Spoken and written narratives in Swedish children and adolescents with hearing impairment

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ABSTRACT

Twenty 10-18 year-old children and adolescents with varying degrees of hearing impairment (HI) and hearing aids (HA), ranging from mild-moderate to severe, produced picture-elicited narratives in a spoken and written version. Their performance was compared to that of sixty-three normally hearing (NH) peers within the same age-span. The participants with HI and NH showed similar patterns regarding intra group correlations between corresponding measures of spoken and written narratives. However, the participants with HI had significantly less diverse language than the NH group. The participants with poorer hearing (higher best ear hearing level, BEHL) produced spoken and written narratives comprising more content words and they also produced written narratives that were less lexically diverse than the participants with better hearing (lower best ear hearing level, BEHL). The difference as to lexical skills emphasizes the importance of focusing on these skills in the group of children with HI. However, the results give support for a quite optimistic view on the development of narration for in children with HI with HA, at least for picture-elicited narratives.

INTRODUCTION

In this study, we wanted to explore the ability to produce picture-elicited narratives in a group of children/adolescents with hearing impairment (HI) and hearing aids (HA) and to compare their performance with that in normally hearing peers (NH). It is now well-known that many children with HI like children with language impairment (LI) have difficulties with complex language activities like narration. (Reuterskiöld Wagner, Ibertsson, and Sahlén, 2010; Yoshinaga-Itano and Downey, 1996).Very few studies have explored how written and spoken narration is associated in children/adolescents with HI or NH. The novelty of the present study lies in the comparison between spoken and written narration and in the inclusion of measures of the written product as well as the writing process.

Around fifty percent of children with mild/moderate sensorineural HI have been reported not to develop language typically (Gilbertsson and Kamhi, 1995; Sahlén and Hansson, 2006). The language problems are, however, usually not as pervasive and persistent as in children with LI (Briscoe and Bishop, 2001). In studies comparing children with LI and children with autism it has been found that it is the cognitive/linguistic status of the child that more reliably predicts the development of complex language skills like narration than the clinical category (Norbury and Bishop, 2003; Miniscalco, 2007). This is probably also the case in children with HI. To produce a narrative is a capacity-demanding task, requiring a range of linguistic, cognitive and social skills. The ability develops through childhood and adolescence and is very important for educational performance and academic success. Spoken narration in children with mild/moderate HI has been studied (Reuterskiöld Wagner et al. 2010; Greenfield 2002) but to our knowledge no studies have so far been published about the relationship between spoken and written narration in the participants. Although written narration is related to spoken narration, the special demands are different and we thus believe that the exploration of written narration in this group would be of interest. Associations between measures of different aspects of spoken and written language in younger and older participants can shed light on the developmental differentiation between spoken and written language.

Children are exposed to narratives from early age, and learn, with increasing linguistic, cognitive and social skills, to produce their own stories. At first, the structure may be simple and contain only a beginning and an ending, but with age the narratives become more complex.

The narrative *product* is typically analyzed at *macro* and *micro* levels. In the present study, analyses of both these levels are made in spoken as well as in written narratives. At a *macro* level, an analysis of story grammar elements is made in order to capture the overall organization and planning of the narrative. In our culture, a narrative typically includes a sequence of elements or components (setting, initiating event, reaction, attempt, consequence and resolution), usually referred to as story grammar units (Stein and Glenn, 1979). The narrator must be able to simultaneously keep the overall organization of the story in mind and, at the same time, formulate the sentences and find the right words (Hedberg and Westby, 1993). The organization of a narrative means special demands on working memory capacity. Working memory capacity refers to a system that makes it possible to simultaneously store and process information and adapt to the listener's and reader's needs. Organizational demands are different in different tasks and picture-elicited narrative tasks may put less strain on working memory capacity than personal narratives, where there is no picture support or in expositories.

At the *micro* level different methods of analysis are used. Lexical skills are considered to be at the core of narration (Norbury and Bishop, 2003). Therefore we wanted to explore this further and study how lexical diversity and density interact with the organization of a story. Lexical diversity is considered to be a measure of the lexical variation, although it cannot be looked upon as a single ideal assessment of vocabulary richness (Malvern, Richards, Chipere and Durán, 2004). Lexical diversity has been studied in picture-elicited narratives produced by 9 to17 year-old normally hearing children and adolescents speaking different languages. Differences for age, language and genre but not for modality (spoken or written) were reported by Berman and Verhoeven (2002), whereas Strömquist, Johansson, Kriz, Ragnarsdóttir, Aisenman and Ravid (2002), found a main effect for age as well as for modality in their cross-linguistic comparison. Yu (2009) investigated the relationship between lexical diversity and holistic quality measures in narrative samples (spoken and written) included in an international language test. The author found that there were significant correlations between the diversity measure and the ratings given. The diversity measure was a better predictor for spoken than for written performance. Further, the measures for spoken and written performance did not only correlate significantly, they were more or less at the same level. In a recent study by McNamara, Crossley and McCarthy (2010), the authors found lexical diversity, as measured by the frequency of rare lexical items, to be one of the three most predictive indices of text quality in an investigation of texts produced by undergraduate students.

L*exical density* is measured as the proportion of content words in texts and is often found to be higher in written texts than in spoken texts. The package of information as measured by the proportion of, for example nouns, verbs, adjectives and adverbs in written texts is thus more concentrated than in spoken texts according to Read (2000). Johansson (2009) explored the developmental aspects of lexical diversity and density among normally hearing participants from 10 years of age and up to university students in spoken and written narrative and expository text production. The author found a stable proportion of content words over the years which was not

dependent on genre but with a great modality difference (higher proportion of content words in written texts). Further, the two lexical measures (density and diversity) correlated significantly in written narratives for 17-year-olds and for university students but not for 10-year-olds and 13-year-olds. Johansson concluded that lexically, the older groups managed to produce texts which were both varied and dense, while the texts produced by the younger groups were more dense than varied. High density in narration could be associated with a more telegraphic style, used by younger children, and could thus be considered to reflect less sophisticated language in certain ages. Asker-Árnason, Ibertsson, Wass, Wengelin and Sahlén (2010) found density to be significantly higher in children with severe and profound HI (SPHI) with cochlear implants (CI) than in controls, and further, that in this group of 11-19 year-old children and adolescents, a high proportion of content words was associated with less developed narrative ability, a smaller proportion of complex clauses and with more spelling errors. These somewhat conflicting results raises the question whether children and adolescents with HI and HA perform more like typically developing and normally hearing age peers than the participants with SPHI and CI in our earlier study with respect to their proportion of content words.

The writing *process* has attracted many researchers during the last decades (Hayes and Flower, 1980; Kellogg, 1988; Dansac and Alamargot 1999; Olive and Kellogg, 2002; Behrns, Ahlsén and Wengelin, 2008). Studying writing from a dynamic point of view might offer a 'window to cognition' in writing. With new tools like key-stroke logging programs it is possible to measure not only the written product but also temporal aspects of writing, for instance pause time. Pauses in writing are mainly thought to be used for planning and revision of the text, but could also reflect uncertainty with spelling. Wengelin (2002) found different pause patterns for a group of adult participants with reading- and writing difficulties, with more frequent pausing and more pauses within words compared to a control group. In an earlier study on the writing process in children and adolescents with SPHI with CI, Asker-Árnason et al. (2010) found that the older participants with CI used significantly more pause time than the normally hearing participants. The authors concluded that this might be due to an increased awareness of the limitations of writing proficiency in this age group (14-19 years) since pause times were not longer in the younger children with CI (11-13 years) as compared to controls. Based on these findings, we would, in the present study, expect the children and adolescents with HI and HA to have a larger proportion of pause time than normally hearing peers.

Written narration is associated to oral narration, but the processing conditions are different. The demands are higher with respect to that the possibility to make adjustments on-line does not exist. The writer and the reader are in different places and usually at different times, but on the other hand, the writer of a narrative has more time to formulate the story. Although new techniques and new media have opened up for "hybrids" between spoken and written communication, like on-line computer conversation, the difference between spoken and written modalities in the traditional setting is, that the speaker has eye-to eye contact with the

listener/audience/conversational partner and that the spoken message is created in interaction. The writer, in the typical situation, does not share the context with the reader of his text. This makes it important for the writer to be more precise and include more specific information. On the other hand, she/he has less time pressure and also the possibility to revise the message in a reviewing process, in which she/he can give it the clarity and relevance needed for the reader to understand it.

This study is focussed on children with HI. A factor of importance is the child's degree of hearing loss (Yoshinaga-Itano and Downey 1996). The author investigated different aspects of narration in children with HI with different hearing deficits (mild to profound) and normally hearing peers and found a main effect for hearing loss, but also an interaction effect for age by hearing loss, which indicated a more pronounced improvement for the children with better hearing levels among the children with HI.

Purpose

The overall aim of this study was

- to explore narrative organization, text volume, lexical ability and pause time in picture-elicited narration in younger and older children with HI with hearing aids (HA) and to compare their performance with that of younger and older normally hearing children (NH) and also to explore the impact of modality (spoken and written), age and group and possible interaction effects.

Specifically, we also wanted to

- compare the relations between narrative organization, text volume and lexical abilities of spoken and written narration.
- investigate the relationship between the narrative organization and the measures of text volume, lexical abilities and pause time.
- find out if the hearing level in the participants with HI was associated to any of the investigated measures, since difficulties demonstrated by children with HI are not always proportional to the degree of hearing loss (Yoshinaga Itano and Downey,1996; Hansson, et al. 2004).

Based on earlier findings reported in the introduction we expected a range of interaction effects for modality, age and group on the above mentioned investigated measures.

METHOD

Participants

The inclusion criteria for participation in this study were bilateral, sensorineural and symmetrical HI and chronological age between 10 and 18 years of age, Swedish as main language, and an IQ within normal limits. All children lived in the south of Sweden. Ten children with HI were recruited from the ENT department, Section of Audiology, at Lund university hospital by audiologists. All of them were mainstreamed. Ten children were recruited by a special teacher in a special school for children with HI. Totally 20 children and adolescents participated, 9 boys and 11 girls. Their age span ranged from 10;0 and 17;4 (Mean = 13;7, SD=2;0), and their BEHL (Best Ear Hearing Level) ranged from 24 – 76 dB (Mean = 48.4 SD=15.3). It should be pointed out, that although the HI of the participants was defined as symmetrical, there is always some difference (up to 10 dB) between the hearing levels for the two ears. All children had been and were, at the time of testing, educated in oral settings.

The reference data from the children with NH were retrieved from two master theses, (both supervised by the first and the sixth author, and with the same methodological design as in the current study), Walldén and Åkerlund (2008), and Gustafsson and Skog (2007). These participants were all monolingual speakers of Swedish with no history of language problems, according to parents and teachers. In all, the number of children with NH was 63, 17 boys and 46 girls ranging in age from 11;2 to 17;2 with a mean age of 14;2**.**

For the group of children with HI, a median split was made, which resulted in younger participants (HIy) (n=10) < 13;2 (range 10;0-13;1) and older participants, (HIo) (n=10) >13;2 (range13;8-17;4) . In the group of NH, 27 participants were < 13;2 (range 11;2-13;1), referred to as NHy, and 36 were > 13;2 (range 14;4- 17;2), referred to as NHo. The reason for making a split was the wide range in age and the intention to explore the impact of age on presumed group differences in the results.

The distribution between younger and older participants of children with HI and NH is presented in table 1.

Table 1. Age, (years; months) for all participating children with HI and NH.

	Participants with HI		Participants with NH	
	M	SD	M	SD
Younger (HIy, NHy)	12;0	0;11	12;2	0;7
Older (HIo, NHo)	15;2	1;3	15;8	1;0
Whole group (HI, NH)	13;7	2;0	14;2	2;0

Procedure

Ten children were assessed by the first author at the department of logopedics, phoniatrics and audiology at Lund university hospital and the other ten were assessed by the third and fourth author at a school for children with HI.

The children were instructed to tell a story orally and subsequently write it on a computer. This order was used for all children, since the influence of written text is believed to be greater on oral presentations than vice versa (Nordquist 1998). The story was based on a selection of six pictures from the frog story "One frog too many" (Mayer & Mayer 1975). In the oral condition, the participant was first presented to the pictures one by one, and he/she was allowed to look at them in silence. After that, the participant was shown the pictures for a second time and was this time told to tell the story orally to a fictive person who could not see the pictures.

The written narratives were collected by means of the key-stroke logging program ScriptLog (Strömquist & Karlsson 2002b). A key-stroke logging program is a computer tool, which enables the study of the actual writing process as well as the final written product. The program saves a record of all events that take place on the computer screen, like inactivity and editing, and the whole writing process can be replayed. The statistics can be retrieved in different ways according to the aims of the study. The same pictures as in the spoken condition appeared on the computer screen, one at a time. The participants were told that there was no need for the story to be exactly the same as in the spoken version. The participant could look at the picture and then click a button to make the next one appear. The whole written story was visible to the participant during the writing.

Measurement parameters

For the *story grammar* analysis, the following scoring system (slightly modified from Stein and Glenn 1979) was used. Three points could be obtained for the *Setting* of the story, one point for a *Complicating action*, three points for *Reactions*, manifested in actions or emotions, one point for *Strategies*, one point for *Actions* in solving the problem, one point for *Consequence*, three points for resolution, two points for *Sense moral/ending*, manifested in feelings, thoughts or action by the characters. The maximum score was thus 15 points. An example of the assessment for a written narrative is given in table 2.

Table 2. Example of analysis and scoring of a narrative.

C-unit	Label	Scores
Det var en gång en pojke som bestämde sig för att ta med sig sina vänner på en åktur på floden, *Once upon a time there was a boy who decided to take his friend for a ride on the river*	*Setting+ setting*	1+1
hans vänner var hunden, sköldpaddan och de två grodorna. *His friends were the dog, the turtle and the two frogs*	*Setting*	1
De två grodorna kom sällan överräns, *The two frogs did seldom get on very well,*	*Setting*	
den stora ville ha pokjen före sig själv och ville inte dras med sin lilla kusin, den lilla grodan. *The big one wanted the boy for himself and didn't want his little cousin, the small frog, around.*	*Setting*	
På floden skulkle det vara enkelt att bli av med "lillen", *It would be easy to get rid of "the small one" on the river*	*Strategi*	1
sakt och gjort den stora grodan sparkade av den lilla grodan när han trodde ingen såg. *Said and done, the big frog kicked away the small frog when he thought no one was watching*	*Complicating action,*	1
Han visste inte att sköldpaddan just vänt sig om och med förfäran såg den lilla grodan fara genom luften och hamna i vattnet. *He didn't know that the turtle just turned around, and in anguish he saw the small frog fly in the air and fall into the water.*	*Reaction*	1
Sköldpaddan rykte kaptenen i byxorna och pekade på den stora grodan och berättade vad som just hade hänt *The turtle pulled the captain's trousers and pointed to the big frog and told him what just had happened*	*Reaction*	1
den stora grodan bara flinade, säker på att han hade elemenerat sin konkurent utan att bli misstämkt för det. *The big frog was laughing, positive that he had eliminated his rival without falling under any suspicion*	*Reaction*	1
-Man överbord: skrek pojken *-Man over board, screamed the boy*	*Action*	1
Hunden ylade i hopp om att grodan skulle höra det och svara honom. *The dog was howling, in hope that the frog should hear him and answer*	*Reaction*	
Sköldpaddan stirade ilsket på den stora grodan och sa kallt, -hur kunde du, din egen kusin. *The turtle stared angrily at the big frog and said in a cold voice,- how could you, your own cousin.*	*Reaction*	
De hoppade av flotten och började leta och hela tiden ropade de efter honom, - lilla grodan, lilla grodan är du här. *They jumped off the raft and started to search, constantly calling for him, -little frog, little frog, are you around.*	*Action*	
Den stora grodan hjälpte till att leta, men han plågades av skuldskänslor *The big frog helped with the search, but he was tormented by guilt*	*Action + resolution*	1
-tänk jag kanske aldrig får se min kusin igen, tänkte han. *-imagine I might never see my cousin again, he thought.*	*Resolution*	1
Sköldpaddan tittade in i en ihållig stock ihop om att lilla grodan kanske krupit in där men han hittade inget, *The turtle looked into a hollow log in hope that the little frog might have crawled into it but he found nothing,*	*Resolution + consequence*	1+1
pojken letade mellan näckrosorna men hittade inget han heller. *the boy searched between the water lilies but he didn't find anything either*	*Action + consequence*	
Hunden sprang omkring bland vassen ihop om att få upp en vittring av lilla grodan där men hur han än letade hittade han ingenting. *The dog was running among the reeds in hope to pick up the scent from the little frog but no matter how hard he was searching he found nothing.*	*Action + consequence*	
Gråtande gick pojken, sköldpaddan och hunden hem och lämnade den lessna stora grodan vid ån, *The boy, the turtle and the dog went home crying and left the sad frog by the river,*	*Resolution*	
mer än en gång vänd sig hunden om och tittade efter honom med en arg blick. *More than once the dog turned around looking for him with an angry gaze.*	*Resolution*	
Den stora grodan hoppade tillbaka i ån och fortsatte att leta efter sin lilla kusin, *The big frog jumped back into the river and continued to search for his little cousin,*	*Resolution*	
vem vet, han kanske hittar honom en dag. *who knows, maybe he will find him some day.*	*Sense moral/ ending*	1
TOTAL		14

The spoken narratives were audio- and videotaped and later transcribed in CHAT format (Mac Whinney 2000) for further analyses in the CLAN programs (Mac Whinney 2000). CLAN (Computerized Language ANalysis) is a program, specifically designed to analyze data transcribed in the format of the Child Language Data Exchange System. One of them is the CHAT format. The *number of words* were counted by the computer in the WORD program, both in spoken and written narratives. For the written narratives, the calculation was made for the final, edited text. For the spoken narratives, the transcriptions did leave out filled pauses and not finished words, but repetitions were counted.

Lexical density was measured by calculating the percent content words in the narratives, i.e. nouns, adjectives and verbs.

L*exical diversity* (VocD) was calculated by means of the CLAN. The program makes a random selection of words and makes a prediction of the diversity. This method is favourable to the commonly used type token ratio, since it is considered to be independent of the length of the text. A minimum of 50 words is needed to carry out the analysis.

The percent *pause time* was only measured for the written condition, since there is no technical method available for a reliable measurement of pause time (which also have to include retaking and vocal mazes) in spoken narration. The pause time was calculated as all periods of inactivity $\geq$ 2 seconds. A pause time criterion is not always easy to set, since it must be determined in relation to the computer writing skills of the participants, and exceed the normal transition time, e.g. the time between two key-strokes. The time that participants with less key-board skills use to find the right keys would otherwise be counted as pause time. Ideally, one would have to stipulate an individual criterion for every participant. A common way of solving the problem is to use a pause criterion that is suitable for the aim of the study (Wengelin, 2002). In an earlier methodological study (Asker-Árnason, Wengelin, Sahlén 2008), the median transition time ranged between 0.23 and 1.11 seconds in a group of normally hearing 10-12-year old children. A pause criterion of 2 seconds was therefore judged to be sufficient for the group of investigated children/adolescents.

Reliability

The story grammar assessment and the lexical density calculation were carried out by the first author. The second author independently analysed 76/166 texts (46%) for story grammar and 72/166 (44%) for lexical density. A mixture from the two groups and the two modalities was used for the calculation. Rating reliability was assessed by means of intra-class correlations. The result for the story grammar assessments was r = .82 (p= .000) and for the lexical density assessment r = .87 (p= .000).

RESULTS

Descriptive data

In table 3, all descriptive data for all participants, the groups of HI and NH, are shown. The collapsed measures, marked in bold, are shown in order to clarify the values exposed in some of the figures.

Table 3. All descriptive data for all participants and for spoken (sp) and written (wr) narratives. Values in bold are represented in figures 2-12.

		Participants with HI						Participants with NH						Part. with HI + participants with NH					
Area	Modality	HIy		HIo		HI		NHy		NHo		NH		HIy+ NHy		HIo + NHo		HI + NH	
		(n=10)		(n=10)		(n=20)		(n=27)		(n=36)		(n=63)		(n=47)		(n=56)		(n=83)	
		M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Story	sp + wr	**10.3**	(1.9)	**11.5**	(2.2)	10.9	(2.1)	**11.2**	(1.8)	**11.5**	(1.6)	11.4	(1.7)	10.8	(1.9)	11.4	(1.9)	11.2	(1.9)
grammar	sp	10.5	(1.7)	10.9	(2.2)	**10.7**	(1.9)	11.1	(1.9)	11.1	(1.4)	**11.1**	(1.6)	**10.8**	(1.8)	**10.8**	(1.8)	10.8	(1.8)
(max. 15)	wr	10.1	(2.2)	12.1	(2.1)	**11.1**	(2.3)	11.3	(1.8)	12.0	(1.7)	**11.7**	(1.8)	**10.7**	(2.0)	**12.1**	(1.9)	11.4	(2.1)
Number	sp + wr	**99.5**	(33.9)	**169.2**	(76.8)	134.3	(67.3)	**150.7**	(76.7)	**155.8**	(71.0)	152.4	(71.4)	148.1	(70.7)	156.7	(68.8)	148.1	(70.7)
of	sp	106.3	(32.1)	168.2	(76.0)	137.3	(65.1)	143.0	(66.3)	138.3	(44.6)	140.3	(54.5)	124.7	(49.2)	153.3	(60.3)	138.8	(59.8)
words	wr	92.6	(36.0)	170.2	(77.5)	131.4	(71.0)	158.3	(86.5)	169.2	(82.5)	164.5	(83.7)	125.5	(61.3)	169.7	(80.0)	148.0	(77.4)
Lexical	sp + wr	46.1	(8.6)	44.2	(4.3)	45.1	(6.7)	44.4	(5.6)	45.0	(5.0)	44.8	(5.1)	44.8	(5.9)	44.6	(5.3)	44.8	(5.9)
density (%)	sp	43.5	(8.8)	39.8	(3.7)	**41.6**	(6.8)	42.5	(5.7)	43.6	(5.2)	**43.1**	(5.4)	43.0	(7.3)	41.7	(4.5)	42.4	(6.1)
	wr	48.6	(8.3)	48.6	(4.9)	**48.6**	(6.7)	46.4	(4.8)	46.4	(4.7)	**46.4**	(4.7)	47.5	(6.6)	47.5	(4.8)	47.5	(5.7)
Lexical	sp + wr	**42.9**	(11.6)*	**51.1**	(10.4)	44.7	(11.0)*	**50.3**	(16.4)	**58.2**	(14.2)	55.1	(17.7)	46.6	(14.0)*	54.7	(12.3)	49.9	(14.4)*
diversity	sp	37.2	(9.7)	42.6	(7.9)	**39.9**	(8.8)	44.7	(13.9)	47.7	(12.3)	**46.4**	**(4.7)**	41.0	(11.8)	45.2	(10.1)	43.2	(6.8)
(VocD)	wr	49.3	(13.4)*	59.5	(12.9)	**54.4**	(13.2)*	56.0	(17.0)	69.5	(16.0)	**63.7**	(17.6)	51.9	(15.2)*	64.5	(14.5)	59.1	(15.4)*
Pause time (% out of total time)	wr	**41.0**	(17.3)	**25.6**	(12.5)	33.3	(16.7)	**42.2**	(11.6)	**21.9**	(10.0)	30.6	(14.7)	41.9	(13.1)	22.7	(10.6)	31.2	(15.1)

*For one of the participants in HIy, the number of words was not sufficient for the lexical diversity (VocD assessment in the CLAN program. The number of participants is thus one less than indicated above.

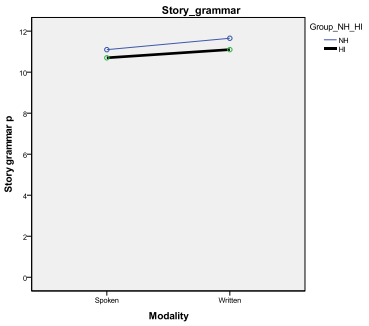
Comparison between modalities ages and groups

Two-way analyses of variance were conducted to explore the impact of modality, age and group and the possible interaction effects between these factors on story grammar, number of words, lexical density and lexical diversity, illustrated in fig 1-5. For the pause time variable (fig.6) only measured in the written modality, a one-way ANOVA was carried out.

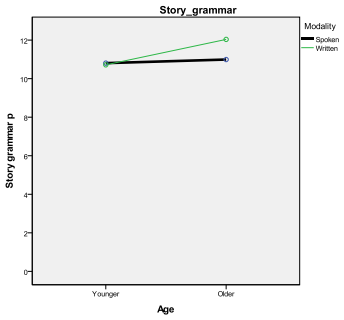
Story grammar

Main effects: There was a significant main effect for *modality* (F(1.79)=4.124, p=.046) (fig. 1), higher scores for the written modality. There was no significant main effect for *age*, or for *group.*

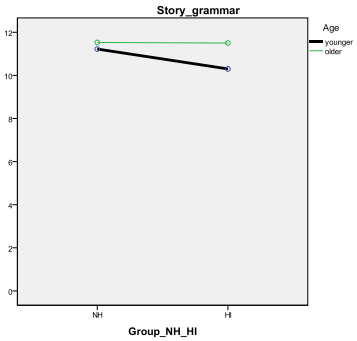
Interaction effects: There was a significant interaction effect for *modality and age*, (F(1.79)=5.801, p=.018) (fig.1). The difference between the younger participants and the older participants in the written modality is more evident than in the spoken modality. *Age and group*: The difference between younger and older participants seemed more evident in the group of HI than in the group of NH story grammar measure, although it did not reach statistical significance (fig.1).



Main effect for modality (p< .05).



Interaction effect for modality and age (p<. 05).



A tendency for a greater difference for the story grammar score between younger and older participants with HI than between the younger and older participants with NH.

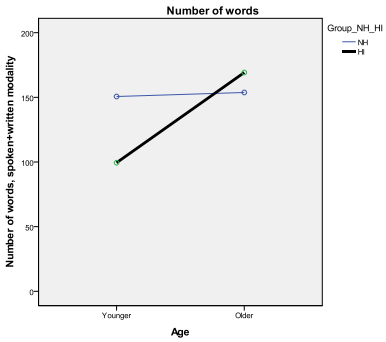
Fig. 1. Story grammar.

Number of words

Main effects: There was a significant main effect for age, (F(1.79) = 5.238, p= .025), older participants used more words, (fig. 2), but no main effect was found for modality and group.

Interaction effects: There was a significant interaction effect for *age and group*, F(1.79) = 4.384, p = .039), (fig. 2). In other words, as for the length of written as

well as for spoken narratives, the increase in length for older participants was more prominent in the group of HI than in the group of NH, where the increase was minimal.



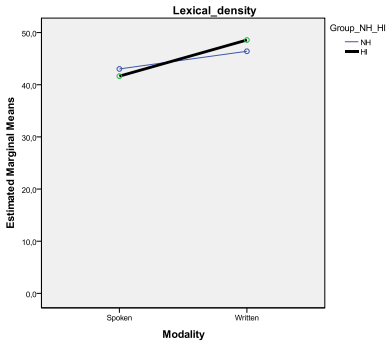
Main effect for age (p< .05) and interaction effect for age and group (p< .05).

Fig. 2. Number of words.

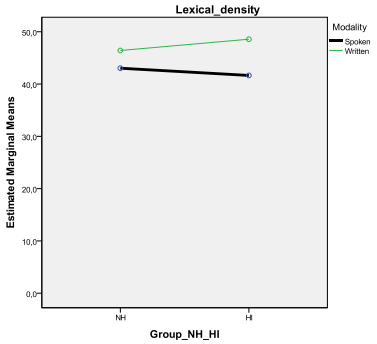
Lexical density

Main effects: There was a main effect for *modality*, (F(1.79) = 52.522, p= .000), (fig. 3), higher density for the written than for the spoken modality. There was no significant main effect for age and group.

Interaction effects: For *modality and group* (fig. 3), (F(1.79)= 6.190, p= .015). The score for the written condition was higher than for the spoken condition, but the difference between the two conditions was more obvious for the group of HI than for the group of NH.



Main effect for modality (p< .001).



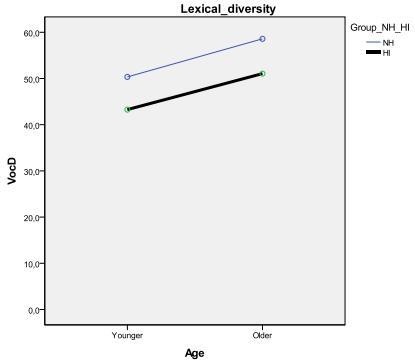
Interaction effect, modality and group (p < .05).

Fig. 3. Lexical density.

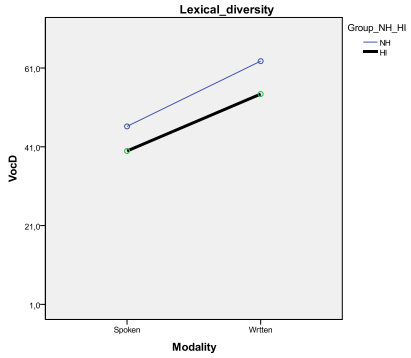
Lexical diversity

Main effects: There were significant main effects for *modality* (fig.4) (F(1.78)= 62.178, p= .000), higher for written modality, for *age* (fig.4) (F(1.78)=6.502. p= .013), higher for older participants, as well as for *group:* (F(1.78) = 6.502, p = 0.23), participants with NH had higher diversity. The individual results for the lexical diversity measure and the differences between groups are further exposed in fig. 5.

Interaction effects: There were no significant interaction effects for the lexical diversity measure.



Main effect for age (p< .05) and for group (p< .05).



Main effect for modality (p< . 001).

Fig. 4. Lexical diversity.

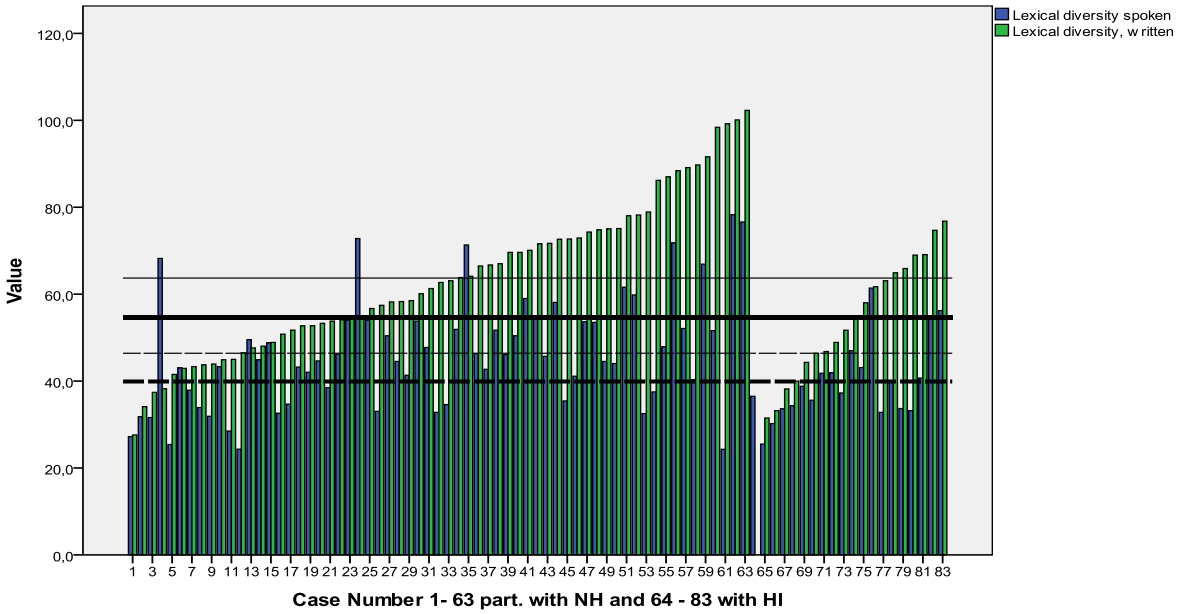
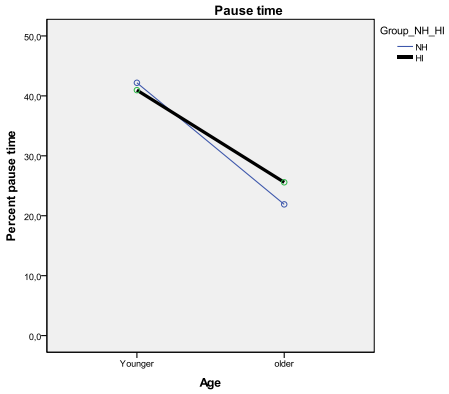


Fig.5. Individual results on lexical diversity, VocD-value for the spoken and written condition separately. (Result for the written condition for one case (no 64) is missing, due to insufficient number of words). Horizontal lines indicate mean results for the groups, in bold for the group of HI. Broken lines indicate means for the spoken condition and unbroken lines for the written condition.

Pause time

Main effects: There was a main effect for age (fig. 6) (F(1.79)= 34.161, p= .000), lower in the older participants. No significant main effects for group were found.

Interaction effects: There was no significant interaction effect for the pause time measure.



Main effect for age (p< .001).

Fig. 6. Pause time.

Summary of the fore mentioned results

Story grammar: Higher scores were obtained for written than for spoken narratives and older participants had higher scores than younger ones. Although not significant, the difference between younger and older participants was most salient in the group of HI.

Number of words: Older participants produced more words than younger, but the difference was most prominent in the group of HI.

Lexical density: The written narratives comprised of a higher proportion of content words than the spoken narratives, and this difference was larger for the group of HI. There was no significant difference as to lexical density between younger and older participants.

Lexical diversity: Higher diversity was found for written than for spoken narratives for both groups and generally higher diversity for older than for younger participants. Higher diversity was found for the group of NH than for the group of HI.

Pause time: The older participants (with HI and with NH) used a lower proportion of pause time than the younger participants (with HI and with NH).

Intra group correlations

Partial correlations, with age controlled for, were conducted for the two entire groups of HI and NH in order to explore relations between *spoken and written* narration (table 4). Partial correlations were also carried out to explore the relations between the narratives at *macro level* (story grammar scores) *and at the micro level*, (number of words, lexical measures and pause time) in corresponding modality (table 5). Further, correlations between the BEHL and the narrative measures were carried out (table 6).

Spoken and written narration, partial correlations for the groups of HI and NH
As can be seen in table 4, the correlations were significant between all the corresponding variables in the written and spoken modalities.

Also in the group of NH, correlations were significant between the corresponding variables in the written and spoken modality (table 4).

Table 4. Partial correlations (with age controlled for) between spoken and written narration.

	Group of HI	Group of NH
Story grammar, spoken – written	.732**	.397**
Number of words, spoken – written	.684**	.681**
Lexical density spoken – written	.522*	.464**
Lexical diversity spoken – written	.429*	390**

*p < .05. **p < .01

Story grammar, partial correlations for the groups of HI, and NH

In table 5, the results from the partial correlations for both groups, between the story grammar score in both modalities and the other variables in corresponding modality, are exposed.

Table 5. Correlations between story grammar score and other variables. Values for group of HI above and for group of NH below.

Story grammar	Spoken	Written
Number of words	.268	.684**
	.593**	.698**
Lexical density	.067	.040
	.406**	.098
Lexical diversity	.093	.081
	.192	.239*
Pause time	-	-.506*
	-	.054

*p < .05. **p < .01

To sum up, the groups of HI and NH showed similar patterns regarding intra group correlations between corresponding measures of spoken and written narratives. Similar patterns were also seen concerning productivity and structure, (the more words produced, the higher the story grammar score). However, the groups differed as to relations between the story grammar measure and other measures. The result for the group of HI was negatively correlated to the percent pause time (the less pause time the higher story grammar score). The story grammar measure was positively associated to lexical measures for the group of NH.

BEHL – partial correlations for the group of HI

Significant correlations were present between the BEHL and the lexical density (spoken as well as written condition) and lexical diversity (written condition), as can be seen in table 6. In sum, participants with higher BEHL (poorer hearing) had significantly higher percent content words in both conditions, and lower lexical diversity in the written condition than participants with lower BEHL (better hearing).

Table 6. Partial correlations, with age controlled for, between BEHL and narrative measures in the group of HI.

	Story gr. p./15		N. of words		Lex. dens. %		Lex. div. VocD		Pause time %
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Written
BEHL	-.161	-.183	.204	.205	.451*	.400*	.042	-.426*	.099

*p < .05.

DISCUSSION

In this study, we explored spoken and written narration in 20 children and adolescents with HI and HA and 63 children and adolescents with NH. As expected, when younger and older participants with HI and NH were compared, older participants generally scored better and, although not always significant, the difference between younger and older participants with HI and NH tended to be greater in the HI-group than in the NH-group. Further, higher scores were generally achieved in both groups on written than spoken narration, but performance in the two modalities was strongly associated in both groups of participants. The most striking difference between HI and NH was that the narratives produced by participant in the HI-group were less lexically diverse. Lower best ear hearing levels as measured by BEHL in the HI-group were associated with less lexical variation in narratives. A range of other interesting links between narrative variables at macro and micro levels were found.

Higher *story grammar* scores were generally obtained for the written version of the narratives than for the spoken (fig. 1). A possible explanation for this is that the participants already had told the story in a spoken version and were familiar with the pictures. They could thus put more effort in the planning of the story in the written version. A significant interaction effect was found for *modality and age* on the story grammar measure. For the younger participants, there was no or little difference between the scores on spoken and written narratives, but for the older participants, the difference was more obvious (fig.1). The explanation for this is probably that older children have encountered written texts to a higher degree than younger children. They have received professional feedback and rhetorical training at school on oral and written presentations and they have successively got more and more acquainted with principles used in different genres; narratives, expositories, argumentative presentations or texts. The gap thus seems to broaden between spoken and written language with age. There was also a trend towards a greater difference between younger and older participants in the group of HI in story grammar scores, (fig.1).

There was a significant interaction effect for group and age (fig.2) on the length measure, the *number of words*, where the younger and older participants produced approximately the same amount of words (with the two modalities added) in the NH group, whereas in the HI group, the older participants produced more words than the younger. We interpret our findings as due to different points of departures and different growth curves in children with HI and NH. The participants with HI started out as less skilled narrators than the children with NH regarding both organisation and length but their development might be more obvious over time at least in the age spans studied here.

The higher *lexical density* in the written narratives (fig. 3) was not a surprise. The spoken modality invites the use of pronouns because of the shared context between

speaker and listener and also to the use of social expressions, comprising more function words (Johansson 2009). The interaction effect for modality and group regarding the lexical density measure showed that the difference between the two modalities was larger for the group of HI than for the group of NH (fig. 3). Our results showed no interaction for age and group. The lexical density was exactly the same (mean value) for the younger and older participants with HI and younger and older participants with NH, respectively, for the written modality. These results corroborate earlier results from a study on children and adolescents with SPHI and CI (Asker-Árnason et al. 2010), where the same picture sequence as in the present study was administered to the participants, and the findings also corroborate the results from Johansson (2009). Our results indicate that the interaction between density and diversity in spoken narration might be different in children with HI. This will be further explored in future studies.

Higher lexical diversity was found in written narratives compared to spoken narratives, (fig. 4) which might be due to the fact that the participants had already processed the story in a spoken version and they were thus familiar with the pictures when they were asked to produce the written story. Additionally, there is always more time to create at written narrative than a spoken, with the possibility of revising the text. This might also have given them the possibility to elaborate the lexical content to become more lexically diverse. There are, to our knowledge no studies on lexical diversity in children with HI, with one exception. Geers, Spehar and Sedey (2002) studied 8 to 9 year-old children with CI and found higher lexical diversity (as measured by different words per minute in elicited language samples) among children using smaller proportion of signs in their expressive language than among children using a bigger proportion of signs. In this study, the difference regarding lexical diversity is striking between participants HI and NH (fig. 4 and fig. 5). Lexical diversity, the number of different words used in the text, is, of course, only one aspect of the text quality and not "the Holy Grale" (Malvern et al. 2004). Vocabulary has been reported to be weak in many children with HI, even in children with fairly mild hearing deficits (Davis 1986; Mayne, Yoshinaga-Itano and Sedey1998, Mayne,Yoshinaga-Itano, Sedey and Carey, 1998). A question of relevance is why children with HI become less lexically diverse. One explanation is offered by Gathercole (2006), who emphasizes the role of phonological skills in lexical development. Children with different degrees of HI, perform at a low level on phonological processing tasks (Hansson et al. 2004; Asker-Árnason et al. 2007). Due to low level auditory perceptual deficits, phonological representations in long term memory risk becoming more imprecise in children with HI than in children with NH. Distinct phonological representations are needed for phonological working memory, crucial for the short term recall of the sound patterns of novel verbal material. Novel word learning can thus become hampered in children with HI (Gathercole, 2006; Wass 2009). One must, however, remember that lexical variation and density in narratives do not necessarily tell anything about vocabulary skills in other contexts. There might be considerable trade-off effects between the demands on organization of a narrative and the demands of retrieval and mobilization of different words. If considerable mental resources are used for

planning and organizing the narrative there might be fewer resources left for lexical elaboration. Older participants with HI and NH used less pause time than younger (fig.6). In our earlier studies on picture-elicited written narration (Asker-Árnason et al. 2008; Asker-Árnason et al. 2010), the pause patterns for the groups of NH in both studies also showed a decrease in pause time with age. However, in children with severe to profound hearing impairment (SPHI) and CI, the amount of pause time did not differ between younger and older groups. Johansson (2009), in her study on 10-19 year old children with NH, found no difference as to the amount of pause time (counting all pauses < 5 sec., except the last one), neither for age, nor for genre.

As noted earlier, children with mild or moderate HI and HA have a quite different point of departure compared to children with SPHI and CI regarding a range of factors. They differ from an audiological point of view, but also from an educational, since children with mild/moderate HI are more often mainstreamed (in this study 50%). At least in Sweden, children with CI have received more attention from professionals than children with HA (and maybe also from parents) and more rehabilitative efforts according to Ibertsson, (2009). This may have made children with CI more aware of writing difficulties and more prone to take their time when writing than children with HI and HA. Several authors have pointed to what Ackerman (1981) called 'performative bias' in children with HI with HA. This means that these children often solve language tasks they experience as difficult in a too speeded and unreflected manner.

Older participants generally used more words, had higher lexical diversity and used less pause time than younger ones. It is also clear that older participants in both groups were able to produce narratives that differed between modalities, i.e. they did not write the way they spoke. We interpret this as an indication that not only participants with NH, but also participants with HI, develop narrative modality awareness considerably during their teens. We thus have a more optimistic view on language development in children with HI than some authors (Allen 1986; Gallaudet Research Institute, 2000) who states that 'the average young adult with HI demonstrate little semantic or syntactic language learning after age 12´.

Not unexpectedly, our results yield strong associations between oral and written narration, in both groups of children (table 4). Spoken narration and written narration are closely related. The little child learns, from early age, the elements of a narrative, and becomes able to create a similar story, based on the structure to which he has been exposed, first orally and later on in a written version. In this study, the same pictures were used to elicit the spoken and written narratives, and it was therefore not surprising that the association between the measures from the two stories should be considerable. However, as mentioned above, there were significant differences between spoken and written narratives as to three out of four possible variables (story grammar score, lexical density and lexical diversity). What the significant correlations show is, that there are intra individual correspondences.

The overall organisation of the narratives was measured by story grammar. One research question was whether the story grammar measure correlated significantly with other narrative measures (table 5). For both groups, the story grammar scores were associated with the length of the written narratives. In earlier studies on written narration, length was significantly correlated to the total narrative ability measurement, a measure of combined assessment of structure, conjunction use and introduction of referents, Crosson and Geers 2001) of the text both for hearing children (Asker-Árnason et al. 2006) and for children with CI (Asker-Árnason et al. 2010).

Length seems to be crucial for teacher's judgment of quality of a narrative text. Hovén and Jakobsson (2010) found that the quality assessment made by school teachers correlated significantly with the number of words produced for the written expositories. The question is if a minimum number of words are needed to create a better quality narrative, or if teachers just judge a narrative comprising more words than one with fewer words as a better story.

One of the main findings in a study on written narration in children and adolescents with severe and profound HI and CI (Asker-Árnason et al. 2010) was the large amount of pause time used by participants above 13 years compared to their hearing peers. In this study, there was no significant difference between the group of HI and NH concerning the percent pause time used. However, for the group of HI, we found a high story grammar score to be significantly and negatively correlated to pause time used in the written narratives, (the better the structure of the written narratives, the lower the amount of pause time). The reasons for using more or less pause time may be different in different ages. For younger and for less skilled writers, the reason for having a large amount of pause time may be uncertainty with different aspects of producing the text, and small amount of pause time could thus be associated with a good text flow. For more skilled writers, a larger amount of pause time could be a sign of putting more effort into producing a high quality text. In earlier studies (Asker-Árnason et al. 2008, Asker-Árnason et al. 2010), the measure for the overall structure also correlated significantly and negatively with the amount of pause time used for younger participants with NH and for participants with SPHI and CI, but not for older participants with NH, which strengthens this hypothesis.

The associations discussed above between use of pause time, story grammar and length must be interpreted in relation to the context. The links found here might be true for short, simple tasks like picture-elicited narration but not for other narratives or expository texts or more demanding writing tasks. These influences of different genres remain to be explored.

One unexpected finding was that the story grammar score was associated with the lexical measures in the group of NH and not in the group of participants with HI (table 5). In an earlier study on children with SPHI and CI (Asker-Árnason et al., 2010), lexical density was found to be correlated to lower narrative ability, fewer

complex clauses and more spelling errors for the group of CI, but not in the group of NH. In Hovén and Jakobsson (2010), lower lexical density was significantly correlated with longer narratives, and, longer narratives were also correlated with higher scores on an overall quality assessment. The lack of an association between lexical measures and story grammar in participants with HI in this study is therefore hard to explain but might be due to the small sample size.

We also wanted to find out about the relationship between hearing level and narrative measures (table 6). Lexical density in both modalities and lexical diversity for the written modality were in this study related to the BEHL. Hansson et al. (2004) found no significant differences between children with mild HI (30-50dB) and moderate HI (50-70 dB), aged 4-7, on any of a range of language and word learning tests. We should, however, remember that in the study by Hansson et al. (2004) narration was not assessed and the BEHL's in their participants were not completely comparable to the participants hearing levels in this study. The relation between better lexical skills and better hearing seems logical, since children with more accurate hearing have a better chance to learn more words.

Methodological considerations

Due to the heterogeneity in the investigated group of participants with HI with respect to age, auditory history and current hearing levels, the results must be interpreted with caution. The narrative task may be considered as fairly simple for this age group but we believe it was a good choice, since all children received the same input (pictures) and the feed back from the researcher could be reduced to a minimum.

A draw-back in the present study is that the comparison group of participants with NH consisted of a higher proportion of girls than the HI-group. Girls often develop faster linguistically. This might have been in favor of the NH group. There was, however, no statistically significant difference in performance between girls and boys in neither group.

There was a slight age difference between participants in the NH and HI groups (table 1). The difference between younger HI and younger NH was two months and between older HI and NH seven months. We consider these differences as negligible. For participants older than 13 years of age, we do not think an age difference of some months influences results (the participants were in the same school grades).

Conclusions

The investigated children and adolescents with HI in this study were heterogeneous as to their hearing levels and school settings. At a group level they resembled the normally hearing participants in many ways. However, a significant difference in lexical diversity, i.e. less varied vocabulary in spoken as well as in written narration was found. Another finding was the different patterns concerning lexical density in the two groups. This merits further investigation and preliminary results on the proportions of different types of content words in the spoken and written narratives in the above investigated groups reveal specific differences as to the relative proportion of adjectives in the written narratives, which seem to be lower in participants with HI than in participants with NH. Our results emphasize the importance of having focus on lexical ability in clinical and pedagogical settings for children with HI. A higher proportion of content words implicate a lower proportion of function words Therefore, in lexical assessments and intervention it is important not only to focus on content words but also on the function words.

Our results thus give support for a quite optimistic view on the development of narration in children with hearing impairment, at least for picture-elicited narratives. It remains to be seen if this holds for personal narratives, an issue that is currently being explored by the author.

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