NPs more often than their hearing peers, who never omitted an obligatory NP (both $p$'s < .0001). The main effect of Age indicated that adults omitted fewer obligatory NPs than both 11-12-year olds ($p < .0001$) and 15-16-year olds ($p = .0006$).

The interaction between Group and Age was significant, $F(4,128) = 3.76, p < .01$, $\eta^2 = .12$. Subsequent one-factor ANOVAs showed, again, an effect of Age only in the individuals who are deaf and proficient in SLN, $F(2,32) = 4.63, p < .05$, $\eta^2 = .29$, and not in the individuals who are deaf and low-proficient in SLN. This indicates that only in the individuals who are proficient in SLN, the number of omissions of obligatory NPs decreased with age: Adults made this error less often than 11-12-year olds ($p = .0047$).

There was no effect of text genre, and the remaining interactions were not significant either.

In sum, as found in the analyses of errors in gender and number agreement, and incorrect addition of articles, individuals who are deaf and proficient in SLN and individuals who are deaf and low-proficient in SLN did not differ in the frequency of omitting obligatory NPs. However, in individuals who are proficient in SLN, the frequency of omitting obligatory NPs decreased with increasing age, a developmental pattern that was not observed in the individuals who are deaf and low-proficient in SLN. Further, the frequency of omitting obligatory NPs in narrative and expository texts was not different for the two text genres.

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.
**Development of children who are deaf and children who are hearing**

The present study served to gain more insight into different developmental trajectories of children who are deaf and children who are hearing. We found that individuals who are deaf (either proficient and low-proficient in SLN) used fewer NP modifiers than individuals who are hearing. In both individuals who are hearing and individuals who are deaf, 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, van Hell, Rosado & Zamora, 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 people who are hearing, was also present in people who are deaf.

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

So far, these results parallel the findings of previous studies in which individuals who are deaf demonstrated problems with NPs and NP morphology, in proportion to the typological characteristics and morphological complexity of the target language (e.g., Quigley & King, 1980; Taeschner, Devescovi & Volterra, 1988; Tur-Kaspa & Dromi, 2001). Quigley and King (1980) reported that the English written language samples of children who are deaf (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 et al. (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 individuals who are deaf only examined narrative texts, we also examined a more formal discourse genre: expository texts. We found that individuals who are deaf, just like individuals who are hearing, 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 individuals who are deaf have difficulty with highly complex morpho-syntactic aspects of a language they have not been able to perceive auditorily from birth onwards. Children who are deaf often had late and 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 children who are deaf 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 children who are deaf 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 the different developmental trajectories in the writing of children who are proficient in sign language and children who are low-proficient in sign language, and the possible influence of sign language proficiency on writing. Given the differences in language background, it was expected that children who are deaf and who are proficient in SLN and children who are deaf and low-proficient in sign language have difficulties with NPs for different reasons. Specifically, we hypothesized that the relatively high number of morpho-syntactic errors in children who are high-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, & Hernandez, 1999; MacWhinney, 2005; Pavlenko & Jarvis, 2002; van Hell & 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 on those NP structures 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 Sign language of the Netherlands and oral Dutch). Moreover, the developmental pattern of acquisition of lexical NPs in written Dutch of children who are proficient in sign language was expected to be different from that of children who are low-proficient in sign language.

Results showed that 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 the Appendix for an example of a text produced by an 11-12-year old child who is deaf and proficient in SLN).

These results can be explained in light of the Competition model (Bates & MacWhinney, 1989), a model that describes first and second language acquisition and emphasizes competition and transfer between languages. In 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 pointed to the fact that there is no one-to-one-correspondence between signs and words. An individual sign often conveys syntactic elements difficult to capture in one English word, and a spoken word can convey meanings that a single sign cannot. People who are deaf and mainly use sign language are thus faced with the problem of how to encode all information in written text. Mayer and Wells (1996) argued that people who are deaf and mainly use sign language tend to express only those elements that have a sign equivalent in writing.

In the present study, this difficulty was typically found with respect to marking definiteness by using articles. People who are deaf and mainly use sign language cannot use their knowledge of sign language to acquire the definiteness in Dutch because sign language has no articles. Indeed, children who are deaf and proficient in sign language
frequently omitted obligate articles in NPs, in contrast to children who are deaf and 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. Although NP modifiers such as demonstratives, numerals and possessives are expressed and marked differently in SLN, the function of determining nouns exists in SLN. And, although sign language has no gender distinctions, words of different grammatical classes (e.g., modifiers and nouns) must agree in form, and the underlying rules are clear and unambiguous. SLN also marks plurality in multiple ways. Further, although subject and object NPs are not always obligatory present in SLN, the function of marking subject and objects in clauses exists in SLN (i.e., overt or marked on verb signs). In light of the Competition Model, it is 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 children who are deaf and proficient in sign language did not differ from low-proficiency signers in the use of NP modifiers, and omissions of obligatory NPs.

We want to emphasize that our results do not imply that the writing of individuals who are deaf and proficient in sign language is always at a disadvantage compared to that of individuals who are deaf and low-proficient in sign language. Singleton et al. (2004) reported that children who are deaf and proficient in ASL used more non-frequent words in their written narratives than children who are deaf and low-proficient in ASL. In a recent study, we obtained evidence indicating transfer of sign language on writing with respect to the use of enriching evaluative expressions, an extremely important narrative tool in sign language (van Beijsterveldt & van Hell, accepted). Children who are deaf and proficient in SLN used more evaluative devices in writing (i.e., evaluations of objects or persons and references to emotional states) than children who are deaf and low-proficient in SLN. Moreover, in the present study, we found that children who are deaf and proficient in SLN wrote longer texts and used more content words (nouns, verbs, adjectives, and adverbs) in their texts than children who are deaf and low-proficient in SLN. This suggests that, when writing, individuals who are proficient in sign language draw upon their knowledge of discourse skills derived from sign language.

The finding that literacy skills (in an oral language) in individuals who are deaf are positively correlated with sign language skills has also repeatedly been shown by studies on reading comprehension skills of children who are deaf (e.g., Chamberlain & Mayberry, 2000; Hofmeister, 2000; Strong & Prinz, 1997).

Development of children who are deaf with different proficiency levels in sign language

Our findings further indicate that children who are proficient in sign language and children who are low-proficient in sign language follow different developmental trajectories in learning to write. The difficulty with using articles, as observed in the 11-12-year old children who are proficient in sign language, was no longer found in the adults. Importantly, the adults who are proficient in sign language hardly ever omitted obligatory articles, in contrast to adults who are low-proficient in sign language, who still made quite a few of such errors. Moreover, in individuals who are proficient in sign language, the number of omissions of obligatory NPs decreased with age, whereas in individuals who are proficient in sign language no such developmental pattern was observed.
So, if we assume that the problems with articles in children who are proficient in sign language can be explained by influences from the structure of sign language, then the pattern in the adults who are proficient in sign language suggests that such effects are a developmental phenomenon, and that this particular effect of sign language transfer on written language is more pronounced in the earlier phases of development. The data suggest that children who are proficient in sign language have a later onset of acquisition of the article system in Dutch compared to children who are low-proficient in sign language, but are likely to eventually catch up with writers who are deaf and low proficient in sign language, and writers with typical hearing.

In the writers who are low-proficient in sign language, no such strong decrease in the number of errors was observed across the different age groups. Possibly, the children who are low-proficient in sign language have experienced more delay or degraded language input in early life, and for this reason may not have developed adequate linguistic competence in Dutch (Mayberry, 2002; Mayberry & Lock; 2003). Together, these differences in developmental patterns of children who are proficient in sign language and children who are low-proficient in sign language hint that the effect of acquiring two languages, here SLN and Dutch, does not seriously impede performance in oral Dutch, and may eventually even benefit performance in oral Dutch.

**Implications for bilingual language development**

The examination of the different developmental trajectories in children who are deaf and proficient in sign language and children who are deaf and low-proficient in sign 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. Our findings suggest that children who are deaf and proficient in sign language make more errors in writing structures that are absent in sign language. Such cross-language transfer 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 & Newport, 1989; Robertson, 2000; Sharma, 2005).

Further, the differences in performance on language-specific structures (such as articles) and discourse skills (such as vocabulary use and text length) in the writing of children who are deaf and proficient in sign language further implies that the effect of bimodal bilingualism differs for different aspects of writing. This issue is also addressed in the literature on linguistic and cognitive development in hearing bilingual children (e.g., Bialystok, 2002; MacWhinney, 2005; Petitto & Kovelman, 2003). Bialystok (2002), for example, argued that children who have learned skills in one language can potentially benefit from that mastery by applying them in the other language.

We observed that the number of omissions of obligatory articles in the writing of 11-12 year old children who are proficient in sign language decreased with age, which suggests that effects of sign language on writing vary with development. This suggestion is corroborated by bilingual studies on oral languages (e.g., Gathercole, 2002; Kohnert, Bates, & Hernandez, 1999). Gathercole (2002), for example, found that the influence of English, which has no gender system, on learning the complex Spanish gender system was strongest in young children and became smaller with development, suggesting that the effect of transfer of one language on another language in bilinguals is most critical at early stages of development.
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. Singleton et al. (2004), for instance, showed transfer effects of semantic knowledge on writing in English in children who are deaf and proficient in ASL. But, clearly, given the scarce number of 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

What are the implications of our findings on the writing of children who are deaf for educational practice and research? We found that both children who are proficient in sign language and children who are low-proficient in sign language have difficulties with morphosyntax. However, they may experience such difficulties for different reasons. In the children who are proficient in sign language, as we discussed above, the relatively high number of obligate articles may hint at a developmental stage in which children mix the morphosyntactic 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 operate, may support children go through this stage.

The relatively high number of errors of the 11-12 year old children has largely disappeared in 15-16-year old and adult individuals who are proficient in sign language. At these ages, these individuals have been exposed to both languages for a longer period. Through the years, they may have gained insight into the differences in grammatical structures between oral and signed language and may have further acquired the rules of the oral/written language, possibly through education that focused explicitly on the differences between signed and oral languages.

On the other hand, the children who are deaf and low-proficient in sign language may have experienced degraded language input early in life, both in oral language and signed language, and therefore may not yet have achieved adequate linguistic competence in written language (Mayberry, 2002; Mayberry & Lock; 2003). Obviously, given the scarce number of empirical studies on writing in children who are deaf with different language backgrounds there is a need for research that tracks children over time to gain a deeper insight into the developmental patterns of children with different language profiles.

Finally, 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 children who are deaf (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.

The present study contributes to our current knowledge on writing in children who are deaf by providing empirical evidence that underlines the importance of taking variations in language backgrounds into account: Children who are deaf and proficient in sign
language and children who are deaf and low-proficient in sign language follow different developmental trajectories in learning to write.
References


Chapter 2


Appendix

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, 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 baas
*and always Ø boss'
*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 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 ruzie 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
*nw 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]
Abstract

We report a study on temporal reference marking in narrative and expository texts written by Dutch deaf individuals, from a developmental and bimodal bilingual perspective. The temporal reference marking systems in Dutch and Sign Language of the Netherlands (SLN) differ substantially, with Dutch, having a wide range of lexical and morphological markers of temporal reference, and SLN relying on lexical marking of temporal reference. The results showed that the youngest proficiently had difficulties with tense morphology, and avoided the marked past tense form and omitted verbs, but showed no problems with lexical marking of temporal reference. In the older proficiently signing writers, verb morphology emerged and temporal reference marking resembled that of the hearing writers in adults. This suggest that bimodal bilingual learners follow the same developmental pathway as hearing unimodal bilinguals who first depend on pragmatic devices and lexical devices, and gradually start using more and more verb morphology to mark temporal reference. It is concluded that deaf proficient signers, deaf low-proficient signers, and hearing children follow different developmental trajectories in temporal reference marking in writing. Our study also shows that in order to gain more insight into deaf people's writing, it is important to take variations in language backgrounds into account.

* This chapter has been submitted for publication
Introduction

In connected discourse like a narrative text, each utterance must contain some time reference. So, whatever is expressed by the clause must be brought into relation to the time at which the event took place. Time reference can be expressed through different linguistic devices, particularly, grammatical categories of tense and lexical items. Grammatical marking of temporal reference is achieved by adjusting the morphology of the verb, so by inflecting the verb for tense. The most common grammatical categories of tense are present, past and future. Lexical marking of temporal reference is achieved by using temporal adverbs or adverbial phrases and connectives such as now, three days ago, tomorrow, then.

In the present study, we examine the use of grammatical and lexical markers of temporal reference in personal-experience narratives written by deaf individuals of different ages and with different proficiency levels in sign language, and hearing individuals. Personal-experience narratives typically recapitulate a past experience by matching a sequence of clauses to the sequence of events that actually occurred (Labov, 1972). Consider the following three fragments of personal-experience stories about social conflicts between people, written by an 11-year-old deaf boy who is proficient in sign language, an 11-year-old deaf boy who is not proficient in sign language, and an 11-year-old boy without hearing impairment, respectively.


2) Een keer op dinsdagavond moest ik gaan darten. Toen ik klaar was, ging ik naar buiten om naar huis te gaan. Toen kwam er die zei mijn naam en schelden. Later ben ik weggerend naar de wijkgebouw waar ik moest darten. En iemand heeft mij weggebracht naar huis.

In the past [past tense temporal adverb in Dutch], me and my class argument with another class [verb is missing]. That is not funny. Other child says. Mieke is stupid and always boss. Then [present tense temporal adverb in Dutch] Mieke says. That you are yourself. Then [present tense temporal adverb in Dutch] quarrel start. Then [present tense temporal adverb in Dutch] other children help other child. Then [present tense temporal adverb in Dutch] my class help Mieke. Later we go inside. Then [present tense temporal adverb in Dutch] other children say to teacher. Teacher of other class says to our teacher. Then [present tense temporal adverb in Dutch] we must not have argument and other children also! Then [present tense temporal adverb in Dutch] we say sorry. And other children also say sorry. Now we don't have argument well a little not much. We can make up.
to play darts. And someone took me home [perfect tense in Dutch which corresponds to imperfective tense in English].

3) *Het gebeurde op een mooie zonnige dag. Ik was aan het skaten bij de olifantjes speeltuin. Daar was ook mijn vriendje Johnny aan het skaten samen met Edward. Van het een kwam het ander en we hadden knalende ruzie. Slaan, schoppen enzovoort. Mijn moeder zag dat, en zei dat ik naar binnen moest. Ik kon zonder eten naar bed.*

'It happened on a beautiful sunny day. I was skating at the elephants' playground. My friend Johnny was also playing there together with Edward. One thing led to another and we had a terrible fight. Hitting, kicking, etcetera. My mother saw that and said that I had to come inside. I was sent to bed without having dinner.'

The typically developing boy and the deaf boy who is not proficient in sign language anchored their narratives in the past tense, by using past tense verb forms and temporal adverbs. The proficiently signing deaf boy, in contrast, anchors his story in the present by using present tense verb forms and temporal adverbs. Once, however, he starts a clause with a temporal adverb indicating past tense *vroeger* 'in the past', but then refrains from using an obligatory (past tense) verb. We hypothesize that the acquisition of temporal reference marking by deaf students can be framed in the perspective of Second Language Acquisition (SLA). Specifically, we hypothesize that the pattern in temporal expression as observed in the proficiently signing deaf boy's story reflects the way in which temporal reference is expressed in sign language. Before describing our study in more detail, we will first discuss acquisition of temporal reference marking in SLA in hearing children. Then, we discuss relevant studies on temporal reference marking in deaf children's writing, discuss how variations in sign language may influence temporal reference marking in writing, and outline the bilingual perspective that we adopt to understand temporal reference marking in deaf writers. As will become evident in this discussion, the relatively few studies that examined temporal reference marking in deaf children's writing focused on isolated sentences, presented out of a meaningful context. Second, most studies on deaf children's writing (on tense and other linguistic aspects) did not take into account that deaf people vary in the use of, and proficiency in, sign language.

*Acquisition of temporal reference marking in SLA*

Researchers on SLA have extensively investigated the acquisition of temporality (see Bardovi-Harlig, 1999, 2000, for reviews). One line of research is concerned with how L2 learners express temporal relations (e.g., Bardovi-Harlig, 1999; Dietrich, Klein, & Noyau, 1995; Lee, 2001; Meisel, 1987; Prévost & White, 2000; Schuman, 1987; von Stutterheim & Klein, 1989). Several target languages (in particular, English, Dutch, German, French, Swedish, Spanish, Italian and Korean) were investigated in mostly longitudinal designs, using interlanguage samples through different elicitation methods. These studies well documented that second language learners have difficulty with the overt realization of tense morphology when referring to past events. In the earlier stages of temporal expression the use of verbal morphology or even verbs is very limited. In this stage, learners employ discourse and pragmatic means to express temporality, such as context, calendric expressions, or making inferences (Schumann, 1987). In a next stage, lexical devices such
as adverbials and connectives are used predominantly to express temporality (Bardovi-Harlig 1999; Meisel, 1987). Following this adverbial-only stage, tense morphology appears. At first tense morphology is not used systematically, and can take a while until tense marking becomes a reliable indicator of temporal reference. In fact, many second language learners may never reach this stage (Dietrich, Klein, & Noyau, 1995). Studies along this line of research basically agree that second language learners’ expression of temporality displays a developmental pattern, from using pragmatic and lexical devices to gradually using more and more grammatical morphology (Bardovi-Harlig, 1999). Other studies investigating tense-aspect morphology point at another universal pattern in second language learning, which is referred to as the Aspect Hypothesis (e.g., Anderson & Shirai, 1996, Bardovi-Harlig & Bergström, 1996, Shirai & Kurono, 1998; Wenzell, 1989, see also Bardovi-Harlig, 1999 and 2000, for reviews). The Aspect Hypothesis claims that the acquisition of tense-aspect morphology is strongly influenced by the inherent semantic aspect of the verbs to which inflections are attached, and that beginning second language learners tend to use verbal morphology to mark lexical aspecual rather than temporal distinctions.

Transfer

When learning a particular language one comes to attend to particular types of meanings and expects them to be expressed by particular types of forms. Form-function relations between linguistic forms and their discourse function are language-specific, and can be different across different languages (e.g., Slobin, 2001). Berman and Slobin (1994), for example, studied the development of temporal expression in spoken retellings of the Frog story (Mayer, 1969) in different languages, and found that monolingual, hearing children speaking different languages acquire typologically distinct ways of expressing temporal relations, reflecting differences in linguistic structure among the different languages. Consequently, people acquiring two languages with different sets of linguistic devices for temporal reference marking have to keep track of the right system when using one language. Several theories and models on bilingual language development deal with this issue (e.g., MacWhinney, 2005) and claim that knowledge of one language can affect performance in another language, which is referred to as cross-linguistic transfer. Specific claims can be made on transfer of morphology. Because morphology is the most language-specific part of a language, mappings between languages are difficult to make. When certain structures in the first language are absent or substantially different, these structures are difficult to learn. Adult second language (L2) learners of Hungarian, for example, have severe difficulties in learning the conjugation of verbs (MacWhinney, 1992). Hungarian distinguishes two ways of verb conjugations: transitive and intransitive. The choice between transitive and intransitive conjugations is controlled by 13 different factors, such as transitivity, definiteness, and reference (MacWhinney, 1989). Not surprisingly, choosing the proper conjugation of the verb is extremely difficult for L2 learners of Hungarian who are not used to take these different factors into account in their native language.

Cross-linguistic transfer has been reported for a number of different morpho-syntactic structures and different language combinations (e.g., Gathercole, 2002, Müller & Hulk, 2001; Nicoladis, 2002; White, 2003). Only a few studies have focused on transfer of temporal reference marking in L2 (cf. Kupersmitt & Berman, 2001, in Spanish children learning Hebrew; Yang & Huang, 2004, in Chinese children and adults learning English; Bartelt, 1989, in adult Navajo- and Western Apache-speaking learners of English; Wenzell, 1989, in Russian adults learning English). These studies typically focus on narrative
development in bilingual speakers of typologically different languages and show that bilinguals use different linguistic forms to meet narrative functions of tense and aspect than monolingual speakers of each of these languages do. Kupersmitt and Berman (2001), for example, studied tense, aspect, and modality in Spanish spoken narratives of nine Spanish-Hebrew children between 4 and 12 years old. The marking of tense, aspect, and modality is more elaborately marked in the grammatical system of Spanish than in Hebrew. Spanish verbs are inflected for tense and aspect (perfective and imperfective in past tense, and progressive and perfect aspect in present, past and future tense), whereas Hebrew has no grammatical aspect but only marks tense on verbs (present, past, and future). The children were raised in families in which (South American) Spanish was the dominant language, and the parents were native speakers of Spanish. The children and their families lived in a Hebrew-speaking country (Israel) and all children attended monolingual Hebrew (pre)schools. It is assumed that the children's L1 is Spanish but that by late preschool, Hebrew has become their primary language. Although most monolingual Spanish storytellers anchor their picture book based stories in the present (Salaberry, 1999), analysis of the Spanish-Hebrew bilingual children's narratives revealed that Spanish-Hebrew bilingual children anchor their narratives in the present (perfective) tense, which corresponds to the simple past tense in Hebrew, the typical form used in Hebrew stories (Berman & Neeman, 1994). The Spanish-Hebrew children also made relatively little use of different varieties of tense and aspect marking. Kupersmitt and Berman (2001) conclude that the bilingual children seemed to avoid those devices in their Spanish stories that are typologically different from Hebrew.

Yang and Huang (2004) investigated the acquisition of the English tense system by Chinese children and adults. Chinese is a language that has no tense but uses pragmatic and lexical devices to mark temporal reference. In contrast, in English temporal reference is grammaticalized. The study involved the analysis of past event narratives written by five age groups (i.e., 10-, 12-, 14-, 16-, and 19-year-olds) of Chinese learners of English (with English proficiency levels ranging from late beginning to advanced) in Hong Kong. They found that beginning Chinese learners of English follow the same, often observed, developmental pathway from the more pragmatic and lexical way of expressing temporal references to the grammatical way. However, because of the Chinese tenseless system, the period in which pragmatic and lexical ways of expressing temporal reference is dominant seems more persistent in these learners. Only university students, being the most advanced learners of English, appeared to have acquired tense morphology.

**Acquisition of temporal reference marking in deaf writers**

Only a few studies examined the acquisition of temporal reference marking in deaf children's writing (Ivimey, 1981; Quigley, Wilbur, & Montanelli, 1976). Quigley et al. (1976) performed a large-scale study on the use of auxiliary verbs, tense sequencing, and verb deletion in 427 English-speaking deaf children between 10 and 18 years old. The deaf children's language backgrounds, particularly variations in proficiency in sign language, were not described. Children had to make a judgment of the grammaticality of sentences. In addition, if a sentence was judged to be incorrect, the children were asked to rewrite it. Results showed that deaf children, generally speaking, knew when a verb was required, but were unable to use one that was correct in either number or tense.

Ivimey (1981) examined tense marking in 11 English-speaking severely deaf children between 9 and 10 years old. One child had deaf parents and used sign language at home.
The other ten children used a mixture of oral communication and sign language. The children were asked to write a sentence about a picture. Then, the children were asked to indicate the time reference of their written sentence. Finally, they were asked to change the time reference of the sentence, for example from present to simple past. Results demonstrated that 80% of the children wrote sentences in which tense agreement between the temporally marked verb and the temporal adverb was violated. The researchers suggest that deaf children express temporal reference mainly by the use of temporal adverbs rather than through inflection of the verb.

A bilingual perspective on the writing of deaf proficient signers

Children who are deaf 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. Children who are deaf and who use a signed language and an oral/written language 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 children who are deaf, however, did not take variations in children's proficiency in sign language into account, and treated children who are deaf as a single and uniform group in the comparison with children who are hearing (Ivimey, 1981; Teaschner, Devescovi & Volterra, 1988; Tur-Kaspa & Dromi, 2001; Quigley & King, 1980; Quigley, Wilbur, & Montanelli, 1976). Given the differences in the amount and type of language input among children who are deaf (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. Research on deaf children's writing development that takes into account differences in language backgrounds may also provide useful input for teaching spoken/written language to deaf students.

Most theories and studies concerning bilingual or second language development involve two or more oral languages. Little is known about bimodal bilingual development, and whether transfer across languages, as observed in hearing bilinguals is also observed in deaf children who handle two languages from different modalities, in particular a signed language and an oral language. Oral languages and signed languages differ in several ways (e.g., Liddell, 2003). An oral language is perceived auditory and produced orally, whereas a signed language is perceived visually and produced manually. Moreover, in contrast to most oral languages, signed languages have no written forms. Finally, signed languages and oral languages differ from a structural point of view. First, signed languages have a more simultaneous organization as opposed to oral languages, which are organized more sequentially. Second, signed language makes linguistic use of the space in front of the signer's body, called the 'syntactic signing space'. For example, when communicating about referents during conversation, signers point to positions in space to refer to them. Finally, in signed language not only the hands are used for linguistic expression, but also the face, head, and body. Importantly, oral language and signed language also differ in the marking of temporal reference (in a later section we explain the discrepancy between SLN and Dutch with respect to temporal reference marking).

Evidence for different developmental trajectories for proficient signers and low-proficient signers comes from a study by van Beijsterveldt and van Hell (in press) who compared evaluative expressions in narratives written by 11-12-year old deaf children who
were proficient in sign language with those of deaf peers who were low-proficient in sign language, and hearing bilingual and monolingual peers, and found that proficient signers used more evaluation in their narratives than low-proficient signers and hearing bilingual and monolingual did. It is suggested that deaf children who are proficient in signed language used their knowledge of evaluative expression in signed language to enrich their narratives in written Dutch.

The present study

The main question of the present study entailed the development of temporal reference marking in the writing of children who are deaf and proficient in signed language, deaf children who are low-proficient in signed language, and children who are hearing. Specifically, we examined to what extent these children follow different (or similar) developmental trajectories in temporal reference marking in written Dutch, a discourse function which requires different language-specific forms in SLN and Dutch. We compared deaf children and adults who are proficient in Sign Language of the Netherlands (SLN) with deaf peers who are low-proficient in SLN, and with hearing peers in three age groups on temporal reference marking. In particular, we focused on grammatical and lexical markers of temporal reference, in which SLN and Dutch differ, and on errors in tense agreement between grammatical and lexical markers of temporal reference. In the following section, we will briefly discuss the typological distinctions with respect to temporal reference marking in Dutch and in SLN.

Secondly, most studies on writing in deaf children and studies on the acquisition of temporal reference marking in bilingual speakers of spoken languages focus on narrative types of discourse. In the present study, we examined the effect of variations in discourse genre on temporal reference marking by comparing personal-experience narrative (an account of an incident related to a conflict in which the writer had been personally involved) and expository discussion (a treatise on the topic of interpersonal conflict from an analytical perspective). Personal-experience narratives, typically, focus on what happened and are built around the temporal sequencing of events (e.g., Berman & Slobin, 1994). Expository texts are built around a topic that usually does not have a temporal dimension. This type of discourse informs about how something is, needs to be, or should be. Consequently, the ordering of descriptions in expository texts does not follow the temporal sequencing of events but is dictated by a problem that needs to be addressed. Tense morphology in these two genres has been studied by Ragnarsdóttir, Aparici, Cahana-Amitay, van Hell, & Vigué (2002) in hearing fourth graders, sixth graders, high school students, and adults in five languages (i.e., Icelandic, Dutch, French, Hebrew, and Spanish). Results showed that across age groups and languages, the personal experience narratives were predominantly anchored in the past, and expository texts were anchored in the present. In the present study, we used a similar framework and investigated the development of temporal reference marking in narrative and expository texts in writers who are deaf. A study of both narrative and nonnarrative texts will further contribute to our understanding of the acquisition of tense morphology in bilinguals (Bardovi-Harlig, 2000).

Temporal reference marking in Dutch and in SLN

Dutch and SLN differ with respect to the degree in which time reference is achieved by grammatical categories or by lexical items. In Dutch, just like English, the grammatical
marking of temporal reference is obligatory. In other words, temporal features are indicated by verb inflection. For example, when referring to something that happened in the past by means of the following sentence, *Yesterday I go to work early and come back late*, would be grammatically incorrect. Rather, the finite verbs *go* and *come* must be marked for past tense. Thus, in Dutch, as in English, it is grammatically correct to write, *Yesterday I went to work early and came back late*. Finite verbs are marked for either present tense, for example, *zij werkt* 'she works', or past tense, for example, *zij werkte* 'she worked'. In complex verbal structures, tense is marked on the first element, the auxiliary, for example, *had moeten werken* 'had-PAST must-INF work-INF' 'must had worked'. Future tense is formed by the modal verb *zullen* 'will'. Nonfinite verbs are not marked for tense. They may stand alone as main verbs, for example *slapen* 'sleep' as in *Zij ging naar huis om te slapen* 'She went-AUX home to sleep-INF'. They can also be preceded by tense-marked auxiliaries and modal verbs, for example, *had kunnen werken* 'had-PAST could-INF work-INF' 'could have worked'. Table 3.1 presents the tense forms in Dutch and examples of each form.

Table 3.1

<table>
<thead>
<tr>
<th>Tense (and Aspect) Forms in Dutch</th>
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<tr>
<td><strong>Tense</strong></td>
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<td>Future Perfect</td>
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<td>Future Past Perfect</td>
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</table>

The Dutch language does not have a rich aspectual system. Generally, aspectual meanings in Dutch are not expressed through verb inflection but through verbal structures (e.g., the combination of certain verbs and/or prepositions with an infinitive, e.g., *is aan het werken* 'is-PRES working-PROGR' (literally: 'is on the work'). Only the *perfective* is partly created through changes of the verb form itself, in combination with an auxiliary, for example *heb gewerkt* 'have-PRES worked-PERF' (see also Table 3.1).

The Dutch system of lexical marking of temporal references, i.e., temporal adverbs, adverbial phrases, and temporal conjunctions, resembles the English system. There is one exception, which plays an important role in the acquisition process. Dutch has two equivalents to the English *then: dan* and *toen*. *Dan* can only be used for reference to present or future, and *toen* is limited to reference to the past.

Research is only beginning to describe temporality, temporal aspect and verb morphology in sign languages. However, up to now, research on the typology of sign language basically agrees that in contrast to many spoken languages, sign language does not use bound morphemes, like the past tense marker -*te* or -*de* in Dutch, to refer to the past. Generally, time in sign language is described in terms of an imaginary time line in the syntactic signing space. The area near the signer's body has the general meaning of *present*, the space in front of the body represents *future*, and the area behind the shoulder
Temporal reference marking

has the general meaning of past. In addition to the time line, many lexical items, such as ‘YESTERDAY’, can be located on or move along certain positions in the syntactic signing space to indicate temporal reference (see e.g., Klima & Bellugi, 1979, for American Sign Language, ASL; Jacobowitz & Stokoe, 1988, for British Sign Language, BSL; Schermer, 1991, for Sign Language of the Netherlands, SLN).

Schermer and Koolhof (1989) investigated the time marking system in native speakers of SLN from different regions in the Netherlands. The data consisted of video recordings of spontaneous language and elicited sentences in SLN. It appeared that signers of SLN generally use a similar imaginary time line as described in ASL and BSL. The space near the body represents the present, the space in front of the body represents future and the space behind the shoulder represents past. Moreover, lexical items are used to refer to past or future, and present time is not marked overtly. A sign such as GISTEREN ‘YESTERDAY’ is used to indicate that something has happened yesterday. The neutral past tense marker VERLEDEN ‘PAST’ is articulated above the right shoulder. Signs such as KOMT ‘WILL’, TOEKOMST ‘FUTURE’ or MORGEN ‘TOMORROW’ are used to indicate future tense. Schermer and Koolhof concluded that the time marking system in SLN strongly resembles the systems of ASL and BSL: Present tense is unmarked and past and future time reference in SLN is expressed by lexical items which can be located on an imaginary time line. Aspect in SLN can be marked lexically or grammatically. Perfective aspect, to indicate that the event being described is completely finished, is marked lexically by the sign KLAAR (or FINISH in ASL) (Schermer, 1991; Liddell, 2003). In addition, many verb signs have morphologically complex forms that express other aspectual meanings (e.g., Liddell, 2003; Schermer and Koolhof, 1989). These complex forms can be created through changes in the form of the sign itself, by modification of the length of the movement or by the use of nonmanual markers. For example, the sign TOEKOMST ‘FUTURE’ can be accompanied by a nonmanual intensifier to emphasize the length of time, and the sign VERLEDEN ‘PAST’ can itself be modified by a nonmanual adverbial to indicate a long(er) time ago. In the present study we only focus on temporal reference marking, and not on aspectual marking, because the Dutch language does not have a rich aspectual system.

Predictions

It can be concluded that the tense systems in Dutch and SLN differ substantially, with Dutch displaying a wide range of inflected verb forms and lexical expressions of time, and SLN having only lexical markers of temporal reference. 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 individuals who are deaf and proficient in SLN experience more difficulty with linguistic features that are absent in sign language and oral language, like grammatical markers of temporal reference, in their written Dutch than individuals who are deaf and low-proficient in sign language, and hearing individuals. Likewise, as both SLN and Dutch have lexical markers of tense, we expected little difference in the use of lexical devices for marking tense between deaf proficient signers and deaf low-proficient signers.

Assuming that the expression of tense is a developmental phenomenon, and that differences between two language systems lead to transfer particularly in the early stages of language learning (e.g., MacWhinney, 2005), we expect that the differences between proficiently signing writers and low-proficiently signing writers (on those structures that differ across SLN and Dutch) will decrease with increasing age.
Finally, we expect differences in grammatical markers of temporal reference between proficient signers and low-proficient signers, and hearing writers to be more pronounced in narratives than in expository texts, because narratives typically have the marked past tense as default tense (see, e.g., Ragnarsdóttir et al., 2002).

**Method**

**Participants**

Three age groups of Dutch deaf individuals participated in the study: 31 children aged 11-12 years ($M = 11;9$, $SD = .05$), 31 high school students aged 15-16-years ($M = 16;0$, $SD = .06$), and 15 adults ($M = 30;7$, $SD = 6.6$). Three age-matched groups of hearing native speakers of Dutch participated, 20 children aged 11-12 years ($M = 12;2$, $SD = 0.4$), 20 high school students aged 15-16-years ($M = 16;2$, $SD = 0.6$), and 20 adults ($M = 25;5$, $SD = 5.7$), as well as a fourth group of 20 hearing children who were younger than the youngest deaf children, i.e., 9-10-year olds ($M = 10;3$, $SD = 0.6$).

Selection criteria for deaf participant inclusion were pre-lingual, severe to profound deafness (> 80dB hearing loss), and no learning disabilities. Each age group contained two subgroups of deaf participants: proficient speakers of SLN and low-proficient speakers of SLN. Proficiency in SLN in the 11-12-year olds was measured by means of a sign language fluency test (Hermans, Knoors, & Verhoeven, in preparation). Children were administered a production task which assesses the children’s use of a variety of SLN structures of syntax and morphology (i.e., verb of motions, verb agreement, aspect, and number marking on verbs). After they had seen an example in which a picture was described in SLN by an SLN-speaker, children were asked to describe a comparable picture in SLN. The task consisted of 32 items. On the basis of their test scores, children were classified as proficient or low-proficient in SLN. Children who scored 15 or above ($n = 15$, $M = 19.00$, $SD = 2.66$) were classified as proficient in SLN, and children who scored below 15 ($n = 16$, $M = 3.69$, $SD = 4.30$) were classified as low-proficient in SLN. Because this test is designed to measure SLN proficiency in deaf children in primary education only, we used a different sign language fluency task for 15-16-year olds and adults. We asked them to sign a short narrative in front of a camera. A native SLN speaker assessed the quality of the narratives on use of morphosyntax (i.e., hand configurations, verb inflection, word order, and nonmanual component) on a scale from 0 to 5. A proficient rating was assigned to 13 students aged 15-16-years and 7 adults who scored 3 or higher ($M = 3.76$, $SD = 0.97$) and a low-proficient rating was assigned to 18 students aged 15-16-years and 8 adults ($M = 0.54$, $SD = 0.76$).

The deaf participants were educated in different special schools for deaf students, hard-of-hearing students or regular schools. In special schools for deaf students and hard-of-hearing students, the language of instruction (oral Dutch, Sign Language of the Netherlands, Sign Supported Dutch) varied. To gain more insight into the deaf writers’ language learning and use, we administered a detailed language background questionnaire. The following describes the language backgrounds of the proficient and low-proficiency signers in the three groups.

**11-12-year old proficient signers.** These children learned Dutch and SLN in special 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 child who had deaf parents who only used SLN.
**15-16-year old proficient signers.** These children learned Dutch and SLN in special (secondary) schools for deaf students, using Sign Language of the Netherlands in combination with Sign Supported Dutch as instructional language. 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 two children who had deaf parents who only used SLN, and one child with a deaf brother and sister who also used only SLN at home.

**Adult proficient signers.** These adults were educated in special primary and secondary schools for deaf students. Before the 1980's, the only language available to deaf children in special schools was oral Dutch without sign language. However, all adults pointed out to have used sign language at home from early age on. Seven adults were educated in special primary and secondary schools for deaf students. Before the 1980's, the only language available to deaf children in special schools was oral Dutch without sign language. However, all adults pointed out to have used sign language at home from early age on. Three of them had two deaf parents, and four had two hearing parents. One participant (with hearing parents) had a deaf sibling.

**11-12-year old low-proficient signers.** Three children learned Dutch in special schools for deaf students, 5 were educated in special schools for hard-of-hearing children, and 7 were educated in mainstream schools. The classroom language of instruction for most children was Oral Dutch, sometimes supported with signs at special schools for deaf students. At home, all children used oral Dutch.

**15-16-year old low-proficient signers.** Eleven children learned Dutch in special (primary and secondary) schools for deaf students, and 7 were educated in either special or mainstream primary schools followed by mainstream secondary schools. The classroom language of instruction for most children was Oral Dutch, sometimes supported with signs at special schools for deaf students. At home, all children used oral Dutch.

**Adult low-proficient signers.** Eight adults were educated in special primary and secondary schools for deaf students, and one was educated in mainstream schools. As noted before, before the 1980's, the only language available to deaf children in special schools was oral Dutch without sign language. At home, during school years, all adults used oral Dutch, sometimes supported with signs.

To verify that deaf proficient signers and deaf low-proficient signers differed in sign language proficiency only and not in proficiency in Dutch, we compared proficient and low-proficient signers on three different measures. We compared proficient and low proficiently signing children (11-12-year olds and 15-16-year olds) with respect to scores on the Reading Comprehension Tests (Aarnoutse, 1996) obtained in previous research (Wauters, van Bon, & Tellings, 2006) in which 76% of the children participated. A one-factor ANOVA revealed that proficient signers ($M = 20.38$, $SD = 5.38$) and low-proficient signers ($M = 22.13$, $SD = 4.07$) did not differ significantly in level of reading comprehension, $F (1,46) = 1.622, p = 0.21$. Further, MLU (in words) and text length measures were calculated in order to gain insight into the writers' levels of linguistic development (Brown, 1973). We calculated MLU in words instead of morphemes because presence of verbal inflectional morphemes is part of the dependent measures in this study. Text length was analyzed in terms of number of clauses in a text, where a clause refers to "any unit that contains a unified predicate which expresses a single situation (i.e., activity, event, state), including finite and nonfinite verbs, as well as predicate adjectives" (Berman and Slobin, 1994). Mean MLUs and text lengths for narratives and expository texts are given in Table 3.2.
MLU. Two-way ANOVAs: type of writer (deaf proficiently signing, deaf low-proficiently signing, hearing) x text genre (narrative, expository) on MLU for each age group showed significant effects of type of writer and of text genre in 11-12-year olds ($F(2,48) = 5.84, p < .01$, and $F(1,48) = 24.87, p < .0001$) and in 15-16-year olds ($F(2,48) = 5.22, p < .01$, and $F(1,48) = 15.88, p < .001$), and only a significant effect of type of writer in adults ($F(2,32) = 5.14, p < .05$). Post hoc analyses showed that MLUs of the 11-12-year old deaf proficiently and low-proficiently signing writers did not differ significantly, but proficient signers had lower MLUs than hearing peers ($p < .01$). The MLUs of the 15-16-year old deaf proficiently and low-proficiently signing writers did not differ significantly, and both had lower MLUs than their hearing peers ($p < .05$ and $p < .01$, respectively). The MLUs of proficiently and low-proficiently signing adults did not differ significantly, but the low-proficiently signing adults had lower MLUs than their hearing peers. Further, overall, the 11-12-year olds and the 15-16-year olds had a higher MLU in narratives than in expository texts. The remaining effects were not significant.

Text length. Two-way ANOVAs: type of writer (3) x text genre (2) on mean number of clauses for each age group showed only effects of type of writer, and only for 15-16-year olds ($F(2,48) = 21.73, p < .0001$) and adults ($F(2,32) = 4.663, p < .05$). Post-hoc tests revealed that hearing writers wrote longer texts than both proficiently and low-proficiently signers (15-16-year olds: both $p$'s < .0001; adults: $p = .07$ and $p < .01$, respectively). No differences were observed between proficiently and low-proficiently signers, in all age groups.

So, proficiently and low-proficiently signing peers did not differ in reading comprehension, MLU and text length in written Dutch texts. Because both proficiently and low-proficiently signing deaf writers wrote shorter texts than their hearing peers, we divided each score of each writer by the total number of clauses in her or his text (expressed in percentages), so that differences in text length between participants are controlled for and cannot bias the effects.
### Table 3.2

**Mean MLU and Number of Clauses (and SDs) in Narrative and Expository Texts of Deaf Proficiently Signing Writers, Deaf Low-Proficiently Signing Writers, and Hearing Writers**

<table>
<thead>
<tr>
<th></th>
<th>Deaf writers</th>
<th></th>
<th>Hearing writers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proficient in SLN</td>
<td>Low-proficient in SLN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11-12-years</td>
<td>15-16-years</td>
<td>adult</td>
</tr>
<tr>
<td>Nar MLU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>5.32</td>
<td>4.31</td>
<td>6.17</td>
</tr>
<tr>
<td>$SD$</td>
<td>1.31</td>
<td>0.96</td>
<td>0.86</td>
</tr>
<tr>
<td>Nar Clauses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M$</td>
<td>21.53</td>
<td>20.07</td>
<td>19.00</td>
</tr>
</tbody>
</table>

Nar = Narrative; Exp = Expository text
Materials and Procedure

Participants first viewed a three-minute video clip without words that showed fragments with teenagers involved in different social, moral and physical conflicts. Participants were then asked to write a story about a situation in which they had been involved or an incident they had experienced of interpersonal conflict, and an expository text discussing the issue of interpersonal conflict. The instruction explicitly told not to retell the fragments they had seen in the video (the instruction was identical to that used by, e.g., Berman & Verhoeven, 2002 and Ragnarsdóttir et al., 2002). The order in which the writing tasks were performed was counterbalanced. The participants were not limited in time when writing their texts.

Data analysis

All texts were transcribed, coded and analyzed using the CLAN program of the CHILDES International Child Language Data Base (MacWhinney, 1995). Texts were coded for the presence of grammatical tense markers, lexical markers of temporal reference, clauses without obligatory grammatical tense markers, and errors in tense agreement between grammatical and lexical tense marker. Below, we describe these measures in more detail. As noted before, in the analyses, each score of each writer was divided by the total number of clauses in her or his text (and expressed in percentages), so that differences in text length are controlled for.

Grammatical markers of temporal reference. Each clause in each text was coded for grammatical categories of tense. Table 3.1 lists the eight grammatical categories of tense and examples for Dutch. In the statistical analyses, all past tenses (i.e. simple past, present perfect, and past perfect) were collapsed, as well as all future tenses (i.e., present future, past future, perfect future, past perfect future).

Missing obligatory tense marker. Each clause in each text was coded for clauses in which an obligatory grammatical tense marker was missing. In this category we included clauses without any verbs (e.g., *soms hij wel lief of zo of boos,'sometimes he sweet or something or angry'), and clauses without a finite verb indicating tense (e.g., *de jongen altijd taxi slapen 'the boy always taxi sleep' [infinitive in Dutch]).

Lexical markers of temporal reference. Each text was coded for total number of temporal adverbs, (e.g., nu 'now', dan 'then'), temporal adverbial phrases (e.g., volgende week 'next week', vorig jaar 'last year'), and temporal conjunctions (e.g., toen 'when'). These different devices were collapsed for the statistical analyses.

Tense agreement errors. Each text was coded for clauses in which the lexical marker of temporal reference does not agree in tense with the verb. This scoring category includes for example clauses in which there is disagreement in tense between the temporal adverb and the finite verb. An example is "Vroeger ik woon daar 'In the past I live there' from a narrative of a 12-year-old deaf boy. In this example, the temporal adverb marks past tense, whereas the finite verb marks present tense. A second frequently observed error was when there was no grammatical tense marker but only a temporal adverb for marking tense. An example from a narrative of a 12-year-old deaf boy is "En toen mijn fiets pakken door stom jongen 'And then my bike take by stupid boy'. In this example, the Dutch temporal adverb toen 'then' indicates past tense. The only verb in this clause, pakken 'take', is an infinitive, which has not been marked for tense. So, in this example, tense is only marked by a temporal adverb (toen 'then').
Results and Discussion

Deaf proficient signers, deaf low-proficient signers and hearing peers in three age groups (11-12-year olds, 15-16-year olds, and adults) were compared on 1) grammatical tense markers (i.e., present, past and future tense), 2) missing obligatory grammatical tense markers, 3) lexical markers of temporal reference, and 4) tense agreement errors in narratives and expository texts. 3

Narratives

Grammatical markers of temporal reference. In the first analysis, we examined the distribution of present, past and future tense in narratives of deaf proficient signers, low-proficient signers and hearing participants and the extent to which this pattern is qualified by age. A three-way ANOVA: Group (deaf proficient signers, deaf low-proficient signers, hearing participants) x Age (11-12-year olds, 15-16-year olds, and adults) x Tense (present, past, future), treating Group and Age as between-subjects variable, and Tense as within-subject variable, was performed on the mean number of (grammatical) tense marked clauses. In this and all following ANOVAs, alpha was set at 5% and post hoc analysis (Bonferroni/Dunn) was used if appropriate. The resulting means are presented in Tables 3.3 and 3.4.

Table 3.3

<table>
<thead>
<tr>
<th>Hearing writers</th>
<th>9-10-year old</th>
<th>11-12-year old</th>
<th>15-16-year old</th>
<th>adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nar</td>
<td>Exp</td>
<td>Nar</td>
<td>Exp</td>
<td>Nar</td>
</tr>
<tr>
<td>Present tense</td>
<td>34.2</td>
<td>77.4</td>
<td>22.1</td>
<td>75.2</td>
</tr>
<tr>
<td>M</td>
<td>34.2</td>
<td>21.4</td>
<td>29.4</td>
<td>28.4</td>
</tr>
<tr>
<td>Past tense</td>
<td>50.3</td>
<td>10.0</td>
<td>74.3</td>
<td>11.4</td>
</tr>
<tr>
<td>M</td>
<td>36.7</td>
<td>19.6</td>
<td>31.3</td>
<td>24.3</td>
</tr>
<tr>
<td>Future tense</td>
<td>0.1</td>
<td>2.3</td>
<td>0.1</td>
<td>4.9</td>
</tr>
<tr>
<td>M</td>
<td>0.6</td>
<td>5.7</td>
<td>0.5</td>
<td>9.1</td>
</tr>
<tr>
<td>Missing tense marker</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lexical markers of temporal reference</td>
<td>34.0</td>
<td>26.2</td>
<td>25.5</td>
<td>19.5</td>
</tr>
<tr>
<td>M</td>
<td>22.0</td>
<td>25.1</td>
<td>16.5</td>
<td>14.1</td>
</tr>
<tr>
<td>Tense agreement errors</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
The three-way ANOVA on the mean number of (grammatical) tense marked clauses showed a significant three-way interaction between Group, Age, and Tense, $F(8,256) = 6.09$, $p < .0001$. The source of this interaction appears to be the relatively frequent use of present tense by 11-12-year-old proficient signers (63.8%; use of present tense in remaining groups varies from 22.1% to 47.3%). Further, there were significant main effects of Group, $F(2,128) = 5.90$, $p < .01$, Age, $F(2,128) = 5.90$, $p < .0001$, and Tense, $F(2,256) = 120.30$, $p < .0001$. The analysis also showed significant interaction effects between Group and Age, $F(4,128) = 3.82$, $p < .01$, and between Group and Tense, $F(4,256) = 7.58$, $p < .0001$. Because the significant main effects and two-way interaction effects were qualified by the significant three-way interaction, we performed subsequent Group (deaf proficient signers, deaf low-proficient signers, hearing participants) x Tense (present, past, future) ANOVAs for each age group to gain more insight into the source of the three-way interaction.

11-12-year olds. The analysis showed significant main effects of Group, $F(2,48) = 6.40$, $p < .01$, and Tense, $F(2,96) = 40.13$, $p < .0001$. Hearing participants used more tense marked verbs than both proficient and low-proficient signers (both $p$'s < .01). Proficient and low-proficient signers did not differ significantly in the overall number of tense marked verbs.
Further, past and present tense was used more often than future tense (both $p$'s < .0001). However, the effects of main Group and Tense were qualified by a significant interaction, $F(4,96) = 18.12$, $p < .0001$. To explain this interaction, we performed subsequent one-way ANOVAs: tense (3) for proficient signers, low-proficient signers, and hearing 11-12-year olds.

The analysis in the 11-12-year old proficient signers showed a significant main effect of tense, $F(2,28) = 82.40$, $p < .0001$. Present tense ($M = 63.8\%$) was used more much more frequently than past tense ($M = 9.38\%$) and future tense (0%; both $p$'s < .0001). The difference between past and future tense was not significant. The main effect of tense was also significant in the 11-12-year old low-proficient signers, $F(2,30) = 9.22$, $p < .001$, but the pattern differed from that of the proficient signers. Past tense ($M = 39.86\%$) and present tense ($M = 35.45\%$) were used equally often, and both were used more often than future tense ($M = 0.7\%; p < .001$ and $p < .01$, respectively). The main effect of Tense was also significant in the 11-12-year old hearing children, $F(2,38) = 31.70$, $p < .0001$, but in turn, the pattern differed from that of both deaf groups. Past tense ($M = 74.3\%$) was used more often than present tense ($M = 22.1\%; p < .0001$), and both were used more often than future tense ($M = 0.1\%; p < .0001$ and $p < .005$, respectively).

15-16-year olds. The analysis showed only a significant main effect of Tense, $F(2,96) = 56.90$, $p < .0001$. Past tense was used more often than present tense and future tense, and present tense was used more often than future tense (all $p$'s < .0001 or better).

Adults. As in the 15-16-year olds, the analysis showed only a significant main effect of Tense, $F(2,64) = 34.04$, $p < .0001$. Past tense was used more often than present tense and future tense. Present tense was used more often than future tense (all $p$'s < .0001).

So, the source of the three-way interaction appears to be that the 11-12-year old deaf proficient and low-proficient signers showed a different use of tense than all other groups. Hearing participants in all three age groups, and the deaf 15-16-year olds and adults anchor their narratives in the past. In contrast, 11-12-year old proficient signers use present as dominant tense in their narratives. The deaf 11-12-year old low-proficient signers use past and present tense equally often.

Omissions of obligatory tense markers

A two-way ANOVA: Group (3) x Age (3) on the mean number of omitted obligatory grammatical tense markers showed main effects of Group, $F(2,128) = 10.88$, $p < .0001$, and Age, $F(2,128) = 11.42$, $p < .0001$. Both deaf proficient and low-proficient signers omitted an obligatory tense marker significantly more often than hearing participants who never omitted an obligatory tense marker ($p < .0001$ and $p < .01$, respectively). Proficient signers made this error more often than low-proficient signers ($p < .01$). Further, 11-12-year old children omitted more obligatory tense markers than 15-16-year olds ($p < .01$) and adults ($p < .0001$). The 15-16-year olds and adults did not differ significantly from each other. The effects of Group and Age were qualified by a significant interaction, $F(4,128) = 4.82$, $p < .01$. To explain this interaction, we performed subsequent one-way ANOVAs: Group (3) for each age group.

The analysis for the 11-12-year old children showed a significant effect of Group, $F(2,48) = 9.57$, $p < .001$. Deaf proficiently signing children omitted an obligatory tense marker ($M = 21.9\%$) significantly more often than hearing children (who never omitted one) ($p < .0001$), and somewhat more often than deaf low-proficient signers ($M = 9.2\%$) ($p < .05$). Deaf low-proficient signers did not differ significantly from hearing children. The analysis for the 15-16-year olds also showed a significant effect of Group, $F(2,48) = 7.28$, $p < .01$. As in
the 11-12-year olds, deaf proficient signers omitted an obligatory tense marker ($M = 7.2\%$) significantly more often than their hearing peers (who never omitted one) ($p < .001$), and somewhat more often than deaf low-proficient signers ($M = 4.1\%$) ($p < .05$). Deaf low-proficient signers did not differ significantly from hearing peers. Also the analysis for the adults showed a significant effect of Group, $F(2,32) = 4.08$, $p < .05$. Only low-proficiently signing adults still omitted obligatory tense markers ($M = 1.9\%$); none of the hearing and proficiently signing adults made this error.

**Lexical markers of temporal reference**

A two-way ANOVA: Group (3) x Age (3) on the mean number of lexical markers of temporal reference yielded no significant effects.

**Tense agreement errors**

A two-way ANOVA: Group (3) x Age (3) on the mean number of tense agreement errors showed significant main effects of Group, $F(2,128) = 10.88$, $p < .0001$, and Age, $F(2,128) = 5.68$, $p < .01$. Proficient signers made more errors than both low-proficient signers and hearing participants ($p < .001$ and $p < .0001$, respectively). Low-proficient signers and hearing participants did not differ significantly in the number of tense agreement errors. Further, 11-12-year olds made more errors than adults ($p < .01$); the remaining differences between age groups were not significant. The main effects of Group and Age were qualified by a significant interaction, $F(4,128) = 3.36$, $p < .01$. To explain this interaction, we performed subsequent one-way ANOVAs: Group (3) for each age group.

The analysis on the 11-12-year olds yielded a significant effect of Group, $F(2,48) = 9.54$, $p < .001$. Proficient signers made more tense agreement errors ($M = 8.3\%$) than low-proficient signers ($M = 2.3\%$) and hearing peers, who never made such errors ($p < .01$ and $p < .0001$, respectively). Low-proficient signers and hearing children did not differ significantly from each other. The analysis on the 15-16-year olds also yielded a significant effect of Group, $F(2,48) = 4.97$, $p < .05$. Proficient signers ($M = 3.6\%$) made significantly more tense agreement errors than hearing peers who made no such errors at all ($p < .01$). Low-proficient signers ($M = 0.95\%$) did not differ significantly from hearing peers. The analysis on the adults showed no effect, indicating that deaf proficient signers, low-proficient signers and hearing adults did not differ in the number of tense agreement errors.

**Expository texts**

The statistical procedure is similar to that of narratives texts.

**Grammatical markers of temporal reference**

A three-way ANOVA: Group (3) x Age (3) x Tense (3) was performed on the mean number of tense marked clauses. The resulting means are presented in Tables 3.3 and 3.4. This analysis showed significant main effects of Group, $F(2,128) = 5.71$, $p < .01$, Age, $F(2,128) = 9.44$, $p < .0001$, and Tense, $F(2,156) = 941.33$, $p < .0001$. First, deaf proficient signers used fewer tense marked clauses than deaf low-proficient signers ($p < .0001$) and hearing participants ($p < .001$). Proficient signers and hearing participants did not differ in the number of tense marked clauses. Second, 11-12-year olds used fewer tense marked clauses than 15-16-year olds ($p < .01$) and adults ($p < .001$). The 15-16-year olds and adults did not differ in the number of tense marked clauses. Third, present tense was used considerably more often than past tense ($p < .0001$) and future tense ($p < .0001$), and past tense was used more often than future tense ($p < .01$). Moreover, Group interacted with Age,
The three-way interaction between Group, Age, and Tense was marginally significant, $F(8,256) = 1.92, p < .06$. As can be seen in Tables 3.3 and 3.4, all nine groups of writers clearly anchor their expository texts in the present tense (as also observed in a cross-linguistic study on hearing writers writing expository texts in five different languages, Ragnarsdóttir et al., 2002). At a more detailed level, however, the pattern in the 11-12-year old proficient signers is somewhat different. Because these children relatively often omitted obligatory tense markers, see the analysis reported in the next section, their overall use of tense marked clauses is lower than in the remaining groups. Therefore, the dominance of using present tense over past tense is attenuated in the 11-12-year old proficient signers (i.e., post hoc analyses confirmed that the difference in use of present and past tense in the 11-12-year old proficient signers (49.6%) was indeed smaller than the corresponding difference in the remaining groups).

**Missing obligatory tense markers.** A two-way ANOVA: Group (3) x Age (3) on the mean number omitted obligatory tense markers showed significant main effects of Group, $F(2,128) = 20.03, p < .0001$, and Age, $F(2,128) = 12.12, p < .0001$. As was found for narratives, both deaf proficient ($p < .0001$) and low-proficient signers ($p < .01$) omitted an obligatory tense marker significantly more often than hearing participants who never omitted an obligatory tense marker. Proficient signers made this error more often than low-proficient signers ($p < .0001$). Further, 11-12-year old children omitted obligatory tense markers more often than 15-16-year olds ($p < .01$) and adults ($p < .0001$). The 15-16-year olds and adults did not differ significantly from each other. The effects of Group and Age were qualified by a significant interaction, $F(4,128) = 6.82, p < .0001$. To explain this interaction, we performed subsequent one-way ANOVAs: Group (3) for each age group.

The analysis for the 11-12-year old children showed a significant effect of Group, $F(2,48) = 18.84, p < .0001$. Deaf proficiently signing children omitted an obligatory tense marker ($M = 24.4\%$) significantly more often than deaf low-proficient signers ($M = 7.1\%$) ($p < .001$), and hearing children (who never omitted one) ($p < .0001$). Deaf low-proficient signers did not differ significantly from hearing children. The analysis for the 15-16-year olds also showed a significant effect of Group, $F(2,48) = 5.37, p < .01$. Deaf proficient signers omitted an obligatory tense marker ($M = 7.8\%$) significantly more often than their hearing peers (who never omitted one) ($p < .001$), and deaf low-proficient signers ($M = 5\%$) ($p < .05$). Deaf low-proficient signers did not differ significantly from hearing peers. Finally, the analysis for the adults also showed a significant effect of Group, $F(2,32) = 4.28, p < .05$. Deaf proficiently signing adults ($M = 3.2\%$) omitted obligatory tense markers more often than hearing adults (who never omitted one) ($p < .01$), but not more often than low-proficiently signing adults ($M = 1.1\%$).

**Lexical markers of temporal reference**
A two-way ANOVA: Group (3) x Age (3) on the mean number of lexical markers of temporal reference yielded no significant effects, indicating that, as was found in the narratives, deaf proficient and low-proficient signers, and hearing participants did not differ in the use of lexical markers of temporal reference.

**Tense agreement errors**
A two-way ANOVA: Group (3) x Age (3) on the mean number of tense agreement errors showed a significant main effect of Group, $F(2,128) = 4.53, p < .05$. Deaf proficient signers made more tense agreement errors ($M = 2.3\%$) than low-proficient signers ($M = 0.5\%$) ($p < .001$) and hearing participants who never omitted an obligatory tense marker. The main
effect of Age was not significant. However, Group interacted with Age, \(F(4,128) = 4.34, p < .01\). We therefore performed subsequent one-way ANOVAs: Group (3) for each age group. Only the analysis for the 11-12-year olds yielded a significant effect of sign language proficiency, \(F(2,48) = 7.66, p < .01\). Proficient signers made tense agreement errors (\(M = 5\%\)) more often than low-proficient signers and hearing children who never made this type of error (\(p < .01\) and \(p < .001\), respectively). Few errors were observed in 15-16-year olds, and no significant differences were observed. As can be seen in Table 3.4, tense agreement errors were no longer or were rarely observed in the proficiently and low-proficiently signing adults, respectively. This pattern of results is comparable to that observed in the narratives.

In summary, deaf proficient signers, deaf low-proficient signers, and hearing participants from all three age groups anchor their expository texts in the present. Furthermore, the 11-12-year old proficient signers omitted obligatory tense markers more often and made more tense agreement errors than their low-proficiently signing peers. As was also found in the narratives, no significant differences were observed between the proficiently and low proficiently signing 15-16-year olds and adults. Finally, the number of errors (i.e., missing obligatory tense markers and tense agreement errors) decreased with age in both proficient and low-proficient signers.

So, 11-12-year old deaf children who are proficient in sign language appear to have more difficulties with the marking of temporal reference in Dutch, which differs from SLN, than low-proficiently signing children. An alternative explanation for the problems the deaf signing children have is that their development of Dutch tense marking is simply delayed in comparison to that of hearing peers, and is not qualitatively different. To test this, we compared 11-12-year old deaf proficient signers with a younger group of hearing children between 9 and 10 year old. Using the same procedure as in the other participants, we collected written narratives and expository texts of 20 9-10-year old children and scored their texts on the use of present, past and future tense, missing obligatory grammatical markers and tense agreement errors. The resulting means are presented in Table 3.4.

A two-way ANOVA: Group (11-12-year old proficiently signing deaf children, 9-10-year old hearing children) x Tense (present, past, future) on the mean number of tense marked clauses in narrative texts showed a significant main effect of Tense, \(F(2,66) = 28.02, p < .0001\). Present tense (\(p < .0001\)) and past tense (\(p < .0001\)) were used more often than future tense. The main effect of Group was not significant, but Group interacted with Tense, \(F(2,66) = 14.44, p < .0001\). A subsequent one-way ANOVA: Tense (3) on the mean number of tense marked clauses in the 9-10 year old hearing children showed a significant effect of Tense, \(F(2,38) = 11.58, p < .0001\). The 9-10 year olds used present tense and past tense equally often, and both were used more often than future tense (\(p < .01\) and \(p < .0001\), respectively). This pattern does not correspond with the pattern observed in the deaf proficiently signing children, who used present tense predominantly, but rather corresponds with that of deaf low-proficiently signing children, who also show a mixed use of past and present tense.

A two-way ANOVA: Group (2) x Tense (3) on the number of tense marked clauses in expository texts showed significant main effects of Group, \(F(1,33) = 9.07, p < .01\), and Tense, \(F(2,66) = 152.23, p < .0001\). The interaction was not significant. Hearing 9-10 year olds used more tense marked clauses than proficiently signing 11-12-year olds, and present tense was used more often than past (\(p < .0001\) and future tense (\(p < .0001\)). Past and present were used equally often.

As can be seen in Table 3.3, 9-10-year old hearing children never omitted obligatory tense markers and did not made tense agreement errors. In contrast, as can be
seen in Table 3.4, (and as shown in previous analyses) deaf-proficient signers omitted many obligatory tense markers and made many tense agreement errors.

The comparison of written narrative and expository texts of the 11-12-year old proficient signers with texts written by a younger group of hearing children indicates that grammatical tense marking of deaf proficiently signing children is qualitatively different from that of the younger hearing children.

General Discussion

This study focused on tense marking in narratives and expository texts written by Dutch deaf individuals at different ages (11-12-year olds, 15-16-year olds, adults) and with different levels of proficiency in sign language, and their hearing peers. We analyzed the use of grammatical and lexical markers of temporal reference. It appeared that narrative texts of typically developing individuals are predominantly anchored in the past (only 9-10-year olds show a mixed use of past and present tense). Expository texts are mostly written in the (timeless) present tense. These findings correspond to those of Ragnarsdóttir et al. (2002) who compared form and content of verb phrases in narrative and expository texts written by children and adults in five languages. Moreover, our data showed that typically developing hearing individuals at all age levels had no difficulties with tense morphology. All hearing writers used the morphologically marked tense form (past tense) fluently, and made no errors in tense agreement between lexical and grammatical markers of temporal reference.

However, tense morphology developed differently for deaf writers. The omission of obligatory tense marked on finite verbs, tense agreement errors, and the tendency to use the unmarked tense form (present tense) we observed in the deaf writers, parallel earlier findings on tense and verb morphology in English-speaking deaf children (Ivimey, 1981; Quigley, Montanelli, & Wilbur, 1976). Both the Dutch and English tense marking systems are highly grammaticized systems, and the empirical studies demonstrate that grammatical marking of temporal reference is difficult to learn for deaf individuals.

It can hardly be surprising that individuals who are deaf have difficulty with highly complex morpho-syntactic aspects of a language they have not been able to perceive auditorily from birth onwards. Children who are deaf often had late and 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 children who are deaf use sign language as their main language of communication, whereas others are less frequently exposed to sign language and use mainly spoken language. The majority of previous studies on deaf children’s writing did not take into account that deaf people may vary in proficiency in sign language. To gain more insight into the potential cause of deaf writers’ difficulty with tense marking in Dutch, we distinguished between deaf individulas who are proficient in SLN and deaf individuals who are low-proficient in SLN and use oral language predominantly. SLN is a language in which temporal characteristics of events are not categorized by a rich and obligatory system of grammatical morphology as in Dutch, but by a system of lexical markers. Our results showed that variations in sign language proficiency indeed modulated the grammatical marking of temporal reference, in particular in the 11-12-year olds. In the narratives, the proficiently signing 11-12-year olds used the unmarked tense form (present tense) considerably more often than a marked tense form (here: past tense as used by typically developing and low-proficiently signing children) to refer to states, actions or events.
that happened in the past. Further, the proficiently signing 11-12-year olds omit obligatory tense marking -by omitting finite verbs or using morphologically unmarked verb forms (infinitives)- more often than their low-proficiently signing peers, in both narratives and expository texts. Also, the proficiently signing 11-12-year olds made more errors in tense agreement between temporal adverb and finite verb than their low-proficiently signing peers. Although proficiently signing 15-16-year olds used past tense more often than the 11-12-year olds in narratives, they still omitted more finite verbs and made more tense agreement errors than their low-proficiency signing peers. The relatively high number of errors in the 11-12-year old and the 15-16-year old proficient signers, however, was no longer observed in the adult proficient signers.

The other linguistic form available to express temporal reference, i.e., via the use of lexical devices (temporal adverbs, phrases and connectives) is typologically less different in Dutch and SLN, although the position of lexical markers of temporal reference within a sentence may vary across the two languages. Hence, we expected that the effect of writers’ variation in sign language proficiency would be less pronounced in the use of lexical markers of temporal reference in Dutch writing. Our data indeed show that proficient and low-proficient signers did not differ on the use of lexical markers of temporal reference.

So, our findings indicate that children who are proficient in sign language and children who are low-proficient in sign language follow different developmental trajectories in learning to write. The difficulty with tense morphology, as observed in the 11-12-year old children who are proficient in sign language, was no longer found in the proficiently signing adults. This corresponds to findings obtained by Yang and Huang (2004), who investigated the acquisition of the English tense system by hearing Chinese children and adults whose L1, just like SLN, has no tense but uses pragmatic and lexical devices to mark temporal reference. They found that beginning Chinese learners of English avoided verb morphology to mark tense, and used pragmatic and lexical ways of marking time reference. It was not until adulthood, being the advanced stage of L2 learning, that verb morphology was used appropriately to mark temporal reference. In the present study, deaf children who are proficient in sign language showed difficulties with tense morphology, and avoided the marked past tense form in narratives and omitted verbs, but showed no problems with adverbials. This suggests that they relied heavily on lexical means of temporal reference marking. In the older proficiently signing groups, verb morphology emerged and temporal reference marking resembled that of typically developing writers. In the 15-16-year olds and adults, the (morphologically marked) past tense is now the dominant tense in narratives. The 15-16-year olds made substantially fewer morphological errors in temporal reference marking than the 11-12-year olds, and such errors were basically absent in the adults’ texts. But are likely to eventually catch up with writers who are deaf and low proficient in sign language, and writers with typical hearing.

Also low-proficiently signing deaf children (who use oral language predominantly) show difficulty with tense marking on verbs. However, they may have such difficulties for different reasons than the proficiently signing deaf children. The low-proficiently signing deaf children may have experienced degraded language input early in life, both in oral language and signed language, and for this reason may not yet have achieved adequate linguistic competence in written language (e.g., Mayberry, 2002; Mayberry & Lock; 2003). Together, these differences in developmental patterns of children who are proficient in sign language and children who are low-proficient in sign language hint that the effect of acquiring two languages, here SLN and Dutch, does not seriously impede performance in oral Dutch, and may eventually even benefit performance in oral Dutch.
Given the fact that SLN does not mark temporal reference morphologically, the proficiently signing deaf children's difficulty with using tense morphology in writing can be understood in light of models and studies on bilingual processing which emphasize interaction, competition and transfer across languages (e.g., Gathercole, 2002; Kupersmitt & Berman, 2001; MacWhinney, 2005; Müller & Hulk, 2001; Nicoladis, 2002; Wenzell, 1989; White, 2003; Yang & Huang, 2004). When certain structures in the first language are substantially different from, or are absent in, the second language, these structures are difficult to learn. In the present study, the cross-modal bilingual writers' challenge was particularly large for grammatical tense marking. People who are deaf and mainly use sign language cannot use their knowledge of sign language to acquire tense, because sign language does not mark temporal reference grammatically. Rather, SLN uses lexical items for expressing temporal reference, and, moreover, has no auxiliary verbs and copula. The adult proficient signers appeared to have largely acquired the Dutch tense system, and hence seem to be more focused on these contrastive structures in the two languages. With respect to the use of lexical items for temporal reference marking, however, SLN and Dutch overlap to a large extent. It is then expected that this can be learned more easily. Our data indeed show that proficient and low-proficient signers at all age levels did not differ in the use of temporal adverbs and connectives.

**Implications for teaching deaf students**

As we have argued, the typical pattern of temporal reference in proficiently signing children's writing may hint at a developmental stage in which children mix the morphosyntactic systems of oral language and signed language, just like hearing bilinguals in two spoken languages do. What are the implications of this finding for teaching deaf signers a written language? Methods of language teaching to L2 learners has traditionally focused on the monolingual native speaker, and minimised the role of the L1. Cook (1999) argues for a L2 user approach to language teaching, in which L2 leaners are considered as speakers and writers in their own right and which takes variations in L2 learners language profiles into account. Following Cook's line of argument, teaching written language to deaf signers could focus on the specific difficulties deaf children encounter in learning an auditory-oral language. It could be helpful that teachers draw the students' attention towards the nature of a written language, and could highlight those aspects of written language that are differently marked in signed language, such as verb inflection.

To conclude, this study contributes to previous work on the acquisition of temporal reference marking in SLA (as discussed in the Introduction) by showing that the basic patterns of development and transfer also apply to languages from two different modalities, Sign Language of the Netherlands and oral Dutch, that differ with respect to temporal reference marking. Obviously, given the rare number of empirical studies on how variations in sign language proficiency may explain deaf people's writing, more research is necessary to gain more insight into the details of the cross-language interaction and transfer processes in languages from two different modalities.

Our study also shows that in order to gain more insight into deaf people’s writing, it is important to take variations in sign language proficiency into account. As discussed in the Introduction, the potential influence of sign language knowledge onto writing in an oral language has largely been neglected in related studies on writing by children and adults who are deaf. Our cross-sectional study demonstrated that deaf proficient signers, deaf low-proficient signers, and hearing children follow different developmental trajectories in
temporal reference marking in writing, with proficiently signing children following the same developmental pathway as unimodal bilinguals who first depend on pragmatic devices and lexical devices, and gradually start using more and more verb morphology to mark temporal reference.
References


Evaluative expression in deaf and hearing children's written narratives

Abstract

Children who are deaf vary in the use of and proficiency in signed language. The majority of studies on writing skills of children who are deaf did not assess deaf children's proficiency in signed language and/or grouped together deaf children with varying sign language skills. Adopting a bimodal bilingual perspective, we examined evaluative expression, an important narrative tool in both oral/written languages and signed languages, in narratives written in Dutch by deaf children who are proficient in Sign Language of the Netherlands (SLN) and deaf children who are low-proficient in SLN, and hearing monolingual and bilingual children. We hypothesized that deaf children who are proficient in signed language use their knowledge of evaluative expression in signed language to enrich their narratives in written Dutch, and more so than deaf children who are low-proficient in signed language and hearing monolingual and bilingual children. We examined the use of eight different evaluative devices in narratives written by deaf proficiently and low-proficiently signing children, and hearing monolingual and bilingual children. Narratives were also examined for morpho-syntactic errors and use of complex sentences. The results show that proficiently signing deaf children's narratives contain more evaluative devices that enrich the referential structure of the narrative than narratives of low-proficiently signing deaf children, and hearing bilingual and monolingual children. We propose that proficiently signing deaf children use their knowledge of SLN to convey evaluation in their written narratives, and thus have an advantage in enriching their narratives. This study also shows that in order to gain insight into deaf people's writing, it is important to take variations in sign language proficiency into account.

Introduction

Consider the following fragment of a personal-experience narrative dealing with social conflicts, written by a Dutch 11-year-old deaf girl who is highly proficient in Sign language of the Netherlands (SLN).

'Soms sneeuw op snelweg tussen Assen. [verb is missing; incorrect use of preposition]
Dan ik wel in taxi zit. [word order violation]
In Assen [determiner is missing] chauffeur zegt
Beter ga terug. [word order violation; subject is missing]
Dan ik ben beetje sip. [word order violation]
En mama zegt hoe moet ik nou weer naar [omission of article] horende
[grammatical gender error] school.
Grote [grammatical gender error] probleem. [verb is missing; subject is missing]

'TSometimes snow on highway between Assen. [verb is missing; incorrect use of preposition]
Then I am in taxi. [word order violation; Not in English]
In Assen [determiner is missing] driver says
Better go back. [word order violation; subject is missing]
Then I am little disappointed. [word order violation; not in English].
And mom says how should I go to [omission of article] hearing [grammatical gender error] school.
Big [grammatical gender error; not in English] problem. [verb is missing; subject is missing]

From a linguistic point of view, this written fragment contains many errors, including word order violations, verb omissions, grammatical gender errors, and errors in the use of prepositions and articles. Writing a narrative, however, requires more than only using correct linguistic forms. In this paper, we report a study on evaluative expression in narratives written by deaf children who are proficient in SLN and deaf children who are not proficient in SLN. Their data were compared to that of hearing children with different language backgrounds: monolingual children and bilingual children from Turkish immigrant families born in the Netherlands.

In their classical study, Labov and Waletzky (1967) describe a narrative as a sequence of temporally related clauses from a particular point of view. They distinguish two aspects in narratives: referential and evaluative aspects. Referential aspects constitute the plot and convey information of characters, actions and events in the story. Evaluative aspects, on the other hand, express what actions and events mean. These reveal the writer's reactions to the narrated events and actions, and the writer's attitude towards the characters, actions, and events. To illustrate, in the fragment of the deaf girl's narrative at the beginning of this Introduction, evaluative information is conveyed via different devices. Disappointed describes her emotional state about the event she describes. Moreover, little in 'Then I am little disappointed' modifies the emotional state of disappointment, and big in 'Big problem' intensifies the noun 'problem' to which it refers. Finally, direct speech, such as in 'In Assen driver says better go back' and 'And mom says how should I go to hearing school' makes the narrative more vivid and suspends the action of the narrative. So, despite the many morpho-syntactic errors in this fragment, this deaf girl -who is proficient in signed
Evaluative expression

language- seems well able to enrich her narrative through evaluative devices. In the present study, we hypothesize that the high number of linguistic errors on the one hand and narrative enrichment on the other hand in this high-proficiently signing girl's narrative can be explained by influence of sign language knowledge on writing. Before we describe our study in more detail, we discuss research on evaluation in narratives of hearing children. Then, we review studies dealing with writing in deaf children, and outline the bilingual perspective we adopt to gain insight into deaf children's narrative writing.

Evaluation

Enriching narratives through evaluation involves expressing the interlocutor's knowledge state and involvement. Moreover, it entails that the writer or speaker adjusts the linguistic form and content of the narrative to maintain the recipient's attention and interest. Not surprisingly, enriching narratives through evaluation is a complex skill that requires linguistic, cognitive and affective/social abilities and its achievement exhibits a long developmental route (e.g., Bamberg & Reilly, 1996; Berman & Slobin, 1994). Most research dealing with evaluation in narratives has examined evaluative expression in spoken narratives, using the wordless picture book *Frog Where are You?* (Mayer, 1969), and adopted a developmental perspective. It has been found that 3-year-old hearing children already use paralinguistic devices, that is, facial expressions, gestures, prosodic features and phonological stress to express evaluative functions in their spoken narratives. At around the age of 6 years, children begin to use linguistic devices of evaluation (Bamberg & Reilly, 1996; Reilly, 1992). Furthermore, the frequency of and variety in evaluative devices increases with increasing age (e.g., Bamberg & Damrad-Frye, 1991; Bamberg and Reilly, 1996; Peterson & Biggs, 2001; Peterson & McCabe, 1983; Reilly, 1992). In contrast to spoken narratives, evaluation in written narratives has received little, if any, empirical attention. In the present study, we examine evaluation in narratives written by deaf bimodal bilingual children who use two languages from different modalities: signed language and written language. Their data are compared to evaluation in narratives written by hearing bilingual and monolingual children. We adopt a bilingual approach to gain better insight into the specificities of deaf children's writing.

Deaf children's writing

There is a small body of literature dealing with written language production in deaf children and it demonstrates that deaf children have difficulty with morphology and syntax. The majority of these studies focused on deaf children in English speaking communities (e.g., Power & Quigley, 1973; Quigley & King, 1980; Quigley, Power, & Steinkamp, 1977; Wilbur & Quigley, 1977). Quigley and King (1980), for example, analyzed written language samples of 450 deaf children between 10 and 19 years old. In these studies, no information is provided about the deaf children's language backgrounds, such as variations in the use of and proficiency in signed language. The analysis focused on several syntactic structures, and demonstrated that deaf children made many errors in word order, use of pronouns, conjunctions and verb inflection. Findings from studies in languages other than English demonstrate that the difficulties with morpho-syntax observed in deaf children's writing in English are not language specific (see Taeschner, Devescovi, & Volterra, 1988, for Italian deaf children; Tur-Kaspa & Dromi, 2001, for Hebrew deaf children). Many of the errors observed in these studies were rarely or never observed in hearing children.
Another line of research studying deaf children’s written language adopts a communicative perspective on writing narratives and relates linguistic structures to their communicative functions rather than focussing on isolated clause structures (e.g., Tomasello, 1998). Studies within this framework focus on communicative competence and how texts are made coherent and meaningful. Several studies of deaf children’s written discourse skills have identified that deaf children are less able to make use of discourse rules in text writing than hearing peers (e.g., Everhart & Marschark 1988; Maxwell & Falick, 1992; Yoshinago-Itano, Snyder, & Mayberry, 1996). For example, Yoshinago-Itano, Snyder, and Mayberry (1996) performed a semantic and syntactic cohesion analysis of deaf and hearing children’s narratives. Forty-nine prelingually, moderately to profoundly deaf children between 10 and 15 years of age participated in this study. Twenty-seven of them were educated via oral methods, and 22 children were educated in Total Communication programs (i.e., use of manual communication, speech amplification, and lip reading). One of the analyses focused on the frequency and distribution of major and minor propositions. A major proposition consists of a subject and a predicate, such as ‘the dog is running’. Minor propositions are modifying elements such as ‘the big brown dog is running very quickly’, The results showed that deaf children used a greater number of major propositions, and a fewer number of minor propositions than hearing children did, suggesting that deaf children introduced more topics in their narratives than hearing children did, but elaborated less on them. Everhart and Marschark (1988) examined creative language use in narratives written by deaf children and hearing children between 12 and 15 years old. The deaf children were educated in Total Communication programs. Results showed that deaf children, when compared to hearing peers, used fewer nonliteral constructions, such as modifiers, figurative language, and novel linguistic constructions for old or new ideas in their written narratives.

Not all studies found deviant written discourse skills in deaf children. Marschark, Mouradian and Halas (1994) performed a causal network discourse analysis in written narratives of 18 deaf children between 7 and 15 years old. All children were educated in a Total Communication program, and used signed language as their primary mode of communication both at school and at home. A causal network discourse analysis describes the organization of stories as goals, actions, and outcomes (GOA), which serve as the foundation of the storyline (Trabasso & Nickels, 1992). A GOA sequence is composed of a clearly defined goal, actions or attempts to achieve the goal, and outcomes. In addition to the GOA analysis, a linguistic analysis (including grammatical and stylistic rules, sentence structure, use of modifiers) was carried out. The linguistic analysis demonstrated impeded performance in deaf children: deaf children used fewer modifiers, infrequent words and complex syntactic structures than their hearing peers did (which is consistent with previous findings from studies on morpho-syntactic abilities in deaf children). However, the GOA analysis demonstrated similar use of discourse structures in deaf and hearing children. This suggests that deaf children are indeed aware of discourse rules but lack the linguistic skills necessary for written text production.

A bilingual perspective on deaf children’s narratives

The majority of studies on deaf children’s writing skills did not assess deaf children’s proficiency in signed language and/or grouped together deaf children with varying sign language skills. In the present study, we compared narratives written by deaf children who are either proficient in signed language or low-proficient in signed language, and focused on evaluative expression. Evaluative expression is an important narrative tool in
both oral/written language and signed language. It can be expected that deaf children who are proficient in signing write differently than deaf children who are not proficient in signed language and use oral language predominantly. This prediction follows from theories and research dealing with the effects of bilingualism on children's language and cognitive development. This research shows that transfer of cognitive or literacy skills from the dominant language influences learning related skills in the second language (Bialystok, 2001; Cummins, 1991; MacWhinney, 2005).

An important question is whether the mechanisms underlying transfer in bilinguals using oral/written languages also apply to bimodal bilinguals using a signed language and a written language. Few studies have investigated the issue of transfer between a signed language and spoken/written language. Research has only begun to investigate the relation between knowledge of signed language and reading (Chamberlain & Mayberry, 2000, Hoffmeister, 2000, Strong & Prinz, 1997). Findings from these studies suggest that highly developed sign language skills are related to high levels of reading achievement in deaf individuals who use signed language predominantly. Few studies have studied the effect of variations in sign language proficiency on writing skills. Singleton, Morgan, DiGello, Wiles, and Rivers (2004) compared the use of vocabulary in the narratives of deaf elementary school children with various levels of proficiency in American Sign Language (ASL) with that of hearing second language learners of English and hearing monolingual speakers of English. Vocabulary analysis included the use of frequent (content) words (following the list of 105 Most Frequent Words Used for Coding Writing Samples, Hillerich, 1978, as cited in Singleton et al., 2004) and unique words (type-token ratio). They found that highly proficient signers' narratives contained semantically richer vocabulary (indexed by the use of a higher number of non-frequent and unique words) than narratives written by low-proficiency signers and hearing second language learners of English. Singleton et al. suggest that highly proficient signers drew upon their broad semantic knowledge in ASL and use novel and meaningful vocabulary in their written stories.

Influence of sign language proficiency on writing was also found in narratives and essays written by Dutch deaf children. Van Beijsterveldt and van Hell compared Dutch deaf proficiently and low-proficiently signing children and adults and focused on temporal reference in written narratives and expository texts. Temporal reference marking differs considerably between oral/written language and signed language, with Dutch displaying a wide range of inflected verb forms and lexical expressions of time, and Sign Language of the Netherlands (SLN) having only lexical markers of temporal reference. Sign language proficiency appeared to modulate writing only with respect to grammatical marking of temporal reference (and not lexical marking of temporal reference), and most clearly in the 11-12-year old proficient signers. Proficiently signing children had particular difficulty with tense morphology, and used the unmarked tense form (present tense) considerably more often than a marked tense form (here: past tense as used by hearing and low-proficiently signing children) to refer to states, actions or events that happened in the past. Further, the proficiently signing 11-12-year olds often omitted obligatory tense marking and made more errors in tense agreement between temporal adverb and finite verb than their low-proficiently signing peers. (Differences between proficient and low-proficient signers could not be due to differences in text length, since the authors controlled for this.) The proficiently and low-proficiently signing children did not differ in lexical marking of temporal reference. Van Beijsterveldt and van Hell conclude that the pattern in temporal reference marking as observed in the proficiently signing deaf children reflects the way in which temporal reference is expressed in signed language. Together, these studies on the influence of sign
language knowledge on writing and reading suggest that sign language knowledge affects reading and writing, and that the effects of influence of sign language knowledge are different for different aspects of writing (and possibly reading).

**Evaluation in signed language**

It can be expected that variations in sign language proficiency also affect the use of evaluation in written narratives. Here we describe how evaluation is conveyed in signed language. Signed languages are visual-gestural languages. Signed languages have independent linguistic systems not derived from spoken languages, with both complex organizational properties shared with spoken languages, and grammatical devices that are unique to the visual-gestural modality. In signed language there are many ways of conveying evaluation: lexical signs, eye gaze, body shifts, modifications of sign speed and movement serving as affective prosody, facial expression, and gesture (Emmorey, 2002; Reilly, 2001). A common narrative technique in signed language is, for example, the use of role shift to express direct speech as well as to report actions from a particular point of view. A storyteller can take on the perspective of a character by portraying the facial expression, eye gaze, and head movements of that character. Hence, the storyteller demonstrates aspects of the action from the attitudinal or affective perspective of that character (Emmorey, 2002; Emmorey & Reilly, 1998; Reilly, McIntire, & Bellugi, 1990). In a study on the development of evaluative expression in narratives in spoken English and American Sign Language (ASL), Reilly (2001) showed the extreme importance of the evaluative aspect of narrative in signed language. She found that deaf mothers when signing to their deaf children used a wealth of channels to convey evaluation, such as modifications in sign movement serving affective prosody as well as face, body and eye gaze shifts. Hearing mothers, on the other hand, used mainly linguistically and lexically encoded evaluation when speaking to their hearing children, e.g., emotional words, intensifiers, or frames of mind. Hearing mothers also employed prosody in an effective way, but significantly less often than deaf mothers did. It was also found that deaf signing children frequently used eye gaze shifts and facial emotional expressions to report actions in direct quotes in their signed narratives in the adult manner by the age of five (Emmorey & Reilly, 1998; Reilly, 2001). Further, Everhart and Marschark (1988) compared signed narratives of deaf children and spoken narratives of hearing children between 12 and 15 years of age on the use of creative language. They observed that the deaf children in their signed narratives were more likely to use nonliteral language, that is, novel and frozen figurative language, gestures, pantomime, linguistic modifications, linguistic inventions, and lexical substitutions, than the hearing children did in their spoken narratives.

**The present study**

In the present study, we compare deaf children who are proficient in SLN, deaf children who are low-proficient in SLN, and hearing children on the use of evaluative devices in written narratives. Given the importance of evaluation in signed narratives and the many channels signed languages have to convey evaluation, it can be expected that deaf proficient signers use this knowledge of rhetorical devices such as evaluative expression to enrich their narratives in written Dutch, and more so than deaf children who are not familiar with signed language and use spoken language predominantly, and the hearing children. Hence, if variations in sign language proficiency modulate the use of evaluative expression...
in deaf children's narratives, and deaf proficient signers draw upon their knowledge of narrative techniques in signing, we can expect that proficient signers use more evaluation in their written narratives than low-proficiency signers and hearing children.

Moreover, we compared the written narratives of deaf proficient and low-proficiently signing children with those of hearing children with different language backgrounds: monolingual children and bilingual children. The bilingual children were children from Turkish immigrant families born in the Netherlands. Turkish-Dutch bilingual children are the most representative sample of bilingual children living in the Netherlands, since it is the largest group of bilingual children in the Netherlands. Although Turkish and Dutch differ with respect to linguistic characteristics and rhetorical style, they both express evaluation lexically (in contrast to SLN). By comparing deaf signing children with hearing bilingual children who also deal with two languages, we gain insight into whether the use of evaluation in proficient signers' narratives can be explained by sign language proficiency or, rather, by more general factors related to being able to use two languages.

Method

Participants
Twenty-six deaf children participated in this study (Mean age = 12;0, SD = 5.02; 11 girls and 15 boys). They were compared with 20 hearing children speaking one language (Mean age = 12;2, SD = 0.4, 10 girls and ten boys), and 13 hearing Turkish immigrant children who speak Turkish and Dutch regularly (Mean age = 10;6 years, SD = 3;9).

All deaf children had a hearing loss of more than 80dB hearing loss on the better ear (unaided), had normal non-verbal intelligence, and had no learning disabilities or additional handicaps. Proficiency in SLN was measured by means of a signed language fluency test (Hermans, Knoors, & Verhoeven, in preparation). Children were administered a production task which assesses the children's use of a variety of SLN structures of syntax and morphology (i.e., verb of motion, verb agreement, aspect, and number marking on verbs). After they had seen an example in which a picture was described in SLN by an SLN-speaker, children were asked to describe a comparable picture in SLN. The task consisted of 32 items. On the basis of a visual inspection (box plots) of their scores, children were classified as proficient or low-proficient in SLN. Children who scored 16 or above (M = 19.58, SD = 2.50, n = 13; range 16-22) were classified as proficient in SLN, and children who scored below 11 (M = 3.00, SD = 3.76, n = 13; range 0-11) were classified as low-proficient in SLN.

To gain more insight into the deaf writers' language learning and use, we administered a detailed language background questionnaire. The proficiently signing deaf children were educated in special schools for deaf students. The classroom language of instruction for these children was Sign Language of the Netherlands, which was frequently alternated with Sign Supported Dutch. At home, the dominant mode of communication for the majority of these children was SLN, which was frequently alternated with Sign supported Dutch. One child had two deaf parents and only used SLN. The other children in this group had hearing parents.

The children who were low-proficient in SLN were educated in different special schools for deaf students, hard-of-hearing students, or regular schools. Children who attended a regular school were also involved in a special language-remediation program. Three children learned Dutch in special schools for deaf students, 5 were educated in special schools for hard-of-hearing children, and 7 were educated in mainstream schools.
The classroom language of instruction for most children was oral Dutch, sometimes supported with signs at special schools for deaf students. At home, all children used oral Dutch. All of these children had hearing parents.

The proficient and low-proficient signers did not differ with respect to their levels of hearing loss on the best ear (unaided) ($p = .88$; $M = 103$ dB, $SD = 10.79$, and $M = 103.9$ dB, $SD = 16.36$, respectively). Furthermore, proficient and low-proficient signers did not differ on visual working memory capacity, as was assessed by the Visual Matrix Task from the Swanson-Cognitive Processing task (1996) ($F(1, 24) = 0.38$, $p = .54$; $M = 3.00$, $SD = 0.58$ in proficient signers, and $M = 3.31$, $SD = 1.70$ in low-proficient signers).

The hearing bilingual children were born and raised in families with a Turkish background (first or second generation immigrants from Turkey to the Netherlands). The language spoken at home was Turkish, but all children were educated in primary schools where Dutch is the language of instruction.

The hearing monolingual children were native speakers of Dutch. They were educated in regular primary schools and spoke only Dutch at home.

**Materials and Procedure**

Participants first viewed a three-minute video clip without words that showed fragments with teenagers involved in different social, moral and physical conflicts. Participants were then asked to write a story about a situation in which they had experienced problems with someone. They were explicitly instructed not to describe what happened in the video, but to write a story about something that happened to them personally. The participants were tested individually, in a quiet room at their school. They were instructed to ask any questions before writing, but did not receive help during writing. Participants were not limited in time when writing their stories. This procedure and elicitation video we used was identical to those used by, amongst other, Berman and Verhoeven (2002), and van Hell, van Oosterhout, Tak, and Verhoeven (2005). Stories were coded using the CLAN program of the International Child Language Data Base (MacWhinney, 2000).

**Coding of stories**

Because our review of earlier studies on deaf children's narratives in the Introduction suggests that deaf children perform differently with respect to syntax than with respect to evaluative expression, we coded all narratives for both evaluative devices and grammatical measures. **Morpho-syntax and complex syntax.** To assess children's grammatical skills, we counted morpho-syntactic errors and analyzed complex syntax. Morphological errors include omission of auxiliaries, subject-verb agreement errors, errors in pronouns, omission of determiners, gender and number agreement errors within the noun phrase, and omission and substitution of prepositions. Complex syntax included passive sentences (e.g., „He was teased by a couple of guys“) and subordinate clauses, i.e., adverbial clauses (e.g., „I don't like my sister, because she always yells at me“), and relative clauses (e.g., „Then three boys came who began to shout at us“).

**Evaluation.** Evaluative elements provide additional information to the plotline, which makes the story more engaging and vivid, and, hence, enrich narratives. Two raters, both MA students, coded the evaluative elements in the narratives after having received a brief training from the first author. The raters worked independently, and the inter-rater reliability was high (Cohen's kappa = .87; Cohen, 1960). Our coding scheme was based on Labov and Waletzky (1967) and included the following evaluative devices:
Evaluative expression

Emotional labels. These devices refer to a character’s emotional state, e.g., „She got angry“, or emotion-signaling actions, e.g., „He was crying“. Evaluative comments. These comments express an opinion about an event or person, e.g., „That was fun“, or „That was such a troubled situation“. Cognitive states and Hedges. References to a character’s cognitive state include descriptions of intentions, hopes, and predictions, such as „I hope everything is gonna be all right“. Hedges, specifically, indicate the writer’s uncertainty, e.g., as „I think everything went all right“.

Intensifiers and qualifiers. These labels function to emphasize or qualify words they modify, e.g., „I was really mad“ and „!!!“. Negotiations. This label expresses what did not happen or what is not the case, which serves to define the writer’s perspective. An example is „I like her, but my girlfriends don’t“. Figurative language. This label includes ironic language and names.

Attention markers. Attention markers draw the attention of the reader to a specific behavior or episode by using direct speech, e.g., „I said go away“, sound effects, e.g., „Bam and he fell“, and sender-oriented remarks, e.g., „It started like this."

Repetition of words or ideas. This emphasizes the importance of words or an expressed idea, e.g., „It was fun there.... we had fun“. Results

Deaf proficiently signing children, deaf low-proficiently signing children, hearing bilingual children, and the hearing monolingual children did not differ on mean text length, both when expressed in total number of words and when expressed in MLU (Brown, 1973). Means and standard deviations are presented in Table 4.1.

Table 4.1

<table>
<thead>
<tr>
<th></th>
<th>MLU in words</th>
<th>Text length in words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proficiently signing deaf children</td>
<td>5.60 (1.17)</td>
<td>109.23 (61.23)</td>
</tr>
<tr>
<td>Low-proficiently signing deaf children</td>
<td>5.90 (1.56)</td>
<td>89.08 (21.76)</td>
</tr>
<tr>
<td>Hearing bilingual children</td>
<td>5.78 (0.97)</td>
<td>66.69 (36.67)</td>
</tr>
<tr>
<td>Hearing typically developing children</td>
<td>6.00 (0.74)</td>
<td>113.20 (72.44)</td>
</tr>
</tbody>
</table>

To make sure that differences in text length between individual children are controlled for and cannot bias the effects, we divided each score of each writer by the total number of clauses (in analyses of morpho-syntax and complex syntax) and words (in analyses of evaluative devices) in her or his text.

To the best of our knowledge, deaf children’s written narratives have never been examined for evaluative expression. Moreover, previous studies on deaf children’s morpho-syntactic skills in writing (examining narratives written in English, Italian, and Hebrew) did not take variations in proficiency in signed language into account. In order to compare the...
writing of the deaf children tested in our study with the findings of earlier studies, we first report a basic comparison of deaf children as a group with hearing monolingual peers on grammatical measures and evaluative devices. To gain specific insight into the role of sign language proficiency, we then compare deaf proficiently and low-proficiently signing children separately with hearing monolingual and bilingual children.

**Comparison of deaf and hearing children**

In order to compare deaf children and hearing monolingual children on grammatical performance, we performed one-factor (hearing status: deaf vs hearing) ANOVAs on the mean percentage of morpho-syntactic errors and on the use of complex sentences. In this and all following ANOVAs, alpha was set at 5% and post hoc analysis (Fisher's PLSD) was used if appropriate.

The analysis on the morpho-syntactic errors yielded a significant effect of hearing status, $F(1,44) = 17.71, p < .001$, indicating that deaf children ($M = 42.18, SD = 42.68$) made many more morpho-syntactic errors than hearing monolingual children, who made hardly any errors ($M = 1.73, SD = 4.61$). The analysis on complex sentences also yielded a significant effect of hearing status, $F(1,44) = 92.77, p < .0001$, indicating that deaf children used fewer complex sentences than hearing monolingual children ($M = 6.06, SD = 9.64$ and $M = 46.28, SD = 18.29$, respectively).

These results are consistent with findings from studies on morpho-syntactic skills in deaf children from English, Italian and Hebrew speaking communities, which also showed impeded grammatical performance in deaf children (e.g., Quigley & King, 1980; Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001).

Next, we compared deaf and hearing children on the use of evaluation and performed one-factor ANOVAs on the mean percentage of total evaluative devices and on each of the eight evaluative devices. The analyses yielded no significant effects, indicating that deaf children as a group did not differ from hearing peers on the use of evaluative devices. So, although deaf children experience major problems with morpho-syntax and the use of complex sentences, they demonstrate similar performance on the use of evaluative devices when compared to hearing children.

**Comparison between deaf proficiently and low-proficiently signing children, hearing bilingual and monolingual children**

To gain insight in the role of sign language proficiency on writing, we divided the deaf group into proficiently and low-proficiently signing children, and examined grammatical skills and evaluative expression in these two groups, as well as hearing monolingual and bilingual children.

**Morpho-syntax.** A one-factor (group: proficiently vs. Low-proficiently signing deaf children vs. Hearing bilingual children vs. Hearing monolingual children) ANOVA on the mean percentage of morpho-syntactic errors yielded a significant effect, $F(3,55) = 7.55, p < .001$. The means and standard deviations are presented in Table 4.2. The post-hoc analyses showed that proficiently signing deaf children made more morpho-syntactic errors than hearing monolingual children ($p < .0001$) and hearing bilingual children ($p < .05$), but not than low-proficiently signing deaf children. Further, low-proficiently signing deaf children
made more errors than hearing bilingual children \( (p < .01) \). The remaining comparisons yielded no significant differences.

The one-factor ANOVA on the mean percentage of complex sentences also yielded a significant effect, \( F(3,55) = 29.09, p < .0001 \). The means and standard deviations are presented in Table 4.2. Proficiently signing deaf children used fewer complex sentences than hearing monolingual children \( (p < .0001) \) and hearing bilingual children \( (p < .01) \), but not than low-proficiently signing deaf children. Furthermore, deaf low-proficiently signing deaf children and hearing bilingual children used fewer complex sentences than monolingual children (both \( p's < .0001 \)). The remaining comparisons yielded no significant differences.

So, deaf proficiently signing children make more morpho-syntactic errors and use fewer complex sentences than hearing bilingual and monolingual children. Proficiently signing deaf children did not differ significantly from low-proficiently signing deaf children, but as can be seen in Table 4.2, the proficiently signing deaf children tend to make more morpho-syntactic errors and used complex sentences less frequently.

### Table 4.2

**Mean Percentages (and Sds) of Morphosyntactic errors and Complex Syntax in Children’s Narratives**

<table>
<thead>
<tr>
<th></th>
<th>Deaf proficiently signing children</th>
<th>Deaf low-proficiently signing children</th>
<th>Hearing bilingual children</th>
<th>Hearing typically developing children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morpho-syntactic errors</td>
<td>49.77 (24.23)</td>
<td>34.58 (55.53)</td>
<td>19.47 (19.86)</td>
<td>1.73 (4.61)</td>
</tr>
<tr>
<td>Complex sentences</td>
<td>2.41 (4.19)</td>
<td>9.70 (12.13)</td>
<td>20.86 (16.99)</td>
<td>46.28 (18.29)</td>
</tr>
</tbody>
</table>

**Evaluation.** Using a one-factor ANOVA on the mean percentage of total evaluative devices, we compared deaf proficiently and low-proficiently signing children, and hearing monolingual and bilingual children on the use of evaluation in their narratives. The corresponding means and standard deviations are presented in Table 4.3. The analysis yielded a significant effect of group, \( F(3,55) = 5.45, p < .01 \). Post-hoc analyses indicated that proficiently signing deaf children use more evaluation in their narratives than low-proficiently signing deaf children \( (p < .01) \), hearing bilingual children \( (p < .001) \), and hearing monolingual children \( (p < .05) \). The remaining comparisons yielded no significant differences.

So, proficiently signing deaf children use evaluative devices to enrich their narratives more frequently than low-proficiently signing deaf children, hearing monolingual and bilingual children.²

Interestingly, the analysis on grammatical skills showed that proficiently signing deaf children had many difficulties with morpho-syntax and the use of complex sentences in written narratives. At a more general level, these analyses show that an overall comparison of deaf children with hearing children without taking variations in sign language proficiency into account gives a distorted view of deaf children’s writing performance, in particular, of evaluative expression in writing.

To gain more insight into the distribution of different evaluative devices, we compared the four groups of writers on each of the eight different evaluative devices. The analyses revealed significant effects for number of references to emotional states, \( F(3,55) = 6.98, p < .001 \), and evaluations, \( F(3,55) = 4.67, p < .01 \); remaining effects were not
significant. Post-hoc tests indicated that deaf proficiently signing children more frequently expressed references to emotional states (such as ‘sad’ and ‘happy’) than deaf low-proficiently signing children ($p < .05$), hearing bilingual children ($p < .0001$), and hearing monolingual children ($p < .05$). Both deaf low-proficiently signing children and hearing monolingual children, in turn, used more references to emotional states than hearing bilingual children (both $p$'s $< .05$). Furthermore, deaf proficiently signing children used evaluations (such as, I didn’t like that) more frequently than deaf low-proficiently signing children ($p < .01$), hearing bilingual children ($p < .01$), and hearing monolingual children ($p < .05$). The remaining comparisons yielded no significant differences.3

Table 4.3

**Means (and Sds) of Total Evaluative Devices (in percentages) in Children’s Narratives**

<table>
<thead>
<tr>
<th></th>
<th>Deaf proficiently signing children</th>
<th>Deaf low-proficiently signing children</th>
<th>Hearing bilingual children</th>
<th>Hearing typically developing children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total evaluative devices</td>
<td>16.81 (8.07)</td>
<td>10.13 (4.60)</td>
<td>9.29 (4.38)</td>
<td>12.39 (3.46)</td>
</tr>
<tr>
<td>Emotional labels</td>
<td>2.13 (2.10)</td>
<td>1.16 (1.20)</td>
<td>0.05 (0.18)</td>
<td>1.18 (0.94)</td>
</tr>
<tr>
<td>Evaluative labels</td>
<td>4.25 (2.64)</td>
<td>1.74 (1.31)</td>
<td>2.05 (1.90)</td>
<td>2.55 (1.48)</td>
</tr>
<tr>
<td>References to perceptual &amp;</td>
<td>3.00 (2.33)</td>
<td>1.56 (1.69)</td>
<td>2.52 (2.37)</td>
<td>2.46 (1.73)</td>
</tr>
<tr>
<td>cognitive state</td>
<td>1.75 (1.84)</td>
<td>1.90 (2.20)</td>
<td>1.56 (2.51)</td>
<td>2.38 (1.66)</td>
</tr>
<tr>
<td>Intensifiers</td>
<td>3.21 (2.43)</td>
<td>2.06 (1.97)</td>
<td>1.89 (2.26)</td>
<td>2.50 (1.90)</td>
</tr>
<tr>
<td>Negotiations</td>
<td>0.27 (0.50)</td>
<td>0.30 (0.58)</td>
<td>0.10 (0.36)</td>
<td>0.42 (0.64)</td>
</tr>
<tr>
<td>Figurative language</td>
<td>1.96 (4.07)</td>
<td>1.43 (2.08)</td>
<td>1.13 (2.32)</td>
<td>0.54 (1.13)</td>
</tr>
<tr>
<td>Attention markers</td>
<td>0.07 (0.23)</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
<td>0.31 (1.06)</td>
</tr>
<tr>
<td>Repetition of words</td>
<td>0.07 (0.23)</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
<td>0.31 (1.06)</td>
</tr>
</tbody>
</table>
Discussion

Narrative performance involves not only producing correct grammatical utterances, but the speaker/writer must also maintain the reader/listener's attention and interest and gauge a character's knowledge state and involvement (Labov & Waletzky, 1967), which is referred to as evaluation. Many studies focused on evaluation in spoken narratives (e.g., Bamberg & Damrad-Frye, 1991; Bamberg & Reilly, 1996; Peterson & Biggs, 2001; Peterson & McCabe, 1983; Reilly, 1992). In this study, we examined evaluation in personal-experience narratives written by Dutch deaf and hearing children. In the overall analysis (combining the data of high- and low-proficiently signing deaf children, and comparing them with hearing monolingual children), we found that deaf children do not differ from hearing children in the frequency and distribution of evaluative devices. This result somewhat contradicts earlier studies showing that deaf children use few modifying elements (Yoshinago-Itano, Snyder & Mayberry, 1996) and creative language (Everhart & Marschark, 1988) in their narratives. Analyses of morpho-syntax and use of complex sentences, in contrast, revealed deaf children's frequently observed difficulties in this area of writing (e.g., Quigley & King, 1980; Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001). The deaf children in our study made many morpho-syntactic errors, and used fewer complex sentences than hearing monolingual children. Such a discrepancy between grammatical errors but intact discourse skills in deaf children was also reported by Marschark, Mouradian and Halas (1994), a finding they interpret to imply that deaf children are indeed aware of discourse rules but lack the linguistic skills necessary for written text production.

The majority of previous studies on deaf children's writing skills did not take into account that deaf people differ in sign language proficiency, and did not distinguish between deaf children with varying sign language skills. In the present study, we compared narratives written by deaf children who are proficient in signed language and children who are low-proficient in signed language. Consistent with our predictions, writing patterns differed in proficiently and low-proficiently signing deaf children. Specifically, proficiently signing deaf children used evaluative devices more often than low-proficiently signing deaf children and hearing monolingual children. In particular, proficiently signing deaf children relatively frequently used references to emotional states (such as 'sad' and 'happy') and evaluations (such as 'I didn't like that'). The differences in the use of evaluation between proficient and low-proficient signers also imply that an overall comparison of deaf and hearing children without taking deaf children's differences in sign language proficiency into account yields an incomplete view of deaf children's written language performance.

The typical pattern of evaluation in deaf proficiently signing children can be explained in terms of transfer processes, and the observation that knowledge and skills in the first language are transferred to the second language, which facilitates learning related skills in the second language (e.g., Bialystok, 2001; Cummins, 1991; MacWhinney, 2005). In signed languages, evaluation is conveyed through many different ways, and evaluative aspects are extremely important ingredients in signed narratives (Emmorey & Reilly, 1998; Everhart & Marschark, 1988; Reilly, 2001). Our study suggests that deaf proficiently signing children use their knowledge of the many ways signed languages have to convey evaluation to enrich their narratives in written Dutch (and more so than children who are low-proficient in SLN). Interestingly, they use evaluative devices in written narratives to express this, suggesting that they can use linguistic devices or have linguistic skill to convey this. This finding is in line with the small body of literature on deaf bimodal bilinguals in which it is found that sign language proficiency is related to writing proficiency. On the one hand, deaf
children who are proficient in signed language have been found to write more creative narratives (Singleton, Morgan, DiGello, Wiles, & Rivers, 2004) than deaf children who are not proficient in signed language. On the other hand, proficient deaf signers seem to have more difficulties than low-proficient deaf signers with grammatical structures that are structurally different in signed languages and written languages, or that are absent in signed languages, like temporal reference marking (van Beijsterveldt & van Hell, submitted). This strengthens the idea that transfer processes underlying performance of unimodal bilinguals also apply to deaf bimodal bilinguals.

We also compared the proficiently and low-proficiently signing deaf children with hearing Turkish children with Dutch as their second language, to examine whether the extensive use of evaluation in proficiently signing children is related to proficiency in signed language in particular, or to more general factors related to being able to use two languages. The comparison showed that the proficiently signing deaf children also use more evaluative devices than hearing bilingual children (who in turn did not differ from low-proficiently signing deaf children). This suggests that the use of evaluation in proficiently signing deaf children cannot be explained by their bilingualism alone, but rather seems to be a unique pattern in bimodal bilingual deaf children who use a signed language and a written language. Turkish does not differ from Dutch as much as SLN does regarding evaluation. Turkish and Dutch both convey evaluation lexically in writing, whereas signed languages, in contrast, have many different ways of conveying evaluation in narratives. Moreover, as shown by Reilly (2001), evaluation is used more often and is more pronounced in signed narratives.

What are the implications of our findings on deaf children’s writing for research and educational practice? Both proficient and low-proficient signers have difficulties with morpho-syntactic and the use of complex syntax. However, they may do so for different reasons. In the proficient signers, the relatively high number of morpho-syntactic errors and the relatively low use of complex syntax may hint at a developmental stage in which children mix the syntactic systems of written language and signed language. More exposure to both languages and a skilled teacher who can made the differences between the grammatical systems explicit and explain to deaf bimodal bilingual learners how each of the grammars of the languages operate, may help children go through this stage. On the other hand, the low-proficiently signing children possibly have experienced degraded language input early in life (both in oral language and signed language), and for this reason may not have achieved adequate linguistic competence in written language (Mayberry, 2002; Mayberry & Lock; 2003).

Van Beijsterveldt & van Hell’s cross-sectional study on the development of temporal reference marking in deaf children, however, suggests that eventually both proficiently and low-proficiently signing deaf children master morpho-syntactic skills in Dutch. The high number of errors in tense morphology observed in deaf 11-12-year old children was strongly reduced in 15-16-year olds, and was no longer observed in adult deaf writers. This developmental pattern was shown by both proficient and low-proficient signers. Obviously, given the scarce number 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 a deeper insight into the developmental patterns of deaf children with different language profiles.

Further, skills developed in signed language (such as evaluative expression) 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
Evaluative expression

thinking about ways in which signed language can be used to give access to oral/written language.

This study shows that although narratives written by 11-12-year old deaf children contain a relatively high amount of morpho-syntactic errors and contain fewer sentences with complex syntax, proficiently signing deaf children’s narratives are infused with many evaluative devices that enrich the referential structure of the narrative, and considerably more so than the narratives written by low-proficiently signing deaf children, hearing bilingual and hearing monolingual children. Our study also shows that in order to gain more insight into deaf people’s writing, it is important to take variations in sign language proficiency into account. As discussed in the Introduction, the potential influence of sign language knowledge onto writing in an oral language has largely been neglected in studies on writing by deaf children. Our study indicates that proficiently signing deaf children have an advantage in enriching their written narratives through evaluation, and use their knowledge of SLN to convey evaluation in their written narratives.
References


Van Beijsterveldt, L. M., & van Hell, J. G. The development of deaf writers’ tense marking in narrative and expository text: a bimodal bilingual perspective (submitted manuscript).


Adjective-noun structures in deaf and hearing children: a structural priming study*

Chapter 5

Abstract

In the present study, we examined priming of adjective-noun structures in hearing and deaf children. In Experiments 1 and 2, we primed hearing 7-8-year olds and 11-12-year olds, respectively, by having them read either a prenominal structure (e.g., de De blauwe bal [The blue ball], or a relative clause structure (e.g., De bal die blauw is [The ball that is blue], or a main clause (e.g., De bal is blauw [The ball is blue]. After reading each prime structure, children described a target picture in writing. Half of the target pictures contained the same noun as used in the prime structure, and half contained a different noun as used in the prime structure. Both hearing 7-8-year olds and 11-12-year olds showed priming effects for all three structures. In 7-8-year olds, the priming effect in with respect to relative clauses was enhanced when prime and target contained similar nouns. In Experiment 3, we examined whether deaf children are also sensitive to structural priming, and found that deaf children, just like hearing children, showed priming effects for all three structures. This suggests that deaf children posses abstract representations of adjective-noun structures, and that deaf children's difficulty with complex syntax is not due to limited abstract knowledge of syntactic structures. Despite similar structural priming patterns for deaf and hearing children, deaf children overall used fewer prenominal structures and more post-nominal structures than hearing children. The latter result is discussed within a bimodal bilingual framework.

* This chapter has been resubmitted for publication
Introduction

Structural priming refers to the tendency to re-use a particular structure that has recently been encountered. In a classical study, Bock (1986) found that adults who listened to and repeated a sentence in a passive form (e.g., The boy was kissed by the girl) were more likely to describe a new picture, containing different lexical items, in a passive form than in active form (e.g., The dog was chased by the cat rather than The cat chased the dog). Structural priming has been replicated in later studies using different communicative settings, such as spoken completion tasks (e.g., Branigan, Pickering, McLean, & Stewart, 2006), written completion tasks (e.g., Pickering & Branigan, 1998), and dialogue (Cleland & Pickering, 2003). Moreover, structural priming effects were obtained in the production of different linguistic structures, for example, in different noun phrase structures (Cleland & Pickering, 2003), active and passive structures (e.g., Bock, 1986), and dative structures (e.g., Corley & Scheepers, 2002). Further, structural priming occurs within different languages, for example, English (e.g., Bock, 1986) and Dutch (Hartsuiker & Westenberg, 2000), and across languages in bilinguals (e.g., Bernolet, Hartsuiker, & Pickering, 2007; Loebell & Bock, 2003).

Explanations for structural priming typically refer to the mechanisms underlying the formulation of syntactic structures (Cleland & Pickering, 2003; 2006; Pickering & Branigan, 1998, based on Levelt, Roelofs, & Meyer, 1999). More specifically, it is proposed that a lemma node (representing the base form of a word, e.g., sheep) is linked to nodes which specify the kinds of grammatical constructions a word can occur in, that is, nodes that specify category information (e.g., Noun), and nodes that specify combinatorial information (e.g., Pickering & Branigan, 1998, for verbs; Cleland & Pickering, 2003, for nouns). A picture of a red sheep can be described using a prenominal construction in which the adjective precedes the noun, the red sheep, or a post-nominal construction containing a relative clause, the sheep that is red. As such, there are different combinatorial nodes for each of the two constructions. Producing 'sheep' in the construction the red sheep activates the lemma node sheep, the combinatorial node for prenominal constructions, and the link between them. Similarly, producing 'sheep' in the construction the sheep that is red activates the lemma node 'sheep', the combinatorial node for relative clause constructions, and the link between them. The idea behind structural priming is that these specific syntactic representations (specific combinatorial nodes) used in the prime remain activated and, hence, are used when producing a subsequent syntactic structure. So, when first having encountered a relative clause structure, people are more likely to use a relative clause structure than a prenominal structure when describing another picture (Cleland & Pickering, 2003). Because prime and target sentences involve different lexical items, the conclusion is drawn that adults have representations of syntactic forms at an abstract level, independent of particular lexical items.

Although structural priming is observed in the absence of lexical overlap between prime and target, it is repeatedly found that priming is enhanced when prime and target sentences contain identical verbs (Corley & Scheepers, 2002; Schoonbaert, Hartsuiker & Pickering, 2007) or nouns (Cleland & Pickering; 2003; Bernolet, Hartsuiker, & Pickering, 2007). When the prime structure contains the same noun as the target, people are more likely to use a structure similar to the one they encountered in the prime (often referred to as 'lexical boost') than when prime and target contain different nouns (Cleland & Pickering, 2003; Pickering & Branigan, 1998). In this case, it is claimed that the link between the lemma node and the combinatorial node remains active as well as the combinatorial node
itself, which results in an increased priming effect. This indicates that syntactic knowledge is not fully abstract but is influenced by lexical factors (Pickering & Ferreira, 2008).

In the present study, we examined structural priming in children, both hearing children (Experiments 1 and 2) and children who are deaf (Experiment 3). Research on structural priming in children can gain insight into how children acquire the structural properties of their language, syntax, and whether children have similar or different representations of structural knowledge as adults. Few studies have investigated structural priming in children (Huttenlocher, Vasilyeva, & Shimpi, 2004; Miller & Deevy, 2006; Savage, Lieven, Theakston, & Tomasello, 2003; Shimpi, Gámez, Huttenlocher, & Vasilyeva, 2007). These studies aimed to determine if the production of particular structures can be affected by prior exposure, and whether very young children (ranging between 3-6 years), like adults, possess and use abstract representations of syntactic structure (independent from lexical items), or whether their syntactic representations are more lexically based (e.g., see Tomasello, 2000, for a representative theory based on the latter view).

Huttenlocher, Vasilyeva, and Shimpi (2004) studied priming of different transitive (i.e., active and passive) and dative (i.e., double object and prepositional phrase) sentences in 4- and 5-year-old children in three experiments using three different methods. In the first experiment, the children saw a picture that was described by the experimenter. Children repeated the experimenter's sentence and were shown a new picture to describe. In the second experiment children did not repeat the sentences. In the third experiment, the children saw a block of 10 pictures each described by the experimenter. Then the children described a block of 10 pictures without further input of the experimenter. In all three experiments, primes and targets contained different nouns and verbs. Findings showed that children were more likely to use a particular structure if it had been used by the experimenter.

Shimpi, Gámez, Huttenlocher, and Vasilyeva (2007) observed similar priming effects with respect to transitives and datives in 4-year olds, but not in 3-year olds. However, when changing the task (3-year olds now repeated the prime sentences before describing the pictures) priming effects were also observed in the 3-year olds.

Savage, Lieven, Theakston, and Tomasello (2003) studied priming of active and passive sentences in 3-, 4-, and 6-year olds and additionally manipulated lexical overlap between prime sentence and target picture. All children saw a picture that was described by the experimenter, and repeated the experimenter's sentence. Next, they were shown a new picture to describe. For half of the children in each age group, there was high lexical overlap between the prime sentence and the sentence children would like to produce to describe the target picture, and for the other half there was low lexical overlap. Specifically, in the high-overlap condition, the prime sentence contained pronouns and grammatical morphemes that can be used in describing the target picture, although different actions and objects were used (e.g., It is pushing it/It got pushed by it). The results showed that, in both the low and high lexical overlap conditions, the 6-year olds were more likely to produce a particular sentence construction if it had been used by the experimenter, but the 3- and 4- year olds showed only priming when there was high lexical overlap between prime and target.

Together, these studies show that exposure to particular structures increased children's use of these structures, that is, the use of particular transitive and dative constructions, some of which are rare in young children's spontaneous language production. The mixed findings with respect to effects of lexical repetition suggest that children use both item-specific knowledge and abstract structural knowledge.
The present study

Previous studies on priming in children focused on verb structures, in particular, actives vs. passives, and prepositional vs. (double) direct objects (Huttenlocher, Vasilyeva, & Shimpi, 2004; Miller & Davy, 2006; Savage, Lieven, Theakston, & Tomasello, 2003, Shimpi, Gámez, Huttenlocher, & Vasilyeva, 2007). Adjective-noun structures have not been investigated before in children, but only in adults (Cleland & Pickering, 2003, Bernolet, Hartsuiker, & Pickering, 2007). Both Cleland and Pickering, and Bernolet et al studied priming of prenominal and relative clause adjective-noun structures in English and Dutch, respectively, and found that although the overall use of relative clause structures was low, adults could be primed into using this structure.

In the present study, we examined priming of adjective-noun structures in Dutch school-aged children, aged 7-8 years and 11-12 years. Research described above indicates that children of this age possess abstract representations of syntactic structures. In Experiment 1 and 2, we examined whether the production of adjective-noun structures in 7-8-year old children and 11-12-year old children, respectively, can be affected by prior exposure to these structures. In Dutch, as in English, an adjective (here, color) can either precede the noun to which it refers, in a prenominal structure (henceforth PN structure) as in *De blauwe bal* [The blue ball], or the adjective can follow the noun, in a relative clause structure (henceforth RC structure) as in *De bal die blauw is* [The ball that is blue] or in main clause as in *De bal is blauw* [The ball is blue]. We primed children by having them read either a PN structure, a RC structure, or a MC. Previous studies on priming of adjective-noun structures examined PN structures and RC structures (Cleland & Pickering, 2003; Bernolet et al 2007). We added the MC structure, a second post-nominal structure, to explore whether priming occurs with this structure. If school-aged children are sensitive to structural priming, we predict that children, when describing a picture, are more likely to use the structure they had just read as a prime than one of the other structures. Moreover, when the noun in the elicited structures is different from that of the prime structures, an increase of children's production of these structures is considered evidence of abstract representation of different adjective-noun structures rather than evidence of lexicalized syntactic knowledge. To investigate this, half of the object nouns used in the prime structure was identical to the object in the target picture, and the other half was different.

Second, we examined whether the structural priming effect is enhanced when prime and target contain the same noun ('lexical boost'). This question has been tested in studies with adult speakers (e.g., Bernolet, Hartsuiker, & Pickering, 2007; Cleland & Pickering, 2003; Pickering & Branigan, 1998; Schoonbaert, Hartsuiker, & Pickering, 2007), but has not yet been tested in children. Given previous priming studies in adults we expect larger priming effects when object nouns used in the prime sentence are identical to the objects in the target picture than when they are different.

In Experiment 3, we examined priming of adjective-noun structures in children who are deaf. Children who are deaf often have either late or limited exposure to Dutch because of their hearing impairment. Research in the field of language and deafness has focused predominantly on how hearing impairment affects reading, and there is far less systematic research on the writing of deaf children and adults. Nevertheless, a substantial number of studies has examined how deafness affects learning to write in deaf children. These studies observed that deaf children exhibit a qualitatively different syntactic development, and that children who are deaf rarely gain full mastery of syntactic forms in spontaneous production (e.g., Ivimey & Lachterman, 1980; Mayberry, 2002; Quigley & King, 1980; Yoshinago-Itano,
Snyder, & Mayberry, 1996). Current knowledge on deaf children and adult's writing is mainly based on studies with deaf people from English-speaking communities, but the few studies on languages other than English (i.e., Italian, Hebrew and Dutch) corroborate deaf children's problems with syntax in writing (Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001; Van Beijsterveldt & van Hell, in press.). Few studies investigated the mechanisms underlying production in deaf children, and the extent to which deaf children have abstract knowledge of syntactic structures is unclear. In Experiment 3 we examine whether deaf school-aged children are sensitive to priming adjective-noun structures. Priming effects (when lexical repetition is absent) in deaf school-aged children would provide evidence that children who are deaf have abstract representations of syntactic structures and that the difficulties deaf children often have with syntax of spoken language are not due to deficits in abstract syntactic knowledge of Dutch.

Second, we examined whether the structural priming effect is enhanced by repetition of the noun. Just like in Experiment 1 and 2, we examined whether syntactic information in deaf children is partly associated with particular lexical entries.

Finally, we compared deaf and hearing children's production of the three structures, regardless of priming. Here, we examined whether differences in the amount and type of language input among deaf and hearing children affect the use of adjective-noun structures in deaf and hearing children. This will be more elaborately discussed in.

**Experiment 1: Structure priming in hearing 7-8-year olds**

**Method**

*Participants.* Twenty 7-8-year old children (*Mean Age = 7.62, SD = .59; 9 girls and 11 boys) participated in this study. All children grew up in native-speaking Dutch families. They attended school in a small town. None of the children had any known learning disabilities or developmental delays Children were tested at their schools, and parents had given permission for their children to participate in the study.

*Materials.* We created 42 pictures depicting an object that could appear in eight colors (blue, brown, green, orange, pink, purple, red and yellow). Each object appeared in a target picture once, and each color appeared five or six times. The objects were easy to recognize, one-syllable nouns with a length of three to six letters. All nouns had common gender, so that for all nouns the same article (*de [the]*) or relative pronoun (*die [that]*) could be used. Age-of-acquisition norms indicated that all nouns are acquired before the age of six (Van Loon-Vervoorn, 1985).

The stimulus materials construction procedure was based on Cleland and Pickering (2003). From the 42 pictures, we constructed 42 items (see Appendix), defined as a pairing of prime sentence and a target picture. The 42 prime sentences were of the following three types: a PN structure, a RC structure, or a MC structure. Each prime sentence had two variants: the same noun or a different noun as the object depicted in the target. For example, the critical target picture of a red ball was primed by one of the following prime sentences:

1a. *de rode bal [the red ball] (PN structure, same noun)*
1b. *de bal die rood is [literally: the ball that red is 'The ball that is red'] (RC structure, same noun)*
1c. *de bal is rood [the ball is red] (MC structure, same noun)*
1d. *de rode stoel [the red chair] (PN structure, different noun)*
1e. *de stoel die rood is [literally: the chair that red is 'The chair that is red'] (RC structure, different noun)*
Chapter 5

1f. de stoel is rood [the chair is red] (MC structure, different noun)

We constructed 6 item lists. Each list contained 7 items in each of the 6 prime conditions. The 42 target pictures appeared once in each item list. Each list also contained 42 fillers, which were also defined as a pairing of a prime sentence and a target picture. Fillers always involved different nouns and adjectives for prime sentences and target pictures. The fillers were pictures that had been used as primes or targets, but always had a different color from that used in primes or targets. The order of presentation of trials varied for each list and for each child, with the constraint that the first trial was always a filler, and one filler pair intervened between critical items.

**Apparatus and Procedure.** Before the experiment, we presented the pictures used in the study to the child to familiarize it with the object names (following Miller and Deevy's study (2004) on structural priming in children with specific language impairment).

The procedure of the experimental trials was as follows. In each trial, the prime sentence appeared word by word on the computer screen. Each word was presented 500 msec after the preceding word had been presented (this word remained on the screen). After all words were presented, the sentence remained on the screen for 800 msec and then disappeared. The prime sentences and target pictures were presented using E-prime software.

The children were instructed that they had to read the sentence on the screen. Then they were shown a picture of a particular object in a particular color that they should describe in a grammatically correct way in written Dutch. The children were introduced to this procedure in a brief practice session in which one prime in each of the three structures (i.e., PN, RC, or a MC structure) was presented visually. There is evidence that simply perceiving prime structures affects target productions (Huttenlocher et al., 2004; Potter & Lombardi, 1998). We chose a written task rather than a spoken production task, because we will compare the data of the hearing children tested in Experiment 1 with the deaf children that were tested in Experiment 3. 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).

**Scoring.** Children's responses were scored as 'PN, Same noun', 'PN, Different noun', 'RC, Same noun', 'RC, Different noun', 'MC, Same noun', or 'MC, Different noun'. In scoring the responses, spelling errors, gender errors, use of indefinite articles instead of definite articles, and article omissions were not taken into account and thus permitted (e.g., *het blauwe bal*, rather than *de blauwe bal* [the blue ball], *een groene fiets* [a green bike], rather than *de groene fiets* [the green bike], *paarse hond* [purple dog] rather than *de paarse hond* [the purple dog]). Responses in which a word (other than articles) was missing and responses containing word order violations were scored as Other target descriptions, e.g., *de vork geel is* [the fork yellow is]) or, *de boom is die bruin* [the tree is that brown]. In the 7-8-year olds, 2.1% (18) of the responses were scored as Other responses.

**Data analysis.** Children's responses were counted and divided by the sum of PN, MC, and RC responses in each condition (following other studies on structural priming, e.g., Berneot, Hartsuiker, & Pickering, 2007; Cleland & Pickering, 2003). These proportions were calculated for each child and each item. PN, RC, and MC structure responses were analyzed separately, by using 3 (Prime Structure: PN, RC, MC) x 2 (Noun Repetition: same, different) ANOVAs. Prime Structure and Noun Repetition were treated as within-participant and within-item factor. In all ANOVAs, alpha was set at 5% and post hoc analysis (Bonferroni/Dunn) was used if appropriate. Following other studies on structural priming in children (e.g., Huttenlocher, Vasilyeva, & Shimpi, 2004; Shimpi, Gámez, Huttenlocher, &
Vasilyeva, 2007), and adults (Bernolet et al., 2007) frequencies in raw numbers and proportions of PN structure, MC structure and RC structure responses in the different conditions are presented in Table 5.1. Frequencies are based on the participant analyses.

Table 5.1

Raw Numbers and Proportions of Children’s Prenominal Structure, Main Clause, and Relative Clause Responses in Each Condition

<table>
<thead>
<tr>
<th>Children’s responses</th>
<th>PN</th>
<th>MC</th>
<th>RC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hearing 7-8-year olds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PN prime</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same noun</td>
<td>126 (.46)</td>
<td>12 (.04)</td>
<td>1 (.02)</td>
</tr>
<tr>
<td>Different noun</td>
<td>121 (.44)</td>
<td>14 (.05)</td>
<td>2 (.02)</td>
</tr>
<tr>
<td>MC prime</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same noun</td>
<td>51 (.19)</td>
<td>79 (.29)</td>
<td>6 (.01)</td>
</tr>
<tr>
<td>Different noun</td>
<td>64 (.24)</td>
<td>69 (.25)</td>
<td>6 (.01)</td>
</tr>
<tr>
<td>RC prime</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same noun</td>
<td>57 (.21)</td>
<td>20 (.07)</td>
<td>58 (.21)</td>
</tr>
<tr>
<td>Different noun</td>
<td>64 (.24)</td>
<td>28 (.10)</td>
<td>43 (.16)</td>
</tr>
</tbody>
</table>

| **Hearing 11-12-year olds** |        |        |        |
| PN prime             |        |        |        |
| Same noun            | 121 (.43) | 19 (.07) | 0 (0)   |
| Different noun       | 119 (.43) | 18 (.07) | 1 (0)   |
| MC prime             |        |        |        |
| Same noun            | 87 (.31)  | 51 (.18) | 0 (0)   |
| Different noun       | 88 (.32)  | 52 (.19) | 0 (0)   |
| RC prime             |        |        |        |
| Same noun            | 82 (.30)  | 25 (.09) | 32 (.11) |
| Different noun       | 93 (.33)  | 17 (.06) | 28 (.10) |

| **Deaf 11-12-year olds** |        |        |        |
| PN prime             |        |        |        |
| Same noun            | 149 (.42) | 26 (.08) | 1 (.01) |
| Different noun       | 148 (.41) | 30 (.09) | 2 (.02) |
| MC prime             |        |        |        |
| Same noun            | 20 (.06)  | 147 (.44) | 2 (.00) |
| Different noun       | 22 (.06)  | 141 (.41) | 7 (.01) |
| RC prime             |        |        |        |
| Same noun            | 27 (.07)  | 38 (.11) | 105 (.30) |
| Different noun       | 30 (.09)  | 38 (.11) | 104 (.30) |

PN = Prenominal adjective-noun structure; MC = Main clause structure; RC = Relative clause structure
Chapter 5

Results and Discussion

Prenominal responses
The analysis showed a significant main effect of Prime Structure, \( F(2,38) = 21.43, p < .0001, \eta^2_p = .53, F(2,40) = 169.10, p < .0001, \eta^2_p = .89 \). Post-hoc tests showed that 7-8-year old children are sensitive to priming of PN structures: Children were 24% more likely to use the PN structure after reading a similar structure (44.8%) than after reading the MC prime (21.1%). This 24% priming effect was significant (\( p_1 < .0001 \) and \( p_2 < .0001 \)). The priming effect is typically defined as the difference between the use of a particular form following a similar form and the use of that particular form following an alternative form (see also e.g., Branigan, Pickering, McLean, & Stewart, 2006). In this particular case, the priming effect is defined as the difference between PN responses after PN primes and PN responses after MC primes (collapsed across noun repetition), see Table 5.1.

Moreover, children were 23% more likely to use the PN structure after reading a similar structure than after reading the RC prime (22.2%; \( p_1 < .0001 \) and \( p_2 < .0001 \)). Furthermore, the analysis showed a significant main effect of Noun Repetition, \( F(1,19) = 6.97, p < .05, \eta^2_p = .27 \) (The item analyses did not show a significant effects, \( F(1,41) = 2.62, p = .11, \eta^2_p = .06 \), and a significant interaction between Prime structure and Noun Repetition, \( F(2,38) = 4.42, p < .05, \eta^2_p = .19, F(2,40) = 2.95, p = .06, \eta^2_p = .13 \). To gain more insight into the significant interaction, we performed subsequent one-factor ANOVAs (Noun Repetition) for each prime structure. Table 5.1 suggests that children were more likely to use a PN structure after reading the PN prime when the noun was repeated, but the effect of noun repetition was not significant for the PN prime structure. When primes had a MC or RC structure, children were more likely to use the PN structure when the noun was repeated between prime and target, \( F_1(1,19) = 5.70, p < .05, \eta^2_p = .23, F_2(1,41) = 3.18, p = .08, \eta^2_p = .07, \) and \( F_2(1,19) = .41, p < .05, \eta^2_p = .19 \) (The item analyses did not show a significant effect, \( F_2(1,41) = 1.19, p = .28, \eta^2_p = .03 \).)

Relative clause responses
The analysis showed a significant main effect of Prime Structure, \( F_1 (2,38) = 15.73, p < .0001, \eta^2_p = .45, F_2(2,40) = 404.2, p < .0001, \eta^2_p = .95 \). Post-hoc tests showed that 7-8-year old children were 18% more likely to use the RC structure after reading the RC prime (18.6%) than after reading the MC prime (0.6%; \( p_1 < .0001 \) and \( p_2 < .0001 \)). Likewise, children were 16% more likely to use the RC structure after reading the RC prime than after reading the PN prime (2.3%; \( p_1 < .0001 \) and \( p_2 < .0001 \)). Furthermore, the analysis showed a significant main effect of Noun repetition, \( F_1(1,19) = 4.90, p < .05, \eta^2_p = .2; F_2(1,41) = 3.22, p = .08, \eta^2_p = .07 \), and a significant interaction between Prime structure and Noun Repetition, \( F_1(2,38) = 6.57, p < .01, \eta^2_p = .26 \). (The item analyses did not show a significant effect, \( F_2(2,40) = 2.09, p = .14, \eta^2_p = .10 \).) Subsequent one-factor ANOVAs (Noun Repetition) for each prime structure showed that children were 5% more likely to use a RC structure after reading a similar RC structure when the noun was repeated between prime and target (21%) than when the noun was not repeated (16%), \( F_1(1,19) = 7.56, p < .05, \eta^2_p = .29; F_2(1,41) = 3.82, p = .06, \eta^2_p = .09 \). The remaining one-factor analyses yielded no significant effects.
Main clause responses
The analysis showed a significant main effect of Prime Structure, $F_1(2,38) = 20.46$, $p < .0001$, $\eta^2_p = .52$, $F_2(2,40) = 123.4$, $p < .0001$, $\eta^2_p = .86$. Post-hoc tests showed that 7-8-year old children were 22% more likely to use the MC structure after reading the MC prime (26.7%) than after reading the PN prime (4.7%; $p_1 < .0001$ and $p_2 < .0001$), and were 18% more likely to use the MC structure after reading the MC prime than after reading the RC prime (8.6%; $p_1 < .0001$ and $p_2 < .0001$). Furthermore, the interaction between Prime Structure and Noun Repetition was significant, $F_1(2,38) = 4.49$, $p < .05$, $\eta^2_p = .19$; $F_2(2,40) = 3.03$, $p = .06$, $\eta^2_p = .13$. (The main effect of noun repetition was not significant in both the item and subject analysis.) As can be seen in Table 5.1, 7-8-year old children were more likely to use a MC structure after having read a MC structure when the noun was repeated between prime and target, and the one-factor ANOVA was marginally significant, $F_1(1,19) = 3.70$, $p = .07$, $\eta^2_p = .16$. One-factor ANOVAs (Noun Repetition) for the PN and RC prime structures yielded no significant effects.

To summarize, the results of Experiment 1 showed structure priming effects and lexical boost effects in 7-8-year old children. When describing a picture, children were more likely to use the structure they had just read. This was true for all of the three adjective-noun structures: the pre-nominal structure, and the two post-nominal structures (i.e., MC structure and RC structure). These results indicate that in 7-8-year old children, the use of particular adjective-noun structures can be affected by prior exposure to these structures. Moreover, priming effects seem to be enhanced (and significantly so for the RC responses, and marginally significant so for the MC responses) when the noun was repeated between prime and target. However, these lexical boost effects were less clear.

Experiment 2: Structure priming in hearing 11-12-year olds

Method
Participants. Twenty 11-12-year old children (Mean Age = 11.25, SD = .75; 6 girls and 14 boys) participated. All children grew up in native-speaking Dutch families. They attended school in a small town. None of the children had any known learning disabilities or developmental delays. Children were tested at their schools, and parents had given permission for their children to participate in the study.

Materials, Apparatus, Procedure, Scoring, and Data analysis. The materials, apparatus, procedure, scoring and data analysis were identical to those in Experiment 1.

Scoring. The scoring of responses was identical to that of Experiment 1. 0.7% (92) of the 11-12-year old hearing children's responses were scored as Other responses.

Results and Discussion

Prenominal responses
The analysis showed a significant main effect of Prime Structure, $F_1(2,38) = 5.15$, $p < .05$, $\eta^2_p = .21$, $F_2(2,40) = 0.06$, $p < .0001$, $\eta^2_p = .97$. Table 5.1 showed that 11-12-year old children are sensitive to priming of PN structures: Children were 11% more likely to use the PN structure after reading a similar structure (42.9%) than after reading the MC structure (31.5%, $p_1 = .09$) or a RC structure (31.5%, $p_1 = .11$). (The item analyses showed stronger significant differences, both $p$'s < .0001).
Relative clause responses
The analysis on RC structure responses also showed only a significant main effect of Prime Structure, $F_1(2,38) = 6.52, p < .01, \eta_p^2 = .26$, $F_2(2,40) = 113.8, p < .01, \eta_p^2 = .98$. Post-hoc tests showed that 11-12-year old children were 11% more likely to use the RC structure after reading a similar structure (10.7%) than after reading a PN structure (0%), or after reading a MC structure (0.2%; all $p$'s < .01). The remaining effects were not significant.

Main clause responses
The analysis, again, showed only a significant main effect of Prime Structure, $F_1(2,38) = 5.89, p < .01, \eta_p^2 = .24$, $F_2(2,40) = 0.03, p < .0001, \eta_p^2 = .94$. Post-hoc tests showed that 11-12-year old children were 12% more likely to use the MC structure after reading a similar MC structure (18.5%) than after reading the PN prime (6.7%), and children were 11% more likely to use the MC structure after reading a similar MC structure than after reading a RC prime (7.6%; all $p$'s < .01). The remaining effects were not significant.

To summarize, as was found in the 7-8-year old children, Experiment 2 showed a clear effect of structure priming in the 11-12-year old children: When describing a picture, children were more likely to use the structure they had just read. This was obtained for all of the three adjective-noun structures: the pre-nominal structure, and the two post-nominal structures (i.e., MC structures and RC structures). However, whereas in 7-8-year old children priming effects were enhanced when the noun was repeated between prime and target, such a lexical boost was not found in 11-12-year old hearing children.

Experiment 3: Structure priming in deaf 11-12-year olds
In Experiment 3, we examined structural priming in deaf children, and investigated whether deaf children have abstract representations of adjective-noun structures.

Method
Participants. Twenty-seven 11-12-year old deaf children ($\text{Mean Age} = 11.68, \text{SD} = .78; 12$ girls and $15$ boys) participated. The children had a hearing loss of more than 80 dB on the best ear and did not have additional known handicaps. All children were educated in special schools for deaf students in the Netherlands and received language instruction in SLN for a couple of hours a week, usually by a trained deaf SLN-teacher. Most of the classroom teachers are hearing and used SLN or Sign Supported Dutch as the language of instruction in the classroom. All children were proficient in SLN, as was confirmed with a story comprehension test which is part of an assessment instrument for SLN in primary education (Hermans, Knoors & Verhoeven, in preparation). Children saw 5 stories in SLN, one at a time, at a laptop screen. After seeing each story, children subsequently were asked to answer 4 questions about each story. The children were instructed to answer the questions in SLN. They received one point for each of the questions they answered correctly. Some of the questions referred to information literally present in the stories. Other questions were gap-filling or text-connecting questions. The mean score on this test was 17.59 ($\text{SD} = 1.53, \text{Range} = 15 - 20$), which indicates that children were proficient in SLN.

Materials, Apparatus, and Procedure. The materials, apparatus, and procedure were identical to those in Experiments 1 and 2, except for the language of instruction. Deaf children received instructions from a specialized SLN-teacher who was the experimenter.
Structural priming

during the entire session. Like the hearing children, the deaf children described the target picture in written Dutch.

**Scoring.** The scoring of responses was identical to that of Experiment 1 and 2. 8.1% (92) of deaf children's responses were scored as Other responses.

**Data analysis.** In the first series of analyses, we examined whether deaf children were sensitive to structural priming. The procedure was identical to that of Experiments 1 and 2: For each condition, deaf children's responses were divided by all scorable responses (i.e., the sum of PN, RC, MC structure responses). These proportions were calculated for each child. PN, RC, and MC structure responses were analyzed separately, by using 3 Prime Structure (PN vs. RC vs. MC) x 2 Noun repetition (same vs. different) ANOVAs. In all ANOVAs, alpha was set at 5% and post hoc analysis (Bonferonni) was used if appropriate.

Frequencies (raw number and proportions) of PN structure, MC structure and RC structure responses in the different conditions are presented in the lower part of Table 5.1.

In a second analysis, we compared deaf children with the age-matched hearing children from Experiment 2, and the younger 7-8-year old children from Experiment 1 on the use of the different structures regardless of which prime had preceded the responses. We examined whether the use of adjective-noun structures in deaf children is different from that of hearing children. We performed a two-factor ANOVA of Group (deaf children vs. hearing 7-8-year olds vs. hearing 11-12-year olds) by Target structure (PN vs. RC vs. MC). Frequencies (raw numbers and proportions) of PN structure, RC structure and MC structure responses are presented in Table 5.2.

**Results and Discussion**

**Prenominal responses.**

The analysis showed a significant main effect of Prime Structure, $F_1(2,50) = 84.62, p < .0001, \eta^2_p = .77$; $F_2(2,40) = 583.10, p < .0001, \eta^2_p = .97$. The remaining effects were not significant. Post-hoc tests showed that also deaf children were sensitive to priming of PN structures. They were 35% more likely to use a PN structure after they had read the PN prime (41.5%) than after they had read the MC prime (6.1%), and they were 34% more likely to use a PN structure after they had read the PN prime than after they had read a RC prime (7.9%; all $p$'s < .0001). The remaining effects were not significant.

**Relative clause responses.**

The analysis showed again only a significant main effect of Prime Structure, $F_1(2,52) = 51.06, p < .0001, \eta^2_p = .66$, $F_2(2,40) = 269.70, p < .0001, \eta^2_p = .93$. Post-hoc tests showed that deaf children were 29% more likely to use a RC structure after they had read the RC prime (29.9%) than after they had read the MC prime (0.5%), and they were 28% more likely to use a RC structure after they had read a RC prime than after reading a PN prime (1.7%; all $p$'s < .0001).

**Main clause responses.**

The analysis showed a significant main effect of Prime Structure, $F_1(2,50) = 72.19, p < .0001, \eta^2_p = .74$, $F_2(2,40) = 722.2, p < .0001, \eta^2_p = .97$. Post-hoc tests, again, showed a structure priming effect: Deaf children were 34% more likely to use a MC structure after they had read a similar MC structure (42.6%) than after they had read a PN structure (8.7%; $p_1 < .0001$; $p_2 < .0001$). Moreover, they were 32% more likely to use a MC structure after they...
had read a similar MC structure than after they had read a RC structure (11.1%; $p_1 < .0001; p_2 < .0001$). The remaining effects were not significant.

To summarize, just like in hearing children, we found clear structural priming effects in deaf children for all three structures across both noun conditions (same noun, different noun), which suggests that deaf children have abstract knowledge of adjective-noun structures. As in their hearing age-matched peers, there was no effect of noun repetition in deaf children, so the structural priming effect was not boosted by the repetition of lexical items.

**Comparison of deaf and hearing children on using adjective-noun structures**

Finally, we conducted an analysis to compare deaf and hearing children's production of the three structures, regardless of priming. Given differences in the amount and type of language input among deaf and hearing children, it can be expected that the use of adjective-noun structures will be different for deaf and hearing children.

Many deaf individuals use a signed language as their main language of communication. In Sign Language of the Netherlands (SLN), just like in many other signed languages and oral languages, sign order is not free. Although sign order variations are possible, there is a basic unmarked sign order for adjective-noun constructions, which is a post-nominal order; the sign of the adjective is followed by the sign of the noun to which it refers (Schermer, 1991). For example, a picture of a blue ball is signed as BALL BLUE. Note that copula like 'is' are not signed in signed language. So, the unmarked sign order for adjective-noun constructions is post-nominal, and signed language does not distinguish between several post-nominal constructions as oral language does.

Deaf children who use a signed language and an oral/written language thus receive not only a quantitatively different amount of Dutch language input compared to hearing children (because of their hearing impairment), but also a qualitatively different type of language input. Given these differences in the amount and type of language input among deaf and hearing children, it can be expected that the use of adjective-noun structures in Dutch will be different for deaf and hearing children.

Deaf children's use of adjective-noun structures was compared with that of their hearing age-matched peers and the hearing 7-8-year olds. We compared deaf and hearing children on the use of the three adjective-noun structures with a 3 Group (deaf children vs. hearing 7-8-year olds vs. hearing 11-12-year olds) x 2 Response structure (PN vs. MC vs. RC) ANOVA. Raw frequencies and proportions (that is, raw frequencies divided by total PN, MC, and RC responses) are presented in Table 5.2.
Table 5.2

Frequencies in Raw Numbers and (Proportions) of Children's Responses in Prenominal, Main Clause, Relative Clause Structures

<table>
<thead>
<tr>
<th>Children's responses</th>
<th>PN</th>
<th>RC</th>
<th>MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing 7-8-year olds</td>
<td>483 (.59)</td>
<td>116 (.14)</td>
<td>222 (.27)</td>
</tr>
<tr>
<td>Hearing 11-12-year olds</td>
<td>590 (.71)</td>
<td>61 (.07)</td>
<td>182 (.22)</td>
</tr>
<tr>
<td>Deaf 11-12-year olds</td>
<td>396 (.31)</td>
<td>222 (.22)</td>
<td>420 (.39)</td>
</tr>
</tbody>
</table>

Proportions are calculated by dividing total PN responses, RC responses, MC responses, respectively by the total of PN, RC, and MC responses. Other responses are thus excluded.

The results showed a significant main effect of Target Structure, $F_1(2,63) = 6.64$, $p < .0001$, and $F_2(2,122) = 0.40$, $p < .0001$, $\eta^2_1 = 68$, $\eta^2_2 = 87$. PN structures were used more often than RC structures ($p_1 < .0001; p_2 < .0001$), and MC structures ($p_1 < .0001; p_2 < .0001$), and MC structures, in turn, were used more often than RC structures ($p_1 < .01, p_2 < .0001$). The main effect of Group was not significant. More interestingly, the interaction between Response Structure and Group was significant, $F_1(4,126) = 4.66$, $p < .0001$, $\eta^2_1 = .13, F_2(4,244) = 32.53, p < .0001, \eta^2_2 = .35$. To gain more insight into this interaction effect, we performed subsequent one-factor ANOVAs (Group) for each of the three response structures. The analysis on PN structures showed a significant main effect of Group, $F_1(2,64) = 7.586$, $p < .001$, $\eta^2_p = .19$, $F_2(2,123) = 71.65$, $p < .0001$, $\eta^2_p = .54$. Post-hoc tests showed that deaf children used fewer PN structures than hearing 11-12-year olds ($p_1 < .001, p_2 < .0001$) and 7-8-year olds ($p_1 = .06, p_2 < .0001$). The analysis on RC structures also demonstrated a significant main effect of Group, $F_1(2,64) = 7.04$, $p < .01$, $\eta^2_p = .18$, $F_2(2,123) = 13.76$, $p < .0001$, $\eta^2_p = .18$. Post-hoc tests showed that deaf children used more RC structures than hearing 11-12-year olds ($p_1 < .001, p_2 < .0001$), and hearing 7-8-year olds, $p_2 < .0001$; the subject analyses yielded no significant effect). Finally, the analysis on MC structures showed a significant effect of Group, $F_1(2,64) = 2.88$, $p = .06, \eta^2_p = .08, F_2(2,123) = 60.70, p < .0001, \eta^2_p = .50$. As can be seen in Table 5.2, deaf children used more MC structures than both hearing 7-8-year olds ($p_1 = .08, p_2 < .0001$) and 11-12-year olds ($p_1 = .08, p_2 < .0001$). These findings indicate that deaf children used more post-nominal, but fewer prenominal adjective-noun structures than hearing children.

General Discussion

We investigated structural priming of adjective-noun structures in Dutch children. The majority of previous structural priming studies involved adults, and researchers have only begun to examine how structural priming develops in children. Previous studies on structural priming in children focused on verb phrases (Huttenlocher, Vasilyeva, & Shimpi, 2004; Miller & Deevy, 2006; Savage, Lieven, Theakston, & Tomasello, 2003; Shimpi,
Gámez, Huttenlocher, & Vasilyeva, 2007), and showed that exposure to particular structures increases children's use of these structures, some of which are rare in children's spontaneous language production. The adjectival modification of nouns has not been investigated before in children. In Experiments 1 and 2, we primed 7-8-year old children and 11-12-year olds by having them read three types of adjective-noun structures: 1) prenominal structures, in which the adjective (here, color) precedes the noun to which it refers, as in *De blauwe bal* [The blue ball], 2) relative clause structures, in which the adjective follows the noun, as in *De bal die blauw is* [The ball that is blue], and 3) main clause structures, as in *De bal is blauw* [The ball is blue]. The results showed that children from both age groups, when describing a picture, were more likely to use the same structure as the one they had encountered before as a prime. This effect was observed in the prenominal structure and in the two post-nominal structures (relative clause and main clause).

These results demonstrate syntactic priming of adjective-noun structures in children, and add to findings of previous studies on younger children that focused on priming effects at the level of verb phrases (Huttenlocher, Vasilyeva, & Shimpi, 2004; Savage, Lieven, Theakston, & Tomasello, 2003; Shimpi, Gámez, Huttenlocher, & Vasilyeva, 2007).

Our results are also consistent with results from priming studies with adults that focused on adjective-noun structures, and showed that relative clauses are used more often after encountering a relative clause than after encountering a prenominal structure in both English (Cleland & Pickering, 2003) and Dutch (Bernolet, Hartsuiker, & Pickering, 2007). As Cleland and Pickering (2003) noted, relative clauses are rarely used in spontaneous language production, and they are longer and syntactically more complex than the alternatives, such as prenominal structures or main clauses. Our results demonstrate that 7-8-year old and 11-12-year old children are sensitive to structural priming of adjective-noun structures, and that it is possible to prime children into using the more complex relative-clause construction they usually do not encounter very often in everyday language. Moreover, priming effects in all three structures were observed when prime and target contained similar nouns as well as when prime and target contained different nouns. This indicates that children possess representations of syntactic structures at an abstract level, that is, different Dutch adjective-noun structures, independent of particular lexical items.

Our findings can be interpreted in terms of the model proposed by Cleland and Pickering (2003, based on Pickering & Branigan, 1998) that describes how syntactic information is represented and organized in the mind. This model assumes that lemmas are linked to (amongst others) category nodes, here, nouns, and specific combinatorial nodes for specific syntactic structures. When a particular structure is primed, specific combinatorial nodes remain active and are more likely to be used when the person has to produce a new structure, e.g., when describing a picture. Our data show that this mechanism also applies to children. When children had just read a specific adjective-noun structure, they were more likely to use a similar structure when they described a picture than an alternative structure.

In our experiments, we manipulated whether the head noun was repeated between prime and target or not. Previous studies have shown enlarged structural priming effects when prime and target contain the same words ('lexical boost'). Following Pickering and Branigan's model (1998), it is assumed that, when the noun (or verb) is repeated between prime and target, the link between the lemma node and the combinatorial node retains activation as well the combinatorial node itself. Our study demonstrated such a lexical boost (although weak), but only in the 7-8-year olds: priming effects in 7-8-year old children...
Structural priming were larger when prime and target contained similar nouns than when prime and target contained different nouns.

The relatively weak effect of lexical repetition in our study may reflect the relatively small relative clause priming effects in Dutch in comparison to studies on English (Cleland & Pickering, 2003: 27% in the same-noun condition, 12% in de different-noun condition, 15% lexical boost). Bernolet, Hartsuiker, & Pickering, 2007, who studied priming in Dutch adults found relatively weak priming of RC structures (Experiment 1: 21.8% in the same-noun condition, 14.8% in de different-noun condition, 8% lexical boost). Overall, the proportion relative clause responses in our experiment and in Bernolet et al (2007) were lower than proportions of relative clause responses in Cleland and Pickering’s study (2003). Apparently, the tendency to produce relative clauses appears to be weak for Dutch participants, which suggests that the relative clause structure is rarer in Dutch than in English. Obviously, more research on structure priming and lexical repetition in both adults and children in different languages is needed to gain deeper insight into cross-linguistic differences of priming.

It is striking that a lexical boost was found in 7-8-year olds and not in 11-12-year olds. One explanation could be that the effects of lexical repetition vary with development, and that young children are more sensitive to item-specific information than older children and adults. Noticeably, in the 7-8-year olds a lexical boost was particularly found with respect to relative clauses and not with respect to the other adjective-noun structures. Given the assumption that relative clauses are rare in Dutch spontaneous production and moreover, are syntactically more complex than the other structures, a possible explanation for this pattern is that children of this age are more sensitive to item-specific information in less common and syntactically more complex type of structures. Future research could provide insight into whether there is a developmental stage at which item-specific information dominates over abstract syntactic knowledge (Pickering & Fereirra, 2008), and whether this is affected by structural complexity.

In Experiment 3, we examined whether deaf children are also sensitive to priming in the production of adjective-noun structures. Previous studies on language production in deaf children showed that deaf children experience major difficulties with syntax in writing and reading (e.g., Ivimey & Lachterman, 1980; Mayberry, 2002; Quigley & King, 1980; Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001; Yoshinago-Itano, Snyder, & Mayberry, 1996). It is not known, however, whether the difficulties deaf children encounter when writing are due to limited abstract knowledge of syntactic structures. We found that deaf children are sensitive to structural priming and that the pattern of priming effects in deaf children is similar to that of hearing children of the same age, as well as that of hearing younger children who had just learned to read and write. Having read a particular adjective-noun structure increased the likelihood of using that structure when describing a picture. This suggests that deaf children's use of particular syntactic forms can be affected by exposure to these forms. As was found in hearing children, priming effects occurred both in the condition in which the noun was repeated between prime and target, and in the condition in which the noun was not repeated. This shows that deaf children possess representations of syntactic structures at an abstract level.

As noted before, in studies on adults it is repeatedly found that priming occurs in the absence of lexical repetition, but yet is enhanced when there is lexical overlap between prime and target. Such an enhanced priming effect when prime and target contained the same noun was not observed in the deaf children (such an effect was also not observed in hearing age-matched peers in Experiment 2 but it was only observed in the hearing 7-8-year olds).
old children from Experiment 1). It seems that deaf children are not particularly sensitive to lexical information just as hearing children from the same age do not.

Our study thus showed that deaf children demonstrate the use of abstract knowledge of syntactic structures in a priming study even when it is commonly found that deaf writers generally display an overall difficulty with complex syntax. This result seems in line with findings from a study by Lillo-Martin, Hanson, and Smith (1992) who examined comprehension of relative clauses in written English, signed English and American Sign Language (ASL) in more successful and less successful readers. They found that deaf readers comprehended relative clause structures equally well (whether presented in written English, signed English or ASL). It is suggested that a specific syntactic disability does not differentiate deaf successful and less successful readers.

Although deaf (and hearing) children demonstrate abstract syntactic knowledge and show priming effects for all three structures, the overall frequency of the three types of structures was substantially different for deaf and hearing children. Compared to both younger and age-matched hearing children, deaf children used fewer prenominal structures and more post-nominal structures. We argued that this preference difference is due to quantitative and qualitative differences in language input between deaf children and hearing children. As explained above, Dutch has both a prenominal construction and post-nominal constructions. In SLN, the standard sign order is a post-nominal structure in which the adjective sign follows the sign for the noun to which it refers.

Deaf children's preference of post-nominal structures over prenominal structures could be explained within the framework of bimodal bilingualism. A key finding in research on bilingual children using two spoken languages is that the languages interact, and that bilingual children are sensitive to differences in the overlap of structures in their two languages (e.g., Döpke, 2000; Hulk & Müller, 2000; Nicoladis, 2006; Shin & Milroy, 1999). Recently, researchers have begun to explore the issue of language interaction and transfer in bimodal bilinguals using two languages in different modalities, with the goal to characterize the nature of this type of bilingualism (Emmorey, Borinstein, Thompson, & Gollan, 2008; Singleton, Morgan, DiGello, Wiles & Rivers, 2004; van Beijsterveldt & van Hell, in press). Findings from these studies suggest that the mechanisms underlying transfer effects in hearing bilinguals also apply to bimodal bilinguals. Results from our study suggest that deaf children are sensitive to differences in the overlap of adjective-noun structures structures in Dutch and SLN. Deaf children used fewer structures that are absent in SLN (i.e., prenominal structures) than hearing children, and appear to favor structures that overlap in word order across SLN and Dutch. However, given the rare number of empirical studies on how language background may affect deaf people's writing, more research is necessary to gain more insight into the details of the cross-language interaction and transfer processes in languages from two different modalities.

Interestingly, deaf children's preference for post-nominal adjective-noun structures is even reflected in their relatively frequent use of relative clause structures. Our data on the hearing children (and findings on adults in Cleland & Pickering's and Bernolet et al's study) showed that although adjective-noun structures containing a relative clause could be primed, these structures were rarely used by children. This could be due to the fact that they are longer and syntactically more complex than prenominal structures (and main clauses), or that relative clauses are rarer in the Dutch language. The deaf children, however, used relative clause structures more often than hearing peers. The fact that deaf bimodal bilinguals prefer post-nominal structures over pre-nominal structures, even when they are syntactically more complex and rare, seems to support the transfer explanation.
Our study contributed to research on structural priming in children and showed that 7-8-year old and 11-12-year old children are sensitive to priming of adjective-noun structures in Dutch, indicating that children of this age possess abstract knowledge of adjective-noun structures independent of lexical items, and that the use of particular adjective-noun structures can be increased by prior exposure to these structures. Only in the hearing 7-8-year olds, priming effects were particular sensitive to item-specific information and demonstrated a lexical boost when prime and target contained the same noun. Secondly, our study showed that 11-12-year olds who are deaf were sensitive to priming as well, suggesting that although it is commonly found that deaf writers generally display an overall difficulty with complex syntax, this difficulty is not due to limited abstract knowledge of syntactic structures. Deaf children however differ substantially from hearing children in the overall preference for particular adjective-noun structures.
References


Mayberry, R. I. (2002). Cognitive development in deaf children: The interface of...


Appendix

Items
The primes are presented in the following order with respect to the target picture: same noun condition/ different noun condition. The target is presented after the primes. The English translations are presented between parentheses.

32. Roze muis/roze fiets/roze muis. [Pink mouse/pink bike. Pink mouse]
34. Roze leeuw/roze doos. Roze leeuw. [Pink lion/pink box. Pink lion]
35. Gele jurk/gele deur. Gele jurk. [Yellow dress/yellow door. Yellow dress]
Verb morphology in deaf and hearing children: a study on inflection errors, pause duration and writing rate

Chapter 6

Abstract

In the present study, we examined verb inflection in deaf children, aged 11-12-year olds, in comparison to age-matched hearing children and hearing 7-8-year old children who had just learned to write. For deaf children, who use sign language as their main language of communication, verb inflection may be particularly challenging because of modality and grammatical differences between signed languages and oral languages. We found that deaf children made more, and made different kinds of, verb inflection errors: Deaf children often failed to inflect verbs at all whereas hearing children inflected most verbs (although sometimes incorrectly). This suggests that deaf and hearing children follow different developmental language trajectories due to quantitatively and qualitatively different language input.

Secondly, we studied verb writing as it unfolds in real time, linked to a coding of linguistic characteristics of the written product, which provides new ways to gain insight into temporal patterning of cognitive processing in written language production of deaf and hearing children. Analyses of the pause duration and writing rate related to verb inflection showed that deaf children, in contrast to hearing age-matched children and younger children, did not pause longer before and after incorrectly inflected verbs than correctly inflected verbs, suggesting that deaf children have not yet developed metacognitive skills to self-monitor their inflection of verbs.

* This chapter has been submitted for publication


Introduction

Research on written language production in deaf children showed that although deaf children have relatively few problems with spelling (e.g., Burden & Campbell, 1994), deaf children have persistent problems with verb morphology. Quigley and King (1980) summarized the results of a large scale-research program that assessed prelingually, profoundly deaf children's and adolescents' knowledge of English syntax. They found that deaf children and adolescents made many errors in verb inflection for tense, aspect and voice, which were rarely observed in hearing age-matched peers. Difficulties with verb morphology were also observed in Hebrew deaf children (Tur-Kaspa & Dromi, 2001). Tur-Kaspa and Dromi (2001) examined morpho-syntactic errors in written and spoken language samples of 13 severely to profoundly deaf children between 11 and 13 years old, and found that one of the frequently occurring errors in deaf students' written language samples were errors in verb inflection. Hebrew verbs have to agree with the head nouns in terms of gender, number and person, for example, ha-yeled oxe | [The boy is eating], ha-yalda oxelet [The girl is eating], ha-yeladim oxlim [The boys/children are eating], and ha-yeladot oxlot [The girls are eating]. Many deaf children, however, were likely to write: "ha-yeladim oxe | [The children is eating], instead of ha-yeladim oxlim [The children are eating]. Findings from these studies suggest that deaf children have inadequate knowledge, or rather have not yet developed adequate knowledge of morphological rules.

For deaf children, who use sign language as their main language of communication, verb inflection may be particularly challenging because of differences between signed languages and oral languages. Signed languages and oral languages differ both in grammatical structure, including verb morphology, and modality. Moreover, signed language and oral/written language differ in grammatical structure, including verb morphology (e.g., Emmorey, 2002). Given the differences in verb inflection between oral/written language and sign language, deaf children's verb inflection in oral/written language may differ from that of hearing children who have no knowledge of sign language. Moreover, deaf children who develop using two languages are emergent bimodal bilingual learners with a quantitatively and qualitatively different amount and type of language input. Consequently, their language trajectories can be expected to be different from those of hearing monolingual children. In the present study, we examined verb inflection in Dutch deaf children, and explored whether verb inflection in deaf children is affected by sign language knowledge. Secondly, we examined deaf children's ability to monitor their verb inflection, and analyzed pause durations and writing rates related to correctly and incorrectly inflected verbs.

Bimodal bilingual transfer

The prediction that sign language knowledge possibly has an impact on Dutch writing follows from research on bilingual language development. Research on bilingual children has shown that, although bilingual children can differentiate between their two languages early in development, the languages interact and influence each other (e.g., Müller & Hulk 2001; MacWhinney, 2005; Nicoladis, 2006). Cross-linguistic influence is particularly found when languages have different grammatical systems (e.g., Döpke, 2000; Müller & Hulk, 2000; Nicoladis, 2006). An important question is whether the mechanisms underlying such transfer effects in hearing bilinguals also apply to deaf children who use two languages that differ in grammatical structure and in modality. First of all, oral language and
signed language differ in grammatical structure, including verb morphology. Many oral languages, including Dutch, have morphological rules that apply to all verbs. In Dutch, for example, finite verbs are typically marked for person and number characteristics of the subject. First person singular forms, for example, are formed by the stem, and second and third person singular are formed by stem +t. These rules apply to all Dutch verbs. Sign Language of the Netherlands (SLN), like many signed languages, but unlike many spoken languages, distinguishes verb signs that inflect for agreement and verb signs that do not inflect for agreement (Bos, 1990, 1993; Meir, 2002; Schermer, 1998).

Moreover, signed languages and oral languages differ in modality. Signed languages are produced and perceived in the visual-manual modality, and uses the hands, head and body for linguistic expression, whereas oral languages are produced and perceived in the auditory-oral modality. Verb inflection of the verbs that are inflected in signed languages differ from verb inflection in oral languages. Many oral languages, including Dutch, use suffixes (e.g., stem+t for second and third person singular marking) to mark agreement. The process of inflection in signed languages, in contrast, includes a change of the movement direction of the verb sign, and/or the orientation of the palm of the hand and fingers, and/or the location of the verb sign. Moreover, inflected verbs can be marked for the category of person of both subject and object. By varying movement and orientation of the sign in the syntactic signing space, various relations between subject and object are expressed. For example, in an inflected verb like to give, syntactic relations are marked by variations in the direction of the movement. In the sentence I give you, the hand moves from the body of the signer straightforward to the space in front of the signer. The beginning point of the movement signals the subject I, and the end point signals the object you. In the sentence You give me, the hand moves from the location in front of the signer to the signer's own body; the beginning point of the movement signals the subject you, the end point signals the object me. In sum, verb inflection in oral languages and signed languages differs considerably.

Very few studies have investigated deaf children’s error patterns in verb inflection (or in syntactic processing for that matter) in writing in relation to children’s linguistic backgrounds, and acknowledge the possible influence of knowledge of sign language on learning to write and read in an oral language (Chamberlain & Mayberry, 2000; Hoffmeister, 2000; Singleton, Morgan, DiGello, Wiles, and Rivers, 2004; Strong & Prinz, 1997). Mayer and Wells (1996) make specific claims with regard to the role of sign language knowledge on learning morphology in oral languages, and emphasize the modality differences between signed and oral languages. They argue that deaf children, when writing, try to capture signs in print. However, morphological features of verb signs like inflection markers, as we explained above, are often not realized through distinct and separate signs, but through a modulation of the base lexical sign. Mayer and Wells argue that inflection markers, therefore, cannot be translated into print in a direct way, and that these functions are often omitted in the writing of deaf individuals. This assumption, however, received little empirical attention.

In the present study, we investigate to what extent differences in grammatical structure between SLN and Dutch affect verb inflection in written Dutch. If sign language indeed influences verb inflection in Dutch, we expected deaf children to omit verb inflections in written Dutch. Moreover, we examined whether the effects of influence of signed language on Dutch inflection differ for verbs that are typically inflected in SLN and verbs that do not inflect for agreement in SLN.
Temporal management of writing verbs

The majority of previous studies on deaf children’s writing skills adopted a product-oriented approach, and examined and described the errors deaf children made in their written language. These studies provided rich information on linguistic characteristics of the final written products (Quigly & King, 1980; Tur-Kaspa & Dromi, 2001). Considerably less is known about cognitive processes underlying writing, and whether deaf children have developed metacognitive knowledge of morphology. Children who have not yet automatized morphological processes in writing must consciously attend to how difficult a verb will be to inflect and whether they know the morphological structure of the word. In addition to a product-oriented study on verb inflection errors, we adopt a process-oriented approach to verb inflection in writing, and explore cognitive processes involved in writing verbs by analyzing pause time patterns and writing rates in writing.

Children have to develop the ability to self-regulate and monitor the inflection of verbs. Monitoring refers to the process of inspecting one’s own utterance for the purpose of changing the form of the utterance. This can take place before writing (or speaking) or after writing an utterance (Krashen, 1982). In order to be able to monitor the correctness of the inflection, writers have to pay attention to the correctness of the verbs and to their feelings about the correctness of the verb they are about to write, or just wrote down. These abilities are related to the general concept of metacognition, being aware of your state of knowledge (Flavell, 1999). Studies examining metacognitive skills such as monitoring mainly focused on spelling (e.g., Block & Peskowitz, 1990; Kreiner & Green, 2000). Block and Peskowitz (1990), for example, showed that children, by the age of 9, can predict and self-evaluate their spelling accuracy.

The majority of previous studies investigating spelling awareness used off-line procedures in which participants rated their judgements of correctness of their spelling on a scale. Very few studies have used on-line paradigms to study monitoring and metacognitive skills. In the present study, we adopted a real-time approach to explore whether children are aware of the correctness of their written verbs, and analyzed pause time patterns in writing. More specifically, we measured the writing rate and duration of pauses before and after writing incorrectly inflected verbs, and compared these writing rates and pause durations with the corresponding writing rates of and pause duration around correctly inflected verbs. The underlying assumption is that pauses during writing and writing rates are observable and measurable cues of a person’s cognitive activities during writing, and variations in pausing and writing rates can be interpreted as variations in the cognitive demands of writing (e.g., Chanquoy, Foulin, & Fayol, 1996; Delattre, Bonin, & Barry, 2006; Matsumashi, 1987; Schilperoord, 1996; van Hell, Verhoeven, & van Beijsterveldt, in press).

Delattre, Bonin, and Barry (2006), for example, found that French adults pause longer before French words containing irregular sound to spelling correspondences than before words containing regular sound to spelling correspondences, suggesting that writing irregular words reflects time costs involved in resolving conflict generated by different spelling routines. Hence, an analysis of the location and duration of pauses, in combination with a coding of linguistic aspects of writing may serve as a window to cognitive and linguistic processes involved in written language production, including verb inflection. If deaf and hearing children possess metacognitive skills, and are aware of the difficulty of the to-be-inflected verb, children should pause longer before and after incorrectly inflected verbs than before and after correctly inflected verbs. An alternative prediction states that deaf children have not yet developed monitoring and metacognitive skills for writing in Dutch. In
that case, pause durations should be similar for both correctly and incorrectly inflected verb sites.

**The present study**

First, we examined the number and types of errors deaf and hearing children made in Dutch verb inflection. We focused on two types of errors, that is, omission of inflections and other inflection errors, in two types of verbs, that is, verbs that are inflected in SLN and verbs that are uninflected in SLN. Given the different systems of verb inflection in Dutch and SLN, it can be expected that deaf children tend to omit inflection (or show a pattern in which they sometimes omit inflection). Moreover, we examined whether deaf children’s verb inflection differs for verbs that are inflected in SLN and verbs that are uninflected in SLN.

Secondly, we examined whether deaf and hearing children are aware of the difficulty of verb inflection and the (in)correctness of their inflected verbs. We studied writing in real time and analyzed pause time patterns in writing and writing rate in relation to linguistic characteristics of the written product. Specifically, we compared pause durations before and after of correctly and incorrectly inflected verbs, and the writing rates of these verbs. If deaf and hearing children monitor their inflection of verbs, children should pause longer before and after incorrectly inflected verbs than before and after correctly inflected verbs, and writing rates of incorrectly inflected verbs should be longer than writing rates of correctly inflected verbs. If a fundamental problem for deaf children is that they have not yet developed monitoring and metacognitive skills, time patterns should be similar for both correctly and incorrectly inflected verbs.

The deaf children in our study were 11-12 years old. Their data were compared with that of age-matched hearing children, and hearing children between 7-8 years old, who had just learned to read and write. The comparison of deaf children with this younger group of children enables us to test whether the observed results in the deaf children imply a qualitatively different developmental pattern of learning to write in Dutch from that of hearing children, or whether the observed results are due to a developmental delay in the acquisition of Dutch writing.

**Method**

**Participants**

Twenty-eight 11-12-year old deaf children (Mean Age = 11.73, SD = .80) participated, and were compared with 19 7-8-year old hearing children (Mean Age = 7.62, SD = .59) and 20 11-12-year old hearing children (Mean Age = 11.25, SD = .75). The deaf children had a hearing loss of more than 80 dB on the best ear and did not have additional known handicaps. All children were educated in special schools for deaf students in the Netherlands and received language instruction in SLN for a couple of hours a week, usually by a trained deaf SLN-teacher. Most of the classroom teachers are hearing. They used SLN or Sign Supported Dutch as the language of instruction in the classroom. All children were proficient in SLN, as was confirmed with a story comprehension test which is part of an assessment instrument for SLN in primary education (Hermans, Knoors & Verhoeven, in preparation). Children saw 5 stories in SLN, one at a time, at a laptop screen. After each of these stories, children had to answer four questions about the story. The children were instructed to answer the questions in SLN. They received one point for each of the 20 questions they answered correctly. Some of the questions referred to information literally
present in the stories. Other questions were gap-filling or text-connecting questions. The mean score on this test was 17.54 ($SD = 1.62$, $Range = 15 – 20$), which indicates that children were proficient to highly proficient in SLN.

**Materials**

Children had to inflect 44 verbs: 22 verbs that are inflected in SLN and 22 verbs that are uninflected in SLN. Verbs appeared in short sentences containing a subject and an object. Half of the sentence subjects were first person singular pronouns (‘I’), and half were third person singular pronouns (‘S/He’). All verbs were transitive verbs and contained two syllables. Verbs were selected from van Loon-Vervoorn (1985) and were matched for age of acquisition ($F(1,42) = 1.95$, $p = .17$, uninflected verbs: $M = 93.46$, $SD = 6.79$, $Range = 73-100$; inflected verbs: $M = 95.96$, $SD = 4.94$, $Range = 77-100$, respectively), and mean length expressed in number of letters ($F(1, 42) = 0.57$, $p = 0.45$; M = 6.5, SD = 1.23, Range = 5-8, and M = 6.27, SD = .70, Range = 5-9, respectively).

**Apparatus and Procedure**

The stimuli were presented on a laptop computer, and children wrote with a wireless electronic ball-point pen on paper that was placed on a digitizer tablet (WACOM Ultrapad A3), connected to the laptop. All movement data were recorded and analyzed using the OASIS software package, version 7.19 (de Jong, Hulstijn, Kosterman, & Smits-Engelman, 1996). This software package has been extensively tested and is widely used in writing research. The data were collected with a sampling frequency of 206 Hz and a spatial accuracy of 0.02 cm.

Children were tested individually and were presented with 44 pictures (see Figure 1). Each picture depicted a person performing an action, and a sentence in which the verb was missing (e.g., ‘Hij ... de hond’ [He ... the dog]. The children were asked to copy the sentence and fill in the missing verb in the correct form. After the child had finished writing the sentence, the experimenter initiated the next trial by pressing the space bar on the laptop.

**Hij ... de hond.**

Figure 1
*Example of the Presentation of the To-be-completed Sentence*
To make sure that children knew the verb depicted by the 44 pictures, children were first shown each picture with the infinite verb form, see Figure 2. Children could see each picture as long as they wanted. A brief practice session consisting of two trials introduced the child to the experiment.

**Aaien**

Figure 2

*Example of the Presentation of the Target Verb in Infinite Form.*

**Linguistic coding of verb inflection errors**

For each child, each verb was scored on whether it was correctly inflected or incorrectly inflected and whether it would be inflected in SLN or would not inflected in SLN. Additional spelling errors within words were not of interested in the present study, and therefore were not taken into account; examples are: *zij brijt* (correct form: *zij breit*), or *ik slrik* (correct form: *ik strik*). In deaf children, 6.55% of the correctly inflected verbs and 19.75% of incorrectly inflected verbs contained one or more additional spelling errors. In hearing 7-8-year olds, 9.31% of the correctly inflected verbs and 0% of incorrectly inflected verbs contained one or more additional spelling errors. In hearing 11-12-year olds, 1.37% of the correctly inflected verbs and 17.91% of incorrectly inflected verbs contained one or more additional spelling errors.

The following completions were scored as Other responses, and were excluded from analyses: responses in which the target verb was unrecognizable, responses in which an incorrect personal pronoun was used (*I* rather than *s/he*, or the other way around), responses in another tense than the present tense (e.g., *Zij dronk de melk* [she drank the milk] rather than *Zij drinkt de melk* [She drinks the milk]), or use of another verb than the target verb (e.g., *verkopen* [sell] instead of *geven* [give]). In deaf children, 2.66% of the completions were scored as Other responses. In hearing 7-8-year olds, 2.03% of the target completions were scored as Other responses, and in hearing 11-12-year olds, 1.37% of the target completions were scored as Other responses.

The incorrectly inflected verbs were scored as omission of inflection (i.e., the infinitive form is used, such as *Hij drinken de melk* [“He drink the milk”; infinitive in Dutch is used] or other inflection error, such as *Hij wind de wedstrijd* [“He wins the game”; stem +d
is used as inflection marker rather than stem +t], or *Ik duwt de kast [*‘I pushes the closet’, stem +t which marks second/third person singular in Dutch]).

Coding of temporal aspects of writing

Movement trajectories were analyzed using the computer program Oasis (de Jong et al., 1996). In order to analyze temporal aspects of the writing process, the writing trace of each sentence was segmented into pauses, and the writing rate of each verb was determined. Following previous studies on pause duration in writing (Chanquoy, Foulin & Fayol, 1996; Martlew, 1992, van Hell, Verhoeven, & van Beijsterveldt, in press), pause time was defined as the time that elapses between the writing of two consecutive words in which the pen does not touch the paper, that is the time that elapsed between pen tip up and pen tip down. Writing rate is defined as the time that elapses when writing a word, that is the time that elapsed between pen tip down when beginning writing a word, and pen tip up when finished writing the word. Since the program Oasis keeps track of all pen movements on paper, with millisecond accuracy, pause duration and writing rate could be defined to the nearest millisecond.

Each observed pause duration and verb writing rate was coded relative to its position in the sentence: We coded pause durations before and after correctly and incorrectly inflected verbs, and writing rates of correctly and incorrectly inflected verbs. The following pause time and writing rate data were discarded from the analyses: pause times and writing rates related to verbs that were scored as Other responses (see linguistic coding section), and extreme values in pause times and writing rates. Extreme values in pause times and writing rates were values above the 90th percentile (i.e., pause times before verbs that were longer than 2.13 sec. [260 observations of the original total of 2770 observations], pause times after verbs that were longer than 2.53 sec. [220 observations of the original total of 2809 observations], and writing rates that were longer than 7.57 [257 observations of the original total of 2811 observations].

Results

Linguistic analyses of verb inflection errors

A 3 (group: deaf 11-12-year olds vs. Hearing 11-12-year olds vs. 7-8-year olds) x 2 (type of inflection error: omission of inflection vs. Other inflection error) x 2 (type of verb: verbs that are inflected in SLN vs. Verbs that are not inflected in SLN) ANOVA on the mean percentage of incorrectly inflected verbs, treating age as a between-subjects variable and type of verb and type of inflection error as within-subject variables, yielded a significant main effect of group, $F(2, 63) = 6.16$, $p < .01$. Means and standard deviations are presented in Table 6.1.
Table 6.1

*Mean Percentages and (Sds) of Verb Inflection Errors in Two Types of Verbs*

<table>
<thead>
<tr>
<th></th>
<th>Deaf 11-12-year olds</th>
<th>Hearing 7-8-year olds</th>
<th>Hearing 11-12-year olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inflected verbs in SLN</td>
<td>Uninflected verbs in SLN</td>
<td>Inflected verbs in SLN</td>
</tr>
<tr>
<td>Omission of inflection</td>
<td>8.12 (15.47)</td>
<td>8.88 (16.19)</td>
<td>0.51 (1.25)</td>
</tr>
<tr>
<td>Other inflection errors</td>
<td>3.02 (5.89)</td>
<td>4.58 (7.05)</td>
<td>3.55 (3.59)</td>
</tr>
</tbody>
</table>
A post-hoc test (Bonferroni/Dunn, used here and elsewhere when necessary) revealed that deaf children made more errors than both 11-12-year old \((p < .01)\) and 7-8-year old \((p < .05)\) hearing children. Further, the overall ANOVA showed a significant main effect of type of verb, \(F(2, 63) = 5.15, p < .05\). Children made more errors in verbs that are uninflected in SLN than in verbs that are inflected in SLN, \(p < .01\). Finally, there was a significant interaction between group and type of error, \(F(2, 63) = 3.17, p < .05\).

To gain insight into the significant interaction between group and type of error, we performed subsequent one-factor ANOVAs (group) for each type of error separately. The ANOVA on omissions of inflection showed a significant effect of group, \(F(2, 61) = 4.56, p < .05\). A post-hoc test showed that deaf children made more inflection omission errors than both hearing 7-8-year olds and 11-12-year olds who inflected almost all verbs (although sometimes incorrectly). The ANOVA on other inflection errors showed no significant main effect of group, indicating that hearing and deaf children did not differ on the number of other verb inflection errors.

So, the pattern of verb inflection in deaf children was both quantitatively and qualitatively different from that of hearing children. Deaf children made more errors and different kinds of errors than hearing 7-8-year old children and 11-12-year old: Whereas deaf children, as we predicted, often omit verb inflection and used infinite forms, hearing children inflected most verbs (although sometimes incorrectly).

**Analyses of temporal aspects of writing**

In this series of analyses, items rather than subjects were treated as unit of analysis, because for some groups (in particular the 11-12-year old hearing children) the number of observations of incorrectly inflected verbs was not sufficiently high to reliably use subject-based scores. The number of observations for correctly and incorrectly inflected verbs for each group is presented in Table 6.2.

**Pause durations before correctly and incorrectly inflected verbs.** A 3 (group: deaf 11-12-year olds vs. Hearing 11-12-year olds vs. 7-8-year olds) x 2 (verb: correctly inflected verbs vs. Incorrectly inflected verbs) ANOVA on the mean pause durations, treating group as a between-subject and verb as a within-subject variable, yielded a significant main effect of group, \(F(2, 2503) = 73.33, p < .0001\). Means and standard deviations are presented in Table 6.2. Hearing 7-8-year olds paused longer before verbs than both deaf and hearing 11-12-year olds (both \(p's < .0001\)). Deaf and hearing 11-12-year olds did not differ in mean length of pause duration before verbs. There was also a significant effect of verb, \(F(1, 2503) = 15.83, p < .0001\). Children paused longer before incorrectly inflected verbs than for correctly inflected verbs. Importantly, the significant main effects of group and verb were qualified by a significant interaction, \(F(2, 2503) = 4.16, p < .05\). Subsequent one-factor (verb) ANOVAs for each group showed that hearing 11-12-year old and 7-8-year old children paused longer before incorrectly inflected verbs than for correctly inflected verbs, \(F(1, 828) = 5.84, p < .05\), and \(F(1, 585) = 9.24 p < .01\), respectively. In contrast, deaf children’s mean pause durations before incorrectly and correctly inflected verbs were not different.
Table 6.2

Mean Pause Durations and Writing Rates of Correctly and Incorrectly Inflected Verbs

<table>
<thead>
<tr>
<th></th>
<th>Deaf 11-12-year olds</th>
<th>Hearing 7-8-year olds</th>
<th>Hearing 11-12-year olds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pause duration before:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correctly inflected verbs</td>
<td>0.545 (0.380) [834]</td>
<td>0.866 (0.428) [539]</td>
<td>0.530 (0.376) [811]</td>
</tr>
<tr>
<td>Incorrectly inflected verbs</td>
<td>0.583 (0.413) [258]</td>
<td>1.066 (0.547) [48]</td>
<td>0.744 (0.565) [19]</td>
</tr>
<tr>
<td><strong>Pause duration after:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correctly inflected verbs</td>
<td>1.018 (0.516) [855]</td>
<td>1.107 (0.601) [570]</td>
<td>0.690 (0.485) [829]</td>
</tr>
<tr>
<td>Incorrectly inflected verbs</td>
<td>0.971 (0.528) [273]</td>
<td>1.271 (0.642) [44]</td>
<td>0.937 (0.613) [17]</td>
</tr>
<tr>
<td><strong>Writing rates of:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correctly inflected verbs</td>
<td>3.125 (1.182) [867]</td>
<td>4.781 (1.357) [518]</td>
<td>2.960 (1.077) [824]</td>
</tr>
<tr>
<td>Incorrectly inflected verbs</td>
<td>3.425 (1.283) [280]</td>
<td>5.711 (1.195) [35]</td>
<td>3.678 (1.398) [26]</td>
</tr>
</tbody>
</table>

Standard deviations are between parentheses, and number of observations are between square brackets.
Pause durations after correctly and incorrectly inflected verbs. A 3 (group: deaf 11-12-year olds vs. Hearing 11-12-year olds vs. 7-8-year olds) x 2 (verb: correctly inflected verbs vs. Incorrectly inflected verbs) ANOVA on the mean pause durations, treating group as a between-subject and verb as a within-subject variable, yielded a significant main effect of group, $F(2, 2582) = 14.15, p < .0001$. Means and standard deviations are presented in Table 6.2. Overall pause duration after verbs was higher for the hearing 7-8-year olds than for deaf and hearing 11-12-year olds. Deaf 11-12-year olds, in turn, paused longer after verbs than hearing 11-12-year olds (all $p's < .0001$). There was also a significant main effect of verb, $F(1, 2582) = 5.27, p < .05$. Children paused longer after incorrectly inflected verbs than after correctly inflected verbs. Again, the significant main effects of group and verb were qualified by a significant interaction, $F(2, 2582) = 4.52, p < .05$. Subsequent one-factor (verb) ANOVAs for each group showed that only hearing 11-12-year olds and 7-8-year olds paused longer after incorrectly inflected verbs than after correctly inflected verbs ($F(1, 844) = 4.26, p < .05$, and $F(1, 612) = 3.01, p = .08$, respectively). Again, deaf children’s mean pause durations after incorrectly and correctly inflected verbs were not different.

Writing rates of correctly and incorrectly inflected verbs. A 3 (group: deaf 11-12-year olds vs. Hearing 11-12-year olds vs. 7-8-year olds) x 2 (verb: correctly inflected verbs vs. Incorrectly inflected verbs) ANOVA on the mean writing rates, treating group as a between-subjects and verb as a within-subject variable, yielded a significant main effect of group, $F(2, 2544) = 154.30, p < .0001$. Hearing 7-8-year olds wrote slower than both deaf and hearing 11-12-year olds, and deaf 11-12-year olds wrote slower than hearing 11-12-year olds (all $p's < .0001$). There was also a significant effect of verb, $F(1, 2544) = 35.08, p < .0001$. Children were slower on writing incorrectly inflected verbs than on correctly inflected verbs ($p < .01$). The significant main effects of group and verb were qualified by a significant interaction, $F(2, 2544) = 4.78, p < .01$. Subsequent one-factor (verb) ANOVAs for each group showed significant effects for deaf children, $F(1, 1145) = 13.08, p < .001$, hearing 11-12 year olds, $F(1, 848) = 10.98 p < .001$, and 7-8-year old children $F(1, 551) = 15.61, p < .0001$. However, as can also be seen in Table 6.2, the difference in writing rates of incorrectly inflected and correctly inflected verbs was somewhat smaller in deaf children compared to in the 7-8-year old and the 11-12-year old hearing children. This suggests that the relatively small difference in the deaf children as compared to the hearing children is the source of the significant interaction.

In summary, deaf children show no differences in pause durations related to correctly and incorrectly inflected verbs. Both 7-8 and 11-12-year old hearing children, in contrast, pause longer before and after incorrectly inflected verbs than before and after correctly inflected words. Moreover, the difference in writing rates of incorrectly and correctly inflected verbs is smaller in the deaf children than in both groups of hearing children.

Discussion

We examined verb inflection in deaf and hearing children and found that deaf children made more verb inflection errors than hearing age-matched peers and younger hearing children. Deaf children’s problem in verb inflection corresponds to previous studies on written language of deaf children from English- and Hebrew-speaking communities (Quigley & King, 1980; Tur-Kaspa & Dromi, 2001), and further demonstrates that deaf children’s problems with verb morphology are not language-specific.
Moreover, our study showed different types of inflection errors for deaf and hearing children. Hearing children generally were able to segment the verbs in stem and suffix (i.e., inflection marker), and used finite forms. However, in particular the youngest group of hearing children who had just learned to read and write, tended to supply an incorrect inflection marker (e.g., a 'd' rather than a 't'). So, it seems that hearing children, by the age of seven are already aware of inflection as something to be manipulated, even when they still have inadequate knowledge of inflectional suffixes to correctly apply the rules of inflection. Deaf children, in contrast, often omitted inflections, and used infinite forms. So, deaf children fail to apply basic rules of inflection long after the age at which these rules have been developed in hearing children.

Deaf children's error pattern differs from that of hearing children both quantitatively and qualitatively. The typical pattern in verb inflection in deaf bimodal bilingual children may arise from the fact that the deaf children received a quantitatively and qualitatively different amount and type of language input than the hearing monolingual children tested in this study. Because deaf children cannot hear the language spoken around them, they do not learn it spontaneously, and need visual-manual expressions for the perception and production of language. Consequently, their language learning trajectories can be expected to be different than those of hearing children. We proposed that the errors typically found in deaf children are part of the bilingual language learning process and that children pass through a developmental stage in which they are learning to juggle the different morphological systems of written language and signed language. Mayer and Wells (1996) have argued that when writing, deaf children try to capture sign in print. However, an inflected verb sign conveys morphological elements that are difficult to capture in written language. Deaf people who mainly use sign language are thus faced with the problem of how to encode all information in written text. The typical pattern in deaf children's verb inflection in writing, that is the omission of inflection, therefore suggest that deaf children tend to omit those elements that cannot be translated into written language in a direct way. Similar observations have been made on the acquisition of Italian morphology (e.g., Fabretti, Volterra, & Pontecorvo, 1998; Teaschner, Volterra, & Devescovi, 1988).

We also examined whether difficulties with verb inflection in deaf children would be different for verbs that would be inflected for agreement in SLN and verbs that would not be inflected, since sign language distinguishes between verb signs that inflect for agreement and verb signs that are not inflected. We found no clear differences in the number of errors between the two types of verbs: deaf children opted for not inflecting verbs and did so in both types of verbs.

It is important to note that the results of the present study do not necessarily imply that proficiency in signed language always has harmful consequences for learning to writing (e.g., Singleton, Morgan, DiGello, Wiles, and Rivers, 2004; van Beijsterveldt & van Hell, in press). Van Beijsterveldt & van Hell, for example, examined evaluative expression in deaf bimodal bilingual children's written narratives, an important narrative tool in both signed and oral languages. They found that, despite many morpho-syntactic errors, deaf bimodal bilingual learners use their knowledge of communicative affective expressions from sign language to enrich their written narratives and more successfully so than deaf children who were low-proficient in sign language and used oral Dutch predominantly. Deaf proficiently signing children's narratives were also richer in evaluative expression than those of hearing monolingual and bilingual children.

In an attempt to extend current knowledge on written language production in deaf and hearing children with insights from temporal patterns associated with writing, we also
Chapter 6

analyzed inflection errors in combination with the location and duration of pauses during writing and writing rate. We assumed that variations in pause duration and writing rate reflect variations in cognitive processes involved in writing, in this case, self-monitoring processes related to verb inflection. The results showed that hearing children, both the 7-8 year olds and the 11-12-year olds, paused longer before and after incorrectly inflected verbs than before and after correctly inflected verbs, and had slower writing rates for incorrectly inflected verbs than for correctly inflected verbs. This suggests that hearing children self-monitor the inflection of verbs and adapt their rhythm of production when writing a difficult verb. This implies that children, by the age of 7-8, have developed some basic metacognitive knowledge of verbs they were asked to inflect.

In deaf children, in contrast, no differences in pause duration between incorrectly and correctly inflected verbs were observed. This suggests that deaf children do not monitor their verb inflection, and may not yet have developed metacognitive skills related to the inflection of verbs. This lack of metacognitive activity, together with the results obtained from the linguistic analyses discussed above (The most common type of inflection errors in deaf children was the omission of inflection), imply that deaf children do not recognize that inflection in Dutch needs to be expressed in writing. Deaf children tend to omit inflection and do not seem to be aware of the difficulty of verb inflection in Dutch.

What can these results tell us about educational practice and teaching verb morphology in deaf children? Teaching strategies could focus on the specific difficulties deaf children encounter in the visual learning of an auditory-oral language. Special efforts could be made to highlight those aspects of oral language that particularly depend on acoustic cues (which are unavailable to deaf children) and which are differently marked in signed language, like verb inflection. Teachers of deaf children should made explicit the differences in grammar and modality and should explain to deaf children how each of the grammars of the languages operate, which may help children go through a stage in which they mix-up the systems of different languages, and become better writers.

Moreover, for successful learning to inflect verbs, children however have to develop these metacognitive knowledge and self-monitoring skills. An important implication for education is that such knowledge and skills with respect to verb inflection could be better acquired or developed if teachers gave explicit instruction in metacognitive strategies for verb inflection (Block & Peskowitz, 1990).

To conclude, our study showed that in order to gain more insight into deaf children’s writing, including verb inflection, it is important to take sign language knowledge and variations in children’s linguistic backgrounds into account. Given the rare number of empirical studies on the role of variations in linguistic backgrounds and sign language knowledge on deaf children’s writing, more research is needed to gain deeper insight into the details of the unique developmental trajectories deaf children follow. Secondly, the study of writing as it unfolds in real time, linked to a coding of linguistic characteristics of the writing, provides new ways to gain insight into written language production of deaf children. Analyses of the temporal patterning of cognitive processes during verb inflection showed that deaf children, in contrast to hearing age-matched children and younger children, did not pause longer before and after incorrectly inflected verbs than before and after correctly inflected verbs. This suggests that deaf children have not yet developed metacognitive skills that are needed to self-monitor their inflection of verbs.
References


This thesis embodies five studies on written language production in Dutch deaf children and adults. Several main questions have been examined. The first main question entailed the development of writing skills in deaf children, and it was examined if, and if so, to what extent deaf and hearing children follow different developmental trajectories in writing. We focused on later language development, which was examined cross-sectionally by comparing deaf 11-12-year olds, 15-16-year olds, and adults. Secondly, for the deaf children, we adopted a bimodal bilingual perspective to study if, and if so, how sign language affects writing. Writing was investigated by studying deaf and hearing children’s and adults’ narrative and expository texts, and by two experiments on deaf and hearing children’s written production of specific morpho-syntactic structures. In the experiments, we examined structure priming and verb inflectional morphology. Finally, we explored cognitive processes involved in writing as they unfold in real time by analyzing the location and duration of pauses, and writing rates, in combination with a coding of linguistic aspects of writing.

**Development of writing narrative and expository texts in deaf and hearing children**

Research in the field of deafness has focused predominantly on reading, and there is far less systematic research on the writing of deaf children and adults. Nevertheless, a substantial number of studies has examined how deafness affects learning to write in deaf children and adults. Current knowledge on deaf children and adult’s writing is mainly based on studies with English-speaking deaf people. Many deaf children as well as adults have a considerable delay in mastering the morpho-syntactic rules of English, and they make many grammatical errors. The few studies on languages other than English (i.e., Italian and Hebrew) corroborate deaf people’s problems with morpho-syntax in writing. The exact morpho-syntactic structures that pose difficulties, however, are closely related to the specific structural characteristics of the target language: The target language's typological features determines which morpho-syntactic structures will be particularly difficult for users of that language. A systematic study on writing in Dutch deaf children and adults was lacking. In the present study, we gained more insight into the challenges deaf people face with Dutch morpho-syntax, and the different developmental trajectories in learning to write of Dutch deaf and hearing children.

Chapters 2 and 3 describe the development of morpho-syntactic structures in narrative and expository texts written by deaf 11-12-year olds, 15-16-year olds, and adults, and hearing age-matched peers. Chapter 2 focuses on lexical NPs, in particular the presence of overt subject and object NPs, the presence of articles and modifiers, and errors in grammatical gender and number agreement between articles or modifiers and nouns. The results showed that deaf writers used fewer modifiers, omitted more obligatory subject and object NPs, omitted more obligatory articles, and made more gender and number agreement errors than their hearing age-matched peers, who made hardly any errors. These results indicate that Dutch deaf children and adults have difficulties with lexical NPs in text writing, which corresponds to previous studies on writing in deaf children from other language communities (Taeschner, Devescovi, & Volterra, 1988; Tur-Kaspa & Dromi, 2001; Quigley &
King, 1980). However, in general, deaf writers' performance on lexical NPs improves when increasing age, although deaf adults did not seem to reach the level of hearing adults, who did not make any errors in lexical NPs, and who still used more NP modifiers. Importantly, as will be discussed more extensively in the next section, the developmental patterns were different for deaf people who were proficient in signed language and deaf people who were low-proficient in signed language.

In Chapter 3, deaf children’s and adults’ narrative and expository texts were studied for temporal reference marking. The analyses focused on the use of present, past and future tense, omission of obligatory tense marked on finite verbs, tense agreement errors and lexical markers of temporal reference. We found that tense morphology was problematic for deaf writers. Deaf writers typically used the unmarked tense form (present tense) in narratives, and frequently omitted obligatory tense marking on finite verbs and made tense agreement errors in both narrative and expository texts. In contrast, hearing writers used the morphologically marked tense form (past tense) fluently in narratives, and made no errors in tense agreement between lexical and grammatical markers of temporal reference. These findings parallel earlier findings on tense and verb morphology in English-speaking deaf children (Ivimey, 1981; Quigley, Montanelli, & Wilbur, 1976). Both the Dutch and English tense marking systems are highly grammaticized systems, and the empirical studies demonstrated that grammatical marking of temporal reference is difficult to learn for deaf individuals. The relatively large amount of errors observed in the deaf children, however, was no longer observed in adults.

However, as for the development of lexical NPs reported in Chapter 2, the developmental trajectories were different for low-proficient and proficient signers, as will be further discussed in the next section. This suggests that deaf and hearing children follow different developmental trajectories in learning verb morphology and lexical noun phrases.

Whereas the studies reported in Chapters 2 and 3 focused on morpho-syntactic structures in text writing, the study reported in Chapter 4 focused on pragmatic aspects of text writing. An important narrative tool is the enrichment of narratives through evaluative devices. Evaluation in narratives refers to the expression of the interlocutor's state of knowledge of and involvement in the narrated events. Moreover, it entails that the writer adjusts the linguistic form and content of the narrative to maintain the recipient's attention and interest. Enriching narratives through evaluation is a complex skill that requires linguistic, cognitive and affective/social abilities, and its achievement exhibits a long developmental route (e.g., Bamberg & Reilly, 1996; Berman & Slobin, 1994). In Chapter 4, the use of eight different evaluative devices in narratives written by 11-12-year old deaf and hearing bilingual children was examined. The results showed that deaf children were well able to use evaluative devices in their narratives and did not differ from hearing children in the frequency and distribution of evaluative devices.

Together, the results of Chapters 2, 3 and 4 imply that the impact of deafness on writing differs for different linguistic domains. Many deaf children can write a narrative with affective and emotional expression even though the written product often lacks the grammatical correctness and fluency of more experienced (hearing) writers. Furthermore, in line with the studies described in Chapters 2 and 3, and which will be examined more extensively in the next section, the use of evaluative devices in proficiently signing children's narratives was different from that of deaf low-proficiently signing children, and hearing monolingual and bilingual children.
Influence of sign language knowledge on writing

The majority of studies on deaf children's writing skills did not assess deaf children's proficiency in sign language and/or grouped together deaf children with varying sign language skills. Children who are deaf and who develop using a signed language and a written language receive a quantitatively and a qualitatively different language input than deaf children who hardly ever use sign language. Given these differences in language input it can be expected that deaf children who are proficient in signed language write differently than deaf children who are not proficient in signed language and use oral language predominantly. The assumption that sign language knowledge could affect writing performance in deaf children is based on theories and studies on bilingualism that emphasize interaction, transfer, and competition between languages in bilinguals, and assume that knowledge of one language can affect performance in another language (e.g., Gathercole, 2002; MacWhinney, 2005; Müller & Hulk, 2001; Nicoladis, 2006). This research shows that when certain structures in the dominant language differ substantially from structures in the weaker language, or when particular structures are absent in the dominant language, such structures are difficult to learn in the weaker language.

In the studies reported in Chapter 2 (and 3 and 4), we examined if, and if so, how sign language knowledge affects writing, and we grouped deaf writers into proficient signers and low-proficient signers. 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. In the study reported in Chapter 2, we hypothesized that given these differences between Dutch and SLN in marking of definiteness, proficient signers would have more particular difficulty in the use of obligatory articles. This prediction was confirmed. The study reported in Chapter 2 showed that proficient signers omitted more obligatory articles than low-proficiency signers. However, this difference between proficient and low-proficiency signers was only found in the 11-12-year olds, the youngest group. The adult proficient signers hardly ever omitted obligatory articles, in contrast to adult low-proficient signers, who still made quite a few of such errors.

Secondly, both Dutch and SLN have marked subjects and objects, noun modifiers, and agreement between words of different grammatical classes, although there are differences in the way these functions are expressed. Therefore, we predicted little differences in these aspects of lexical NP writing between proficient and low-proficiency signers. Indeed, the presence of obligatory NPs and agreement marking did not differ in proficient and low-proficiency signers.

In the study reported in Chapter 3, we hypothesized that temporal reference marking in proficiently signing deaf writers' texts reflects the way temporal reference is marked in SLN. The systems of temporal reference marking in Dutch and SLN differ substantially, with Dutch displaying a wide range of inflected verb forms and lexical expressions of time, and SLN having only lexical markers of temporal reference. As was predicted, proficient signers used the unmarked tense form (present tense) more often than a marked tense form (past and future tense) in narratives, and used fewer obligatory tense markers and made more errors in tense agreement between temporal adverb and finite verb than low-proficiency signers. As was also found in Chapter 2, the differences between proficient and low-proficient signers were most pronounced in the 11-12-year old children. The 15-16-year old proficient signers used past tense more often than the 11-12-year olds in narratives, but they still omitted more finite verbs and made more tense agreement errors than their low-proficiency signing peers. The relatively high number of errors in the 11-12-
year old and the 15-16-year old proficient signers, however, was no longer observed in the adult proficient signers. Finally, as both SLN and Dutch have lexical markers of tense, little difference in the use of lexical devices for marking tense between deaf proficient and low-proficient signers was expected. Indeed, we found that proficient and low-proficient signers did not differ on the use of lexical markers of temporal reference.

Chapter 4 shows that sign language proficiency benefits the use of evaluative expression in writing. In Chapter 4, we compared proficiently and low-proficiently signing children on evaluative expression in written narratives. Given the importance of evaluation in signed narratives and the many channels sign language has to convey evaluation, it was expected that deaf proficient signers use this knowledge of rhetorical devices such as evaluative expression to enrich their narratives in written Dutch, and more so than deaf children who are not familiar with sign language and use spoken language predominantly. We found that proficient signers indeed used more evaluation in their written narratives than low-proficiency signers. This demonstrates that variations in sign language proficiency modulate the use of evaluative expression in deaf children's narratives, and implies that deaf proficient signers, when writing, draw upon their knowledge of narrative techniques in signing.

Chapters 2, 3, and 4 imply that variation in sign language proficiency is important to take into account in unraveling which factors may play a role in deaf children's writing. However, the potential influence of sign language knowledge onto writing in an oral language has largely been neglected in previous studies on writing by children and adults who are deaf. Given the fact that SLN does not mark temporal reference morphologically, and does not mark definiteness in NPs, the proficiently signing children's difficulty with using tense morphology and articles in writing can be understood in light of theories and studies on bilingualism emphasizing transfer and interaction across languages (e.g., MacWhinney, 2005; Nicoladis, 2006). In the studies reported in Chapters 2 and 3, the deaf bilingual children's challenge was particularly large for morphological tense marking, and article use. Children who are deaf and mainly use sign language cannot use their knowledge of sign language to acquire tense morphology or the use of articles, because sign language does not mark temporal reference morphologically, and does not mark definiteness.

Transfer does not always impede performance, but can also enhance performance (e.g., Kecskes & Papp, 2000). Sign language, typically, has many ways to convey evaluation, and the study reported in Chapter 4 shows that proficiently signing deaf children use this knowledge of rhetorical devices such as evaluative expression to enrich their narratives in written Dutch, with the result that their narratives contain more evaluative devices than those of low-proficiently signing deaf children and hearing children without knowledge of sign language.

Chapters 2 and 3 further showed different developmental trajectories in writing for proficient and low-proficiency signers. The proficiently signing children show a later onset of acquisition regarding the article and tense systems in Dutch than low-proficiency signers, but eventually catch up with hearing writers. If we assume that the proficiently signing children's problems with articles and tense morphology can be explained by influences from the structure of sign language, then the pattern in the adult proficient signers suggests that such effects are a developmental phenomenon, and that transfer effects of sign language on written language are more pronounced in the earlier phases of language development. Such a developmental phenomenon shows that the effects of bilingualism can vary during development, and that transfer is most critical at early stages of development.
In the low-proficiency signers, on the other hand, no such developmental pattern in the use of articles was observed. The low-proficiency signers may have experienced delay or degraded language input (both oral language and signed language) in early life, and for this reason may not yet have developed adequate morpho-syntactic skills in writing (Mayberry, 2002; Mayberry & Lock; 2003). It should be noted, however, that in the studies reported in Chapters 2, 3, and 4, low-proficiently and proficiently signing children did not differ on oral Dutch language skills.

The results of Chapters 2, 3, and 4 further demonstrated different patterns of performance of morpho-syntactic skills and pragmatic/discourse skills in proficiently signing children. If we assume that the pattern of writing observed in proficiently signing deaf children can be explained by influences from sign language characteristics, this implies that the influence of sign language knowledge differs for different aspects of writing. This issue is also addressed in the literature on linguistic and cognitive development in hearing bilingual children (e.g., Bialystok, 2002; MacWhinney, 2005; Petitto & Kovelman, 2003). Bialystok (2002), for example, argues that 'bilingualism is not a holistic experience that excerts a single impact on development' (p. 192). Children who have learned skills in one language can potentially benefit from that mastery by applying them in the other language. On the other hand, acquiring two languages with different sets of forms can lead to interference. We found that the bimodal bilingual children seem to benefit from their proficiency in sign language when expressing emotional and affective attitudes in written narratives through evaluative devices. On the other hand, bimodal bilingual children seem to struggle with the different morpho-syntactic systems of written language and signed language (at age 11-12, not at age 15-16 or as adults).

A related question is whether the pattern of writing in deaf proficiently signing children can be explained by sign language proficiency per se or, rather, by more general factors related to being able to use two languages. In Chapter 4, we compared the use of evaluation in proficiently and low-proficiently signing deaf children with that of Turkish-Dutch bilingual children. Although Turkish and Dutch differ with respect to linguistic characteristics and rhetorical style, they both express evaluation lexically (in contrast to SLN). The comparison showed that the proficiently signing deaf children also use more evaluative devices than hearing bilingual children (who in turn did not differ from low-proficiently signing deaf children). This suggests that the use of evaluation in proficiently signing deaf children cannot be explained by their bilingualism alone, but rather seems to be a unique pattern in bimodal bilingual deaf children who use a signed language and a written language.

Evidence from experiments on written language production in deaf and hearing children

Chapters 2, 3, and 4 focused on the development of morpho-syntactic structures in narrative and expository text writing. In free production tasks, children can choose to use or to avoid certain morpho-syntactic structures. Chapters 5 and 6 reported more controlled experiments on deaf and hearing children’s written production of specific morpho-syntactic structures.

Chapter 5 reports a priming study on the use of adjective-noun structures in deaf and hearing children. The method of syntactic structure priming can provide insight into how syntactic information is represented and organized in memory and whether the use of syntactic structures can be affected by prior exposure to such structures. Deaf children, aged 11-12 years (who were proficient in SLN), were compared with hearing 11-12-year old and 7-8-year old children, and were primed with prenominal, relative clause, and main
clause adjective-noun structures. After reading one of the structures, children described a picture in Dutch. Half of the primes contained the same noun as the target picture, half contained a different noun. It was found that the pattern of priming effects in deaf children was similar to that of hearing children of the same age, as well as that of hearing younger children who had just learned to read and write. Both deaf and hearing children (from both age groups), when describing a picture, were more likely to use the same structure as the one they had read before as a prime, in both the same noun condition and the different noun condition.

First, this implies that prior exposure to syntactic structures can affect deaf children's use of a certain structure even when that structure may be not fully available for use in various situations of spontaneous language production. Second, the fact that priming effects also occurred when the noun in the prime was different from that in the target picture indicates that deaf children, and hearing children, possess representations of adjective-noun structures syntactic structures at an abstract level, independent of particular lexical items. This finding contributes to theories on how syntactic information is represented and organized in memory, which are typically based on adults (e.g., Cleland and Pickering, 2003, Pickering & Branigan, 1998). Our findings suggest that the basic patterns in the processing and representation of adjective-noun structures are similar for adults and children, and are obtained in both deaf and hearing children.

Importantly, although priming patterns for deaf and hearing children were similar, there was a notable difference in the frequency of use of different structures between deaf and hearing children. In contrast to hearing children, who favor prenominal adjective-noun structures, deaf children more frequently used post-nominal structures, in particular relative clause structures. A possible explanation for deaf children's preference for post-nominal structures can be found in the differences between sign language and oral language. Dutch has both prenominal and post-nominal adjective-noun constructions, whereas SLN has only a post-nominal adjective-noun construction. Deaf children seem to favor those adjective-noun constructions that are used in sign language, that is when the adjective is posited after the noun. Our data on the hearing children, and Cleland & Pickering's study on adults, showed that although adjective-noun structures containing a relative clause could be primed these structures were rarely used by both children and adults. This could be due to the fact that relative clause structures are longer and syntactically more complex than prenominal structures (and main clauses). The fact that deaf bimodal bilingual children prefer post-nominal structures over pre-nominal structures, even when they are syntactically more complex, suggests that sign language knowledge drives the use of adjective-noun structures in deaf bimodal bilingual children.

Chapter 6 reports an experiment on verb morphology and extends the study on deaf children's tense marking reported in Chapter 3. In the verb morphology study, we specifically focused on verb inflectional morphology. Because signed language and oral language differ in modality and morphology, verb inflection may be particularly challenging for deaf bimodal bilingual children. Deaf 11-12-year old proficiently signing children were compared with age-matched hearing children and 7-8-year old hearing children (who had just learned to read and write) on first and third person singular marking on verbs. The study showed that deaf children made more verb inflection errors than hearing age-matched peers and 7-8-year old hearing children, and made different types of inflection errors. Hearing children generally inflected all verbs, although the youngest group of hearing children tended to supply an incorrect inflection marker. This suggests that hearing children, by the age of 7-8, are already aware of inflection, even though they may still have inadequate knowledge of
inflectional suffixes to correctly apply the rules of inflection. Deaf children, in contrast, often omitted inflections and used the infinite forms. So, many deaf children failed to apply basic rules of verb inflection three years after the age at which these rules are at least rudimentary developed in hearing children.

Chapters 2-5, together with previous studies reviewed in Chapter 1, have expanded our knowledge about deaf children’s and adults’ writing abilities. However, little information is available on how the texts written by deaf children and adults come about, and the cognitive processes involved in writing. To gain more insight into the temporal patterns associated with written language production in deaf and hearing children, we studied verb writing as it unfolds in real time and analyzed inflection errors in combination with the location and duration of pauses during writing and writing rate in Chapter 6. The underlying assumption was that variations in pause duration and writing rate reflect variations in cognitive processes involved in writing, in this case, self-monitoring processes related to verb inflection. Specifically, we compared pause durations before and after correctly inflected verbs and incorrectly inflected verbs, and the writing rates of these verbs. We found that the hearing children, both the 7-8 year olds and the 11-12-year olds, paused longer before and after incorrectly inflected verbs than before and after correctly inflected verbs, and had slower writing rates for incorrectly inflected verbs than for correctly inflected verbs. This suggests that hearing children self-monitor the inflection of verbs and adapt their rhythm of production when writing a difficult verb. It also implies that hearing children, by the age of 7-8, have developed skills to self-monitor their inflection of verbs.

Deaf children, in contrast, demonstrated no differences in pause duration between incorrectly and correctly inflected verbs, suggesting that deaf children do not self-monitor their verb inflection. The absence of self-monitoring activities, together with the results obtained from the linguistic analyses discussed above (i.e., omission of inflection being the most common type of inflection errors in deaf children), imply that deaf children (at the age of 11-12) do not (yet) recognize that inflection in Dutch needs to be expressed in writing. Deaf children tend to omit inflection and do not seem to be aware of the difficulty of verb inflection in Dutch.

**Implications for theories on bilingualism**

Studies on signed languages have revealed unique insights into the psycholinguistic mechanisms that underlie language processing, and have shown that there is a language-universal processing system regardless of language modality. Thompson, Emmorey, and Gollan (2005), for example, investigated whether ASL signers experience ‘tip-of-the-fingers’ (TOFs), and whether TOFs are similar to ‘tip of the tongues’ (TOTs) in oral language. Thompson et al. (2005) found that ASL signers indeed had TOF experiences in which they could retrieve detailed semantic information, but had little or no access to the sign form. TOFs were similar to TOTs in that the majority involved proper names, and participants sometimes had partial access to phonological form (e.g. recalling the hand configuration and location of a sign, but not its movement).

Further, both signers and speakers show categorical perception effects for distinctive phonological categories in their language, and both combine phonological units prior to articulation, as evidenced by slips of the tongue and hand (see Emmorey, 2007, for a review). So, studies have shown that several basic mechanisms of language processing are not specific to oral language but also apply to signed language.
What are the consequences of dealing with languages in different modalities for the basic mechanisms of bilingual language processing? This question has received increasing attention in research. Most studies on this topic focused on speech production (e.g., Emmorey, Borinstein, Thompson, & Gollan, 2008; Peyers & Emmorey, 2008). When speaking, a unimodal bilingual must stop using one language and switch to a second language. Unimodal bilinguals therefore code-switch between their two languages. A signed language and a spoken language are expressed by different articulators, which allows simultaneous expression of both languages. Peyers and Emmorey (2008), for example, analyzed conversations in English between hearing bimodal bilingual adults (i.e., hearing people who have deaf parents) and native English-speaking non-signers. They found that bimodal bilinguals used grammatical facial expressions from ASL, that is raised brows and furrowed brows, simultaneously with corresponding syntactic structures in English. The researchers argue that bimodal bilinguals rarely code-switch, like unimodal bilinguals typically do. Rather, they produce code blends in which sign and speech are produced simultaneously. Van den Bogaerde and Baker (2006) found that also children who are bimodal bilingual in oral and signed language demonstrate code blends.

The studies on writing reported in the present thesis demonstrated that deaf SLN signing children are sensitive to grammatical structures that are different between signed language and oral language, in particular, lexical NPs, temporal reference marking, verb morphology, and adjective-noun structures. Our findings, along with those of the studies discussed above, suggest that mechanisms of transfer across languages, observed in bilinguals using spoken languages may not be unique to unimodal bilinguals, but may transcend sensory-motor modality and also apply to bimodal bilinguals. Further research should provide deeper insight into how signed and oral languages interact in the bimodal bilingual mind, and how bimodal bilingualism affects mechanisms of transfer and competition between languages in production.

**Implications for educational practice and research**

The studies reported in the present thesis indicate that deaf and hearing children follow different developmental trajectories in writing, and that variation in sign language proficiency in deaf children should be taken into account when studying and explaining deaf children's development in writing. As we have argued, the typical pattern of writing in proficiently signing children may hint at a developmental stage in which children mix the morpho-syntactic systems of oral language and signed language. An implication for education of deaf children is that teaching strategies could focus on the specific difficulties deaf children encounter in the visual learning of an auditory-oral language. Special efforts could be made to highlight those aspects of oral language that are differently marked in signed language, such as definiteness, verb inflection (including temporal reference and person marking), and word order in adjective-noun structures. If we assume that deaf bimodal bilingual children go through a developmental stage in which they mix-up the grammatical systems of the two languages, it may be helpful to make the differences in grammar and modality explicit and explain to deaf children how each of the grammars of the languages operate.

Furthermore, skills developed in signed language (such as semantic-pragmatic and discourse skills) should be used to support learning to write. However, we still have little understanding of how signed language works to support writing and reading development in children who are deaf (Mayer, 2007). This needs to be investigated in future research and it
involves thinking about ways in which signed language can be used to promote oral/written language.

Finally, for successful learning to write, deaf children have to develop metacognitive knowledge and self-monitoring skills. An important implication for education is that such knowledge and skills could be better acquired or developed if teachers gave explicit instruction in metacognitive strategies for writing (for an example of such instructions, see Schirmer, Bailey, & Fitzgerald, 1999).

The relation between sign language knowledge and reading

Although the present thesis showed that there is an increasing body of research on deaf children’s writing abilities, a substantially higher number of studies focused on deaf children’s reading abilities. Research on reading abilities has repeatedly shown that the median reading level of deaf students does not reach the level required for a person to be considered literate (e.g., Conrad, 1979, Traxler, 2000). However, the variation in reading levels of deaf people is quite high (Mayberry, 2002). As is the case for most studies on deaf people’s writing skills, few studies on reading have taken variations in sign language proficiency into account, or assessed sign language proficiency.

Some empirical studies addressed the relation between sign language skills and reading skills (e.g., Chamberlain & Mayberry, 2000; 2008; Hoffmeister, 2000, Strong & Prinz, 1997), and compared good and poor readers on performance in sign language, or examined correlations between reading skill and sign language skill. For example, Chamberlain and Mayberry (2008) showed that deaf adults who were proficient in reading showed higher levels of syntactic and narrative comprehension in American Sign Language than deaf low-proficiently reading adults.

Together, the findings observed in the present thesis along with previous studies on reading ability suggest that deaf children with different proficiency levels in signed language follow different developmental trajectories in learning to write and read. Taking variations in sign language into account in examining deaf children’s reading and writing will enhance our understanding of the role of sign language proficiency in acquiring literacy skills in an oral language.
References


Notes

Chapter 1

1. Bilinguals are individuals who use two or more languages in their everyday lives. This includes individuals who have spoken skills in one language and written skills in the other language, people who speak two languages at varying levels of proficiency, and individuals who are completely skilled in their two languages (Grosjean, 1992).

Chapter 2

1. Lexical density was defined as the proportion of content words (nouns, verbs, adjectives and adverbs) in relation to total words (Strömqvist, Johansson, Kriz, Ragnarsdottir, Aisenman, Ravid, Berman, & Verhoeven, 2002).
2. A first series of Sign language proficiency (proficient signers vs low-proficiency signers) x Text genre (narrative vs expository texts) ANOVAs for all three age groups, and for all three dependent variables (text length, lexical density, abstract nouns) yielded no significant interactions between Sign language proficiency and Text genre. Since the main purpose of our analyses is to gain insight into Dutch proficiency levels of the two groups of participants who are deaf with different sign language proficiency levels, we report one factor ANOVAs for each age group, collapsed across the factor Text genre.
3. Abstract nouns were coded by two Master students and inter-rater agreement was .78 for expository texts and .69 for narrative texts.
4. As we were unable to obtain reading scores of all children, we performed additional three-way Group (3) x Age (3) x 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 as done on all participants.
5. 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.

Chapter 3

1. Aarons, Bahan, Kegl, and Neidle (1995) distinguish between ASL time adverbials that are near to morphological in form and allow a flexibility in realization that expresses a degree of distance in time, and lexical markers of time that are frozen forms. Whether these different types of time adverbials are also present in SLN, is still unknown. It is known, however, that in sign language (including SLN) morphological complexity is not created through the addition of prefixes or suffixes, like in many spoken languages, but through changes in the form of the sign itself, by modification of the length of the movement, or by the use of nonmanual markers.
2. Sign Supported Dutch is clearly distinguished from Sign Language of the Netherlands. Sign Supported Dutch is a sign system derived from spoken Dutch; it
follows the grammatical rules of Dutch, and it uses partly the lexicon of SLN, and partly invented signs. Sign Language of the Netherlands, in contrast, is a natural language having an independent grammar that is quite different from the grammar of Dutch (Schermer, 1991).

3. We performed the same analyses in which we only included the children from who we have reading test scores, and these analyses yielded a similar pattern of results.

Chapter 4

1. Mean level of hearing loss was calculated by dividing the hearing loss at 500, 1000, 2000, and 4000 Hz derived from recent audiograms. From 3 low-proficiently signing children there were no recent audiograms available. Yet, these children, who were educated in mainstream schools, were involved in a special-language remediation program and their remedial teachers confirmed they were profoundly deaf.

2. In a different project, we examined the development of evaluative expression in hearing writers of Dutch, and had collected written narratives in hearing 15-16-year olds and adults using the same procedures as in the present paper. Analyses of the frequency of using evaluative devices in hearing 9-10 year olds, 11-12-year olds, 15-16-year olds and adults showed that the use of evaluation in hearing writers increases with age, and is largest in hearing 15-16-year olds.

3. To make sure that the pattern of evaluation in the hearing bilingual children cannot be explained by the fact that they were two years younger than the other comparison groups, we compared the hearing bilingual children with 20 age-matched hearing monolingual children (Mean age = 10;3 (SD = 0.6), Mean text length = 80.00 (SD = 47.10), MLU = 5.64 (SD = 0.96), and with the 11-12-year old monolingual children from this study. A one-factor ANOVA on the use of evaluative devices showed no effect of group, indicating that hearing bilingual children did not differ from hearing age-matched and 11-12-year old monolingual children on the use of evaluative devices.
Summary

The studies reported in this thesis aimed to gain deeper insight into the development of writing skills in Dutch deaf children. Specifically, in five empirical studies I investigated deaf children's and adults' writing patterns in relation to their linguistic backgrounds, and also studied the possible influence of knowledge of sign language on learning to write an oral language. The research thus adopted a bimodal bilingual perspective.

In the introductory chapter, I reviewed earlier studies on written language production in deaf children. Four foci were used to organize the literature review. First, several studies were discussed that focused on syntactic structures and that described the types of errors deaf children typically make. These studies examined deaf children from English-, Italian- and Hebrew-speaking communities, and all demonstrated that deaf children's writing performance with respect to a wide range of morpho-syntactic structures is different from that of hearing children. Second, studies were reviewed that adopted a cognitive-functional perspective on writing. From this perspective, writing is seen as a social process whose form and function vary across different contexts. Research within this cognitive-functionalistic framework examines the relationship between linguistic forms and their function, in particular the way such forms are used to express thoughts. Most studies examined narratives and showed that deaf children can write coherent texts but they use a smaller variety of linguistic forms and elaborate less on the content. Third, it was discussed how differences in sign language proficiency among deaf children and adults potentially have profound effects on their writing in an oral language. I concluded that in order to gain more insight into deaf people's writing, it is important to take deaf people's variations in sign language proficiency into account. Finally, I discussed how the investigation of temporal markers of writing, such as pause times and writing rates, linked to a coding of linguistic characteristics of a written text can provide insight into the temporal patterning of cognitive processes involved in written language production.

Chapter 2 reports a study on the development of lexical noun phrases (NPs) in narrative and expository texts written by deaf and hearing children and adults. A first question was whether deaf and hearing children follow different or similar developmental trajectories in writing lexical NPs. Secondly, we examined if, and if so how, proficiency in sign language affects the writing of lexical NPs, and compared texts written by deaf children and adults who are proficient in Sign Language of the Netherlands (SLN) with texts written by deaf children and adults who are low-proficient in SLN. The majority of previous studies on deaf people's writing skills did not take sign language proficiency into account. The analyses of the written texts focused on the presence of overt subject and object NPs, the presence of NP articles and modifiers, and gender and number agreement errors between article or modifier and noun. Dutch and SLN have both overlapping features and differences in their NP systems. In both Dutch and SLN, the functions underlying subject and object marking, modifying nouns, and form 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 sign language proficiency influences written language in deaf proficiently signing children, it is predicted that deaf children who are proficient in sign language and deaf children who hardly use sign language show differences in the use of articles in lexical NPs. The results showed that participants who are deaf had
major problems with the morpho-syntactic structure of lexical NPs, in contrast to hearing participants. Further, deaf proficiently signing children (but not adults) more often omitted obligatory articles than low-proficiently signing children. Deaf proficiently and low-proficiently signing children did not differ with respect to the use of NP modifiers, NP-agreement errors and omissions of obligatory NPs. Furthermore, the number of errors in the proficiently signing children decreased strongly with age, but this developmental pattern was not found in the low-proficiently signing children. Similar results were found for narrative and expository texts. Together these results suggest that children who are deaf and proficient in SLN and children who are deaf and low-proficient in SLN follow different developmental trajectories in writing lexical NPs.

The study reported in Chapter 3 adopted a similar developmental and bimodal bilingual approach, and focused on temporal reference marking in narrative and expository texts written by Dutch deaf children and adults. Texts written by deaf children (i.e., 11-12-year olds and 15-16-year olds) and adults who are either proficient in SLN or low-proficient in SLN, and hearing age-matched peers were compared on grammatical and lexical marking of temporal reference. Dutch and SLN differ with respect to temporal reference marking, with Dutch having a wide range of inflected verb forms (e.g., *werkte* 'worked', *had gewerkt* 'had worked') and lexical expressions of time to refer to states, actions or events that happened in the past (e.g. *gisteren* 'yesterday', *drie weken geleden* 'three weeks ago', *toen* 'then') and SLN having only lexical markers of temporal reference. It was predicted that if sign language proficiency influences temporal reference marking in deaf proficient signers, then deaf proficiently and low-proficiently signers will differ in temporal reference marking on verbs, but not in lexical marking of temporal reference. It was found that the youngest proficiently signing children in particular had difficulties with tense morphology, and avoided the marked past tense form and omitted verbs, but showed no problems with lexical marking of temporal reference. The older proficiently signing writers did inflect verbs, and their temporal reference marking eventually resembled that of the hearing writers at adult age. This suggests that deaf proficiently bimodal bilingual learners follow the same developmental pathway as hearing unimodal bilinguals who first depend on pragmatic devices and lexical devices, and gradually start using more and more verb morphology to mark temporal reference. It is concluded that deaf proficient signers, deaf low-proficient signers, and hearing children follow different developmental trajectories in temporal reference marking in writing. This study, as well as the study reported in Chapter 2, shows that in order to gain more insight into deaf people's writing, it is important to take variations in language backgrounds into account.

In another study, we examined evaluative expression in deaf and hearing children's written narratives (Chapter 4). Evaluation in narratives reveals the writer's reactions to the narrated events and actions, and the writer's attitude towards the characters, actions, and events. Evaluative information is conveyed via different devices, such as emotional expressions, intensifiers and qualifying elements, attention markers, figurative language, and direct speech. All suspend the action of the narrative and make the narrative more vivid. Although evaluative expression is an important narrative tool in both spoken/written and signed language, signed language has more ways to convey evaluation. Signed language uses lexical signs, eye gaze, body shifts, modifications of sign speed and movement that served as affective prosody, facial expression, and gesture for evaluative expression. Narratives written by deaf proficiently signing children were compared with those of deaf children who are low-proficient in SLN. Given the importance of evaluation in signed narratives and the many channels signed language has to convey evaluation, it was
expected that deaf proficient signers use this knowledge of rhetorical devices such as evaluative expression to enrich their narratives in written Dutch, and more so than deaf children who are not familiar with signed language and use spoken language predominantly. Moreover, we compared the written narratives of deaf proficient and low-proficiently signing children with those of hearing children with different language backgrounds: monolingual children and bilingual children from Turkish immigrant families born in the Netherlands. Although Turkish and Dutch differ with respect to linguistic characteristics and rhetorical style, they both express evaluation lexically (in contrast to SLN). By comparing deaf signing children with hearing bilingual children who also deal with two languages, we gain insight into whether the use of evaluation in proficient signers’ narratives can be explained by sign language proficiency or, rather, by more general factors related to being able to use two languages.

We found that deaf children are well able to enrich their written narratives with evaluative devices. Moreover, proficiently signing children used even more evaluative expression than deaf low-proficiently signing children and hearing monolingual and bilingual children. This indicates that deaf proficiently signing children use their knowledge of the many ways signed language can convey evaluation to enrich their narratives in written Dutch. The results of the comparison with bilingual children suggests that the use of evaluation in proficiently signing deaf children cannot be explained by their bilingualism alone, but rather seems to be a unique pattern in bimodal bilingual deaf children who use a signed language and a written language.

In addition to linguistic analyses of written texts, we conducted two experiments on deaf and hearing children's written production of specific grammatical structures. The combination of both linguistic analyses of written texts as well as experiments designed to test specific hypotheses is novel in the literature on language skills in deaf children and adults. The data of the more exploratory linguistic analyses were used to inform us on specific linguistic structures of interest in deaf children's writing, which were then manipulated and tested in the experiments. In one experiment, we focused on the production of adjective-noun structures using a structural priming method (Chapter 5). Structural priming methods in young children can provide insight into how children acquire the structural properties of their language, syntax, and whether children have similar or different representations of structural knowledge than adults have. In Chapter 5, structural priming of adjective-noun structures was examined in deaf children (proficient in SLN) aged 11-12-years, and hearing children who had the same age, and younger hearing children, aged 7-8-years. In Dutch, an adjective (here, color) can either precede the noun to which it refers, in a prenominal structure as in De blauwe bal [The blue ball], or the adjective can follow the noun, in a relative clause structure as in De bal die blauw is [The ball that is blue], or in a main clause as in De bal is blauw [The ball is blue]. SLN, in contrast, uses a post-nominal adjective-noun construction. We primed children by having them read either a prenominal structure, a relative clause structure, or a main clause. Then they had to describe a colored picture. It was predicted that children, if they are sensitive to structural priming, were more likely to use the structure they had just read as a prime than one of the other structures. Second, we examined whether such a structural priming effect is enhanced when prime and target contain the same words ('lexical boost'). To investigate this, half of the object nouns used in the prime structure was identical to the object in the target picture, and the other half was different.

We found that deaf children, just like hearing age-matched children and younger children when describing a picture, were more likely to use the same adjective-noun
structure as the one they had read before in both the same noun and different noun condition. This shows that prior exposure to adjective-noun structures can affect deaf and hearing children's use of a certain structure. This also shows that deaf and hearing children possess abstract representations of adjective-noun structures, and that deaf children's difficulty with complex syntax is not due to limited abstract knowledge of syntactic structures. However, although priming patterns for deaf and hearing children were similar, there was a major difference in the frequency of use of different structures between deaf and hearing children. Deaf children preferred to use post-nominal structures, structures that are commonly used in signed language, in contrast to hearing children, who favored prenominal adjective-noun structures. This suggests that the use of grammatical structures of deaf children was influenced by the structure of sign language.

The study reported in Chapter 6 focused on verb inflection. Dutch and SLN differ substantially with regard to verb inflection. Dutch has inflection rules which apply to all verbs. In Dutch, finite verbs are typically marked for person and number characteristics of the subject. These rules apply to all Dutch verbs. SLN, like many signed languages, but unlike many spoken languages, distinguishes verb signs that inflect for agreement and verb signs that do not inflect for agreement. Dutch, like many oral languages uses suffixes (e.g., stem+t for second and third person singular marking) to mark agreement, whereas inflection in signed languages includes a change of the movement direction of the verb sign, and/or the orientation of the palm of the hand and fingers, and/or the location of the verb sign. Deaf and hearing children inflected verbs in Dutch that are inflected in SLN and verbs in Dutch that are uninflected in SLN. We examined the number and types of errors deaf and hearing children made in Dutch verb inflection. We focused on two types of errors, that is, omission of inflections and other inflection errors, in two types of verbs, that is, verbs that are inflected in SLN and verbs that are uninflected in SLN. We hypothesized that errors in verb inflection in Dutch by deaf children is part of the bilingual language learning process and that children pass through a developmental stage in which they are learning to juggle the different morphological and modality systems of written language and signed language. Specifically, given the different systems of verb inflection in Dutch and SLN, it was predicted that deaf children tend to omit inflection (or show a pattern in which they sometimes omit inflection). The results showed that deaf children indeed often omitted inflections, and used infinite forms. Hearing children generally used finite forms, but particularly the youngest group of hearing children tended to supply an incorrect inflection marker (e.g., a d rather than a t). We also examined whether difficulties with verb inflection in deaf children would be different for verbs that would be inflected for agreement in SLN and verbs that would not be inflected. We found no clear differences in the number of errors between the two types of verbs: Deaf children opted for not inflecting verbs and did so in both types of verbs.

In this experiment, also a process-oriented approach to writing was adopted, and cognitive processes involved in writing were explored by analyzing pause time patterns and writing rates in writing (Chapter 6). Such a combined study on the product and the process of writing provides new ways to gain insight into temporal patterning of cognitive processing in written language production of children. Children have to develop the ability to self-regulate and monitor the inflection of verbs. Monitoring refers to the process of inspecting one's own utterance for the purpose of changing the form of the utterance. This can take place before writing the utterance or after writing it. In order to be able to monitor the correctness of the inflection, writers have to pay attention to the correctness of the verbs and have to develop feelings about the correctness of the verb they are about to write, or just wrote down. These abilities are related to the general concept of metacognition, being aware
of your state of knowledge. In this study, we compared pause durations before and after correctly and incorrectly inflected verbs, and the writing rates of these verbs. If deaf and hearing children monitor their inflection of verbs, it can be expected that children will pause longer before and after incorrectly inflected verbs than before and after correctly inflected verbs, and writing rates of incorrectly inflected verbs should be longer than writing rates of correctly inflected verbs. If a fundamental problem for deaf children is that they have not yet developed monitoring skills, time patterns should be similar for both correctly and incorrectly inflected verbs. Pause times and writing rates of incorrectly and correctly inflected verbs were compared, and it was found that deaf children (who were proficient in sign language), in contrast to hearing age-matched children and younger children, did not pause longer before and after incorrectly inflected verbs than correctly inflected verbs. This suggests that deaf children have not yet developed metacognitive skills to self-monitor their inflection of verbs.

Finally, in Chapter 7 the consequences of the empirical studies for understanding deaf children's writing performance and development are discussed. The studies reported in the present thesis imply that the impact of deafness on writing differs for different linguistic domains. Many deaf children can write a narrative with affective and emotional expression even though the written product often lacks the grammatical correctness and fluency of more experienced (hearing) writers. The structural priming study reported in Chapter 5, however, suggests that deaf children's difficulty with complex syntax is not due to limited abstract knowledge of syntactic structures. Chapter 6 provides more insight into how texts written by deaf children come about, and the temporal patterns associated with writing in deaf children. It shows that deaf children do not adapt their rhythm of production when writing a difficult verb. This implies that deaf children do not (yet) self-monitor their verb inflection and do not seem to be aware of the difficulty of verb inflection in Dutch.

Further, this thesis demonstrated that it is important to take variations in sign language proficiency into account when unraveling factors that may play a role in deaf children's writing. Different writing patterns were found for deaf children and adults who are proficient in SLN and deaf children and adults who are low-proficient in SLN, in particular with respect to lexical NPs, temporal reference marking, and evaluative expression in narratives. Our findings, along with those of earlier studies on bilingual language processing, suggest that mechanisms of transfer across languages, observed in bilinguals using spoken languages may not be unique to unimodal bilinguals, but transcend to the sensory-motor modality and may also apply to bimodal bilinguals.
Samenvatting

De experimenten gerapporteerd in dit proefschrift zijn gericht op de schrijfvaardigheid van dove kinderen en volwassenen. Het schrijven van dove kinderen en volwassenen is onderzocht in relatie tot taalachtergrond en de mogelijke invloed van vaardigheid in gebarentaal. In het inleidende hoofdstuk werd een overzicht gegeven van eerdere studies naar geschreven taalproductie van dove kinderen. Vier benaderingen met betrekking tot schrijven zijn gebruikt om het literatuuroverzicht in te delen. Ten eerste zijn studies besproken die gericht zijn op syntactische structuren en het type fouten dat dove kinderen maken. Deze studies hebben betrekking op dove kinderen uit verschillende talige omgevingen, en alle studies hebben laten zien dat het schrijven van dove kinderen verschilt van dat van horende kinderen wat betreft een groot aantal morfo-syntactisch structuren. Ten tweede zijn studies besproken die een cognitief-functionalistische invalshoek hanteren. In deze invalshoek wordt schrijven beschouwd als een sociaal proces waarvan de vorm en de functie variëren per context. Onderzoek vanuit zo’n cognitief-functionalistische perspectief legt de nadruk op de relatie tussen linguistische vormen en hun functies, met name de manier waarop vormen worden gebruikt om een specifieke functie uit te drukken. Het merendeel van deze studies onderzocht verhalen en lieten zien dat dove kinderen weliswaar samenhangende verhalen schrijven, maar een kleinere variëteit aan taalkundige vormen gebruiken en minder details over gebeurtenissen toevoegen. Ten derde is besproken hoe verschillen in vaardigheid in gebarentaal het schrijven van dove kinderen kunnen beïnvloeden. De bespreking laat zien dat om meer inzicht te krijgen in het schrijven van dove mensen het belangrijk is rekening te houden met variaties in gebarentaalvaardigheid. Tenslotte is besproken hoe onderzoek naar temporele eigenschappen van schrijven, zoals pauzeduur en schrijfsnelheid, in combinatie met taalkundige kenmerken van een tekst tot inzicht kan leiden in de temporele aspecten van cognitieve processen tijdens het schrijven.

In Hoofdstuk 2 wordt verslag gedaan van een studie naar het naamwoordelijke deel van een zin (lexical NPs) in geschreven verhalen en opstellen van dove en horende kinderen en volwassenen. Een eerste vraag was of dove en horende kinderen een verschillende of dezelfde ontwikkeling doorlopen in vergelijking met horende leeftijdgenoten. Ten tweede is onderzocht of, en zo ja hoe, vaardigheid in gebarentaal het schrijven van NPs beïnvloedt. Hiertoe zijn verhalen en opstellen van dove kinderen en volwassenen die vaardig zijn in gebarentaal vergeleken met verhalen en opstellen van dove leeftijdgenoten die niet vaardig zijn in gebarentaal. In het merendeel van voorgaande studies naar het schrijven door dove kinderen is geen functioneel onderscheid gemaakt tussen dove kinderen met verschillende niveaus van vaardigheid in gebarentaal. De taalkundige analyses van de teksten waren gericht op de aan- en afwezigheid van NPs (het verplichte onderwerp en lijdend voorwerp in zinnen), het gebruik van lidwoorden, modifiërende woorden (bijvoeglijke naamwoorden, aanwijzende en bezittelijke voornaamwoorden en telwoorden), en geslacht- en getalsfouten binnen NPs. Tussen het Nederlands en de Nederlandse Gebarentaal (NGT) zijn er zowel verschillen als overlap in de vorming van NPs. Zowel in het Nederlands als in NGT worden het onderwerp en het lijdend verwerp van een zin gemanierd. Ook worden zowel in het Nederlands als in NGT modifiërende woorden gebruikt, en is er vormovereenkomst tussen woorden van verschillende grammaticale klassen (hoewel er verschillen bestaan tussen het Nederlands en de NGT in de manier waarop deze functies worden vormgegeven). Het Nederlands en de NGT verschillen echter substantieel van elkaar wat betreft het gebruik van lidwoorden. In het Nederlands is een lidwoord verplicht in bepaalde contexten terwijl in NGT geen lidwoorden gebruikt worden.
Als het zo is dat vaardigheid in gebarentaal het schrijven van de vaardige gebaarders beïnvloedt, dan is de verwachting dat doven die vaardig zijn in NGT en doven die niet vaardig zijn in NGT met name verschillen in het gebruik van lidwoorden. De resultaten hebben laten zien dat doven over het algemeen moeite hebben met NPs in het Nederlands. Zoals verwacht bleek dat dove kinderen die vaardig zijn in NGT veel lidwoorden weglieteten, meer dan dove kinderen die niet vaardig waren in NGT. De 15-16-jarigen die vaardig zijn in NGT lieten minder lidwoorden weg, en de volwassenen die vaardig zijn in NGT lieten vrijwel geen lidwoorden weg. Zo’n ontwikkelingspatroon in het gebruik van lidwoorden werd niet gevonden bij de dove kinderen die niet-vaardig waren in NGT. Vaardige en niet-vaardige gebaarders verschillen verder niet van elkaar in het gebruik van de andere onderzochte maten, namelijk het gebruik van modifiërende woorden, fouten in grammatical geslacht en getal, en ontbrekende NPs. De resultaten waren vrijwel gelijk voor verhalen en opstellen.

De studie die gerapporteerd is in Hoofdstuk 3 was gericht op tijdsmarkeringen in geschreven verhalen en opstellen van dove kinderen en volwassenen die vaardig zijn in NGT, dove kinderen en volwassenen die niet vaardig zijn in NGT en horende leeftijdgenoten. De taalkundige analyses waren gericht op grammaticale en lexicale tijdsmarkeringen. Tussen het Nederlands en de NGT zijn er zowel verschillende als overlappende elementen wat betreft de uitdrukking van tijd. In het Nederlands wordt temporeel perspectief zowel grammaticaal (namelijk door middel van werkwoordsvervoegingen) als lexicaal (namelijk door middel van bijwoorden of voegwoorden van tijd, zoals gisteren, en toen) uitgedrukt. In de NGT wordt tijd alleen uitgedrukt door lexicale elementen, zogenaamde tijdgebaren. Er werd verwacht dat als vaardigheid in gebarentaal het schrijven van de vaardige gebaarders beïnvloedt, verhalen en opstellen van doven die vaardig zijn in NGT en doven die niet vaardig zijn in NGT met name verschillen in grammaticale tijdsuitdrukkingen maar niet in lexicale tijdsmarkeringen. De resultaten hebben laten zien dat met name de 11-12-jarige dove kinderen die vaardig waren in NGT moeite hadden met werkwoordsvervoeging. Deze kinderen gebruikten met name de tegenwoordige tijdsvorm in hun verhalen om te verwijzen naar gebeurtenissen, zij vermijdden de verleden tijdsvorm van werkwoorden en lieten werkwoorden weg. Zoals verwacht verschillen verhalen van deze kinderen niet van die van horende leeftijdsgenoten wat betreft lexicale tijdsmarkering. De andere groepen doven maakten minder tot geen verwoegingsfouten en gebruikten, net als horenden, met name de verleden tijd of gebruikten tegenwoordige en verleden tijd even vaak in hun verhalen. Deze resultaten suggereren dat dove kinderen die vaardig zijn in gebarentaal hetzelfde ontwikkelingspatroon volgen als (horende) tweedetaalleerders en aanvankelijk alleen lexicale elementen gebruiken om te verwijzen naar het verleden en pas in een later stadium van tweedtalaanwijzing werkwoordsvervoeging beginnen toe te passen.

In Hoofdstuk 4 is de uitdrukking van evaluatie in geschreven verhalen van dove en horende kinderen onderzocht. Evaluatieve aspecten in een verhaal worden onderscheiden van referentiële aspecten. Referentiële aspecten hebben betrekking op feitelijke informatie over de verhaalpersonages en over de gebeurtenissen die op een bepaalde locatie in een bepaalde volgorde hebben plaatsgevonden. Evaluatie verrijkt deze referentiële aspecten in een verhaal en geeft de referentiële aspecten kleur en betekenis. Het geeft informatie over de emoties, gedachten en motieven van de verhaalpersonages. Ook verwijst evaluatie naar opvattingen en interpretaties van de schrijver over de personages en gebeurtenissen in het verhaal. De evaluatieve functie in een verhaal kan worden uitgedrukt door middel van verschillende soorten evaluatieve uitingen. Hoewel evaluatieve en emotionele expressie een belangrijk retorisch aspect is in zowel gesproken/geschreven taal en gebarentaal, kent
gebarentaal meer manieren om evaluatie en emotie uit te drukken. Gebarentaal gebruikt naast lexicaal elementen ook veranderingen in blikrichting en lichaamshouding, aanpassingen van snelheid en beweging van gebaren en gezichtsuitdrukking. Verhalen van 11-12-jarige dove kinderen die vaardig zijn in NGT zijn vergeleken met verhalen van dove leeftijdsgenoten die niet-vaardig zijn in NGT. Gezien het belang van evaluatie in gebaarde verhalen en de vele manieren waarop evaluatie wordt uitgedrukt in gebarentaal, was de verwachting dat dove kinderen die vaardig zijn in NGT kennis van rhetorische vaardigheden zoals evaluatieve expressie gebruiken om verhalen te verrijken in geschreven Nederlands, en meer dan kinderen die niet bekend zijn met NGT en voornamelijk Nederlands gebruiken voor communicatie. Daarnaast zijn verhalen van dove kinderen ook vergeleken met verhalen van horende kinderen met een eentalige achtergrond en horende kinderen met een tweetalige achtergrond (Turks-Nederlands tweetalige kinderen). Hoewel het Turks en het Nederlands taalkundig en rhetorisch van elkaar verschillen drukken beide talen evaluatie voornamelijk lexicaal uit (in tegenstelling tot NGT die hier meerdere kanalen voor gebruikt). Door dove tweetalige kinderen te vergelijken met horende tweetalige kinderen, krijgen we meer inzicht in de vraag of het gebruik van evaluatie door dove kinderen die vaardig zijn in NGT verklaard kan worden door vaardigheid in gebarentaal in het bijzonder, of meer door algemene factoren die te maken hebben met tweetaligheid. De resultaten lieten zien dat dove kinderen in het algemeen goed in staat zijn om hun verhalen te verrijken met evaluatieve uitingen. Zoals verwacht gebruikten dove kinderen die vaardig zijn in gebarentaal meer evaluatieve uitdrukkingen in hun geschreven verhalen dan dove kinderen die niet vaardig zijn in gebarentaal en horende eentalige en tweetalige kinderen. Dit suggereert dat dove kinderen die vaardig zijn in gebarentaal hun kennis van evaluatieve expressie in gebarentaal gebruiken om hun verhalen in geschreven Nederlands te verrijken. Ook suggereerden deze resultaten dat het gebruik van evaluatie door dove kinderen die vaardig zijn NGT niet enkel toe te schrijven is aan tweetaligheid, maar dat het een uniek patroon is in dove kinderen die een gebarentaal en een geschreven taal gebruiken.

In aanvulling op taalkundige analyses van geschreven verhalen en opstellen zijn twee experimenten uitgevoerd waarin de productie van specifieke grammaticale structuren is onderzocht. De combinatie van taalkundige analyse van teksten en experimenten waarin specifieke hypothesen worden getest, is nieuw in de literatuur over taalvaardigheid van dove kinderen. Een eerste experiment was gericht op de productie van structuren die een zelfstandig naamwoord en een bijvoeglijk naamwoord bevatten, zoals de structuur de \textit{blauwe bal} (Hoofdstuk 5). In dit experiment werd de geschreven productie van drie typenstructuren met een zelfstandig naamwoord en een bijvoeglijk naamwoord door dove kinderen van 11-12-jaar die vaardig zijn in gebarentaal, horende kinderen met dezelfde leeftijd en horende kinderen van 7-8 jaar oud onderzocht. Dit werd onderzocht door middel van de methode van structuurpriming. Structuurpriming in jonge kinderen kan inzicht bieden in hoe kinderen de structurele eigenschappen van hun taal verwerven en of kinderen dezelfde of verschillende representaties van grammaticale structuren bezitten als volwassenen. Het Nederlands heeft prenominale structuren, waarin het bijvoeglijk naamwoord voor het zelfstandig naamwoord wordt geplaatst (namelijk, \textit{de blauwe bal}), en post-nominale structuren waarin het bijvoeglijk naamwoord achter het zelfstandig naamwoord wordt geplaatst (namelijk, \textit{de bal die blauw is} en \textit{de bal is blauw}). In Nederlandse Gebarentaal wordt het bijvoeglijk naamwoord achter het zelfstandig naamwoord geplaatst. Alle kinderen lazen telkens een van de drie typen structuren en beschreven vervolgens een plaatje van een object in een bepaalde kleur. De verwachting was dat als kinderen gevoelig zijn voor structuurpriming zij de neiging zullen hebben dezelfde structuur
te gebruiken als de structuur die ze van te voren gelezen hadden. Daarnaast is onderzocht of zo'n effect versterkt wordt wanneer het plaatje en de voorafgaande zin hetzelfde woord bevatten. Wat bleek is dat dove kinderen bij het beschrijven van een plaatje, net als horende leeftijdgenoten en jongere kinderen, vaker dezelfde structuur gebruikten als de structuur die ze van te voren gelezen hadden, dan één van de andere structuren. Dit was het geval in zowel de conditie waarin de zin en het plaatje hetzelfde woord bevatten als in de conditie waarin de zin en het plaatje niet hetzelfde woord bevatten. Dit laat zien dat het van te voren aanbieden van structuren het gebruik van grammaticale structuren kan beïnvloeden bij zowel horende als dove kinderen. Ook suggereren de resultaten dat dove en horende kinderen abstracte representaties van syntactische structuren bezitten, en dat de moeilijkheid die dove kinderen ervaren met complexe structuren niet te wijten is aan een gebrek aan abstracte kennis van zulke structuren. Echter, hoewel de effecten van priming globaal hetzelfde waren bij dove kinderen en horende kinderen, was er wel een verschil tussen dove en horende kinderen in de frequentie van het gebruik van de verschillende structuren. Horende kinderen hadden namelijk een voorkeur voor het gebruik van prenominale structuren (zoals *de blauwe bal*), terwijl dove kinderen de voorkeur hadden voor post-nominale structuren (zoals *De bal die blauw is*, en *De bal is blauw*), structuren die het meest gebruikt worden in gebarentaal. Dit impliceert dat de voorkeur voor het gebruik van grammaticale structuren door dove kinderen beïnvloed wordt door kennis van gebarentaal.

De studie die gerapporteerd is in Hoofdstuk 6 was gericht op werkwoordvervoeging. Het Nederlands en de NGT verschillen wat betreft werkwoordvervoeging. In het Nederlands gelden de regels van werkwoordvervoeging voor alle werkwoorden. Finiete werkwoorden worden vervoegd voor persoon- en getalseigenschappen van het onderwerp. De NGT, daarentegen, onderscheidt werkwoorden die vervoegd worden van werkwoorden die niet vervoegd worden. Bovendien gebruiken gesproken talen suffixen voor vervoeging (zoals de toevoeging van een *t* aan de stam van het werkwoord voor tweede en derde persoon enkelvoud in "hij loop*", terwijl vervoeging in gebarentaal veranderingen van de beweging van het werkwoordgebaar, van de oriëntatie van de handplam en vingers, en/of van de plaats waar het gebaar wordt gemaakt, inhoudt.

In het experiment hebben dove kinderen van 11-12 jaar en horende kinderen van 11-12-jaar en van 7-8-jaar twee typen werkwoorden vervoegd: werkwoorden die in NGT vervoegd zouden worden en werkwoorden die in NGT niet vervoegd zouden worden. Het aantal fouten en de soort fouten die dove en horende kinderen maakten zijn onderzocht. Er werd verwacht dat de vervoegingsfouten van dove kinderen onderdeel zijn van het proces van het leren van twee verschillenden talen en dat kinderen een ontwikkelingsstadium doorlopen waarin zij leren om te gaan met twee verschillende taalsystemen. Gegevens de verschillende systemen van werkwoordvervoeging was de verwachting dat dove kinderen de neiging hebben om werkwoorden niet te vervoegen. De resultaten lieten zien dat dove kinderen vervoegingen inderdaad weglieten en onvervoegde vormen gebruikten. Horende kinderen vervoegden vrijwel alle werkwoorden maar maakten fouten in de vervoeging door bijvoorbeeld een *d* te gebruiken in plaats van een *t* bij een werkwoord in derde persoon enkelvoud. Er is ook onderzocht of moeilijkheden die dove kinderen ervaren met werkwoordvervoeging verschillen voor werkwoorden die in NGT wel vervoegd worden en werkwoorden die in NGT niet vervoegd worden. Dit bleek niet het geval; dove kinderen lieten vaak na werkwoorden te vervoegen en deden dit bij beide typen werkwoorden.

In dit experiment werd een taalkundige analyse van fouten gecombineerd met een cognitief georiënteerde analyse van het schrijfproces (Hoofdstuk 6). Meer specifiek, zelf-
monitoring tijdens het vervoegen van werkwoorden werd onderzocht door de pauzedaar voor en na, en schrijftijd van foutvervoegde werkwoorden te vergelijken met de pauzedaar voor en na, en schrijftijd van goedvervoegde werkwoorden. Zo'n gecombineerde studie van taalkundige fouten en schrijfprocessen biedt een nieuwe manier om inzicht te krijgen in temporele aspecten van cognitieve processen tijdens schrijven. Kinderen moeten leren om hun schrijven, in dit geval het vervoegen van werkwoorden, te reguleren en te monitoren. Monitoren verwijst naar het reflecteren op de uiting met als het doel het veranderen of verbeteren van de uiting. Dit kan vóór het schrijven plaatsvinden of erna. Om dit goed te kunnen doen, moeten kinderen aandacht besteden aan de vorm van de uiting en gevoel ontwikkelen over de juistheid van de vorm. Deze vaardigheden zijn gerelateerd aan metacognitie. In deze studie zijn de pauzetijd voor en na, en schrijftijd van foutvervoegde werkwoorden vergeleken met de pauzedaar voor en na, en schrijftijd van goedvervoegde werkwoorden. Als dove en horende kinderen de vervoeging van werkwoorden kunnen monitoren, dan is de verwachting dat pauzetijd voor en na en schrijfnelheden van foutvervoegde werkwoorden langer zijn dan pauzetijd voor en na en schrijfnelheden van goedvervoegde werkwoorden. Als dove kinderen moeite hebben met monitoren, dan is de verwachting dat deze temporele eigenschappen niet verschillend zijn voor fout- en goedvervoegde werkwoorden. De resultaten van deze studie laten zien dat dove kinderen (die vaardig zijn in NGT), in tegenstelling tot horende leeftijdsgenoten en jongeren, dooere kinderen niet langer pauzeerden voor en foutvervoegde werkwoorden dan voor en na goedvervoegde werkwoorden. Dit suggereert dat dove kinderen nog geen vaardigheden hebben ontwikkeld om hun vervoeging van werkwoorden te monitoren.

In Hoofdstuk 7 tenslotte, werd besproken wat de resultaten van de empirische studies betekenen voor het begrijpen van de ontwikkeling van het schrijven van dove kinderen. De studies die gerapporteerd zijn in dit proefschrift laten zien dat de gevolgen van doofheid voor schrijfvaardigheid verschillend zijn voor verschillende taalkundige domeinen. Enerzijds zijn veel dove kinderen, net als horende leeftijdsgenoten, in staat een verhaal te schrijven met evaluatieve expressie. Anderzijds bevatten verhalen en opstellen van dove kinderen vaak grammaticale fouten die in teksten van horende kinderen vrijwel niet voorkomen. De studie naar syntactische priming in Hoofdstuk 5 suggereert verder dat de moeilijkheden die dove kinderen ervaren met complexe grammatica niet te wijten zijn aan minder abstracte kennis van syntactische structuren. Hoofdstuk 6 bood meer inzicht in de temporele processen tijdens het schrijven en hoe het schrijven van dove kinderen tot stand komt. Het liet zien dat dove kinderen hun pauzedaar en productiesnelheid niet aanpassen als zij een moeilijk werkwoord moeten vervoegen. Dit resultaat impliceert dat dove kinderen hun werkwoordvervoeging niet monitoren en zich niet bewust zijn van de moeilijkheid van werkwoordvervoeging.

Verder tonen de studies die gerapporteerd zijn in dit proefschrift aan dat de belangrijk is om rekening te houden met verschillen in vaardigheid in gebarentaal bij het onderzoeken van taalvaardigheid van kinderen die doof zijn. Er zijn verschillen gevonden tussen het schrijven van dove kinderen en volwassenen die vaardig zijn in gebarentaal en dove kinderen en volwassenen die niet vaardig zijn in gebarentaal, namelijk met betrekking tot lidwoorden, tijdsmarkering en evaluatieve expressie in verhalen. Deze bevindingen, in aanvulling op eerdere studies naar tweetaligheid, suggereren dat mechanismen zoals overdracht en interactie tussen talen die vaak gevonden zijn bij tweetaligen die twee gesproken talen gebruiken, ook van toepassing zijn bij bimodaal tweetaligen die een gesproken taal en gebarentaal gebruiken.
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