Assessing Sign Language Acquisition: Development of a NGT sentence repetition task for DHH children of 6-10 years old.

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Abbreviations

ASL	-	American sign language
AUSLAN	-	Australian sign language
BSL	-	British sign language
DSGS	-	Swiss German sign language
HKSL	-	Hong Kong sign language
LIBRA / LSB	-	Brazilian sign language
LIS	-	Italian sign language
LSF	-	French sign language
NGT	-	Dutch sign language
NmG	-	Sign supported Dutch
SASL	-	South African sign language
BCD	-	Bone conducted hearing device
CI	-	Cochlear Implant
DHH	-	Deaf and hard of hearing
DLD	-	Developmental language disorder
HH	-	hard of hearing
L1	-	first language
L2	-	second language
L2M2	-	second language, different (second) modality
SL	-	sign language

SLI	-	specific language impairment
SRT	-	sentence repetition task
SL-SRT	-	sign language - sentence repetition task
CL	-	classifier
ns	-	name sign
OC	-	oral component
PU	-	PALM_UP = general question particle
___FE___	-	frowned eyebrows
___HM-F__	-	head movement-forward
___HN___	-	head nod
___HT-B__	-	head tilt-backwards
___NU___	-	nose up
____PC___	-	puffed cheeks
___RE___	-	raised eyebrows
___SE___	-	squinted eyes
___T__	-	topicalization

Abstract

Spoken language acquisition of deaf and hard of hearing (DHH) children in the Netherlands is monitored extensively by means of observation instruments and standardized language tests. A sentence repetition task (SRT) is a useful, rather easy, and quick test form for this purpose and used a lot in spoken language assessment. Monitoring of sign language acquisition in DHH children, if sign language is provided to them, is done less often and less extensive. One of the reasons for that fact is there are only very few instruments available. An NGT sentence repetition task specifically for children does not exist yet. For this master thesis I constructed a first pilot version of an NGT sentence repetition task for children between 6 – 10 years old, the 'NGT-SRT-kids'. The main research question of this study was: 'What are the most important components to include in a new SRT for deaf and hard of hearing children aged 6-10 years old who are acquiring NGT?'.

The construction of the SRT-NGT-kids is based on previous developed SRT's for children in other sign languages, SASL and LIS (Palmer, 2020; Rinaldi et al., 2018) and the SRT-NGT for adult second language learners of NGT (Schüller, 2018). In line with these SRT's, the pilot version of the SRT-NGT-kids exists of 32 sentences divided in three different complexity levels. Complexity levels are defined by number of manual signs per sentence, type of sentence, but also by use of non-manual features which are a part of the grammatical elements of NGT.

The SRT-NGT-kids is piloted by means of a pre-pilot with 5 deaf young adults and a subsequent pilot with 8 DHH children attending a special primary school for DHH children in the Netherlands. The results of the pilots are analysed both quantitatively and qualitatively. The quantitative results from this pilot indicate the SRT-NGT-kids does discriminate between the three complexity levels. The average percentage of correct sentence repetitions becomes lower as the level of complexity goes up. The results also showed a trend of increase of percentage of correct sentence repetitions related to increase of educational grade. The results, however, did not show a relation between chronological age and percentage of correct sentence repetitions. The qualitative analysis showed it is very important to take both manual and non-manual elements into account when scoring the SRT-NGT-kids. Mandatory elements and accepted variations in the sentence repetitions are described in a scoring grid. Because there is a lot of accepted variation in NGT sentence production it is important to re-discuss this scoring grid and perhaps adjust it. The qualitative

analysis of the children's sentence repetitions provides professionals with information about specific grammatical elements of NGT a specific DHH child requires extra training on.

Based on all the results from this pilot study it can be concluded that the SRT-NGT-kids can be an instrument to follow up on DHH children's own NGT development over time. It does not (yet) provide any norm scores with which the results of the individual test scores can be compared. The current SRT-NGT-kids has not reached its final version. A second round of evaluating and discussing the test sentences must be done with, subsequently, a second, more extensive pilot.

1. Introduction

In the Netherlands a prevalence rate of 0.2 - 0.3% is mentioned for newborn babies born with hearing loss (van der Zee et al., 2022; Zoutenbier et al., 2016). These deaf and hard of hearing (DHH) children are a heterogeneous group when it comes to their audiological profiles and linguistic backgrounds. Around 5-10% of the DHH children are born in families with deaf parents who use sign language as their first language (L1). The other 90-95% of DHH children are born in families with hearing parents who use a spoken language as their L1 (Haug, 2011; Mitchell & Karchmer, 2004). For the latter group of DHH children is it a challenge to fully acquire a language whether it is a spoken or a signed language. On the one hand, spoken language is not (always) fully accessible for DHH children despite neo-natal screening for hearing impairments and provided hearing devices like Cochlear Implants (CI). Sign language, one the other hand, is not provided from birth on because parents are not (yet) proficient in the national sign language (Woll & Morgan, 2020). Based on the fact most DHH children are born in hearing families, these DHH children mostly encounter a spoken language first. Some DHH children encounter sign language from a very early age. This are mostly DHH children who live in families with deaf parents, the 5-10 % of the DHH children mentioned above. Some DHH children with hearing parents however, a small part of the other 90-95 % of DHH children mentioned above, are also exposed to sign language from a very early age because their parents start using it themselves and/or they get their DHH children in contact with DHH native signing adults from a very early age on. Other DHH children, around one-third of the 90-95 % of DHH children of hearing parents, learn sign language when they go to a bimodal bilingual toddler group (from 1.5 years onward) or when they enter a bimodal bilingual special primary school for deaf and hard or hearing children. There is also a large group of DHH children, around two-third of the 90-95% mentioned above, that go to mainstream schools and learn sign language at a later age or do not learn sign language at all (van der Straaten et al., 2021).

Spoken language development of DHH children, also in the Netherlands, is closely monitored by speech-language therapists and/or linguists connected to cochlear implant teams in hospitals, audiological centers, specialized DHH toddler groups, or special schools for DHH children. Monitoring of sign language development is done much less and less extensive. One of the reasons sign language development is monitored less, is there are not so many standardized observation instruments and tests for L1-sign language acquisition available and that can be used in applied contexts such as bimodal bilingual schools for DHH

children (Haug et al., 2021). In the Netherlands only one standardized sign language test for DHH children between 4-12 years old is commercially available, the 'T-NGT', 'Testbatterij Nederlandse Gebarentaal' (Hermans et al., 2010). An observation instrument for NGT-acquisition for younger DHH children, between 0-4 years old, is supposed to become available in 2022; the 'INDEX$_1$, GEBAREN ZO!' (Jansma et al., 2020). This instrument is the successor of the 'NGT-OP' which is also observation instrument for NGT acquisition for young DHH children (Baker & Jansma, 2005). In the 'INDEX$_1$, GEBAREN ZO!' items from the 'NGT-OP' are copied but it is also extended with items from other international observation instruments for sign language acquisition (Jansma et al., 2020).

Due to sub-optimal accessibility of spoken language and low availability of sign language DHH children are in danger of (severe) language deprivation with consequences for language and cognitive development (Hall et al., 2019; Humphries et al., 2016, 2019; Lillo-Martin & Henner, 2021). If DHH children are exposed to a sign language either at home, in day care or in the school environment, it is important to follow up on their sign language development just as is done for their spoken language development in order to stimulate their full linguistic potential (M. L. Hall, 2020; M. L. Hall et al., 2019). In the case of DHH children it is also important to take into account the quality and amount of exposure of all languages used towards the DHH child, spoken and/or signed including home signing, when one wants to say anything about the overall linguistic development of the DHH child (M. L. Hall, 2020).

One of the possible instruments to monitor language acquisition in children is a sentence repetition task (SRT). Many standardized language tests for monitoring spoken language development include a SRT (Marshall et al., 2015). SRT's can be used for different purposes; (1) in typical developing children it is used to assess language acquisition, (2) in adult second language learners it is used to determine language proficiency and (3) it is used as an indication for developmental language disorders (DLD) in children (Haug et al., 2020). When children perform poorly on a sentence repetition task it is considered as a possible indication for a developmental language disorder (Marshall et al., 2015).

Sign language sentence repetition tasks (SL-SRT) for children have been developed for Swiss German Sign Language (DSGS) (Haug et al., 2020), American Sign Language (ASL) (Supalla et al., 2014), Italian Sign Language (LIS) (Rinaldi et al., 2018), British Sign Language (BSL) (Marshall et al., 2015) and South African Sign Language (SASL) (Palmer, 2020). Not all of these SL-SRT's for children are commercially available. Some of them are only used in scientific studies. For NGT, a sentence repetition task is for children has not been

developed yet. The availability of a sentence repetition task NGT for children would be a significant addition to the current instruments for monitoring NGT acquisition. This is very important for DHH children who acquire NGT from an early age on but also for those DHH children who learn NGT at a later age.

Schüller (2018) for her master thesis, developed a sentence repetition task for adults, the 'NGT-SRT', learning NGT as a second language. The NGT-SRT for adults can be used as a base for an NGT-SRT for children. More information about these adult and children's versions of sign language SRT's, specifically the NGT-SRT, SASL-SRT, and LIS-SRT is given in paragraph 2.4.2.

With this study for my master thesis, I will create a first version of a sentence repetition task in NGT for DHH children aged 6-10 years old with the working title 'SRT-NGT-Kids'. I will take earlier developed sign language sentence repetition tasks for both adults and children as a starting point. With this master thesis I aim to answer to the following research question(s):

Main research question:
What are the most important components to include in a new SRT for deaf and hard of hearing children aged 6-10 years old who are acquiring NGT?
Sub-questions:

- What is the relationship between the scores on the SRT-NGT-kids and the following internal test factors: 1) grammatical complexity of the test sentences and 2) length of the test sentences?
- What is the relationship between the scores on the SRT-NGT-kids and the child factor chronological age?
- What is the relationship between the scores on the SRT-NGT-kids and concurrent scores on the T-NGT subtests 'zinsbegrip' (sentence comprehension) and 'zinsvorming' ('sentence production')?

The primary goal for the development of the SRT-NGT-kids is to have a fairly short and easy to administer instrument which enables professionals to follow up on DHH children's individual NGT development and that provides information about the grammatical structures in NGT children already have acquired or not.

A secondary goal of the SRT-NGT-kids is that it might provide an indication for a developmental language disorder (DLD) in children who use NGT as their first language.

Characteristic for a developmental language disorder in several spoken languages is that children with DLD have problems with (1) inflectional morphology, (2) non-word repetition (= phonology) and (3) sentence repetition. Syntactic structures that are mentioned to be problematic for children with DLD are WH-questions (question sentences that contain question words that start with 'wh' like which, what, who etc.) in which there is movement of the grammatical object in contrast to declarative sentences, relative clauses and passive sentences (De Jong et al., 2021). Question is whether the same linguistic features are problematic for deaf children who are suspected to have a DLD in their sign language development (Marshall et al., 2015; Marshall & Morgan, 2015).

Polišenská et al. (2015), in their study, manipulated sentence structures to determine which linguistic elements have the most influence on immediate sentence repetition. They found that the influence of morphosyntactic skills, familiarity with function words and lexical phonology on sentence repetition is stronger than that of semantic knowledge. In the scope of my master thesis in which I look at morphological features and syntactic structures of NGT in a sentence repetition task for deaf children acquiring NGT, I will mainly focus on the possible clinical markers in inflectional morphology and sentence repetition. I will not go further into possible phonological problems in non-sign repetition as an equivalent of non-word repetition in spoken languages.

1.1. Thesis structure

After this first introduction chapter, a theoretical background (chapter 2), based on earlier research, is given about the linguistic situation DHH children grow up in, both at home and in the school environment (paragraph 2.1). In paragraph 2.2 sign language acquisition stages for both DHH children who acquire sign language as their first language (2.2.1) and DHH children who encounter a delayed or inadequate sign language input (2.2.2) are described. Information about monitoring sign language development and specifically which instruments are available in the Netherlands is described in paragraph 2.3. Paragraph 2.4 is focused on sentence repetition tasks as one of the instruments used for tracking language acquisition in both spoken language and sign language. The three sentence repetition tasks that are used for constructing the pilot version of the NGT sentence repetition task for children are described in more detail in the subsequent sub-paragraphs (paragraph 2.4.2.1 – 2.4.2.3).

In chapter 3 the methodology of the pilot with the SRT-NGT-kids is written down. It first describes the participants of the pilot study (paragraph 3.1) and thereafter the materials used in the study (paragraph 3.2). The materials that are used are divided in existing material

like the subtest of the T-NGT (paragraph 3.2.1) and the materials constructed for the SRT-NGT-kids (paragraph 3.2.2). For the latter also information is given about the grammatical constructions that are part of the test (paragraph 3.2.3). The procedure of the pilot test itself is described in paragraph 3.3. In paragraph 3.4 a short description of the used statistical tests for answering the research questions is given.

The results of the pilot study are described in chapter 4. The pilot study with the SRT-NGT-kids is divided in a pre-pilot with deaf young adults and a pilot with DHH primary school children. The results of the pre-pilot are described in paragraph 4.1 and the results of the pilot with the children in paragraph 4.2. The results of the latter group are again divided in quantitative results (paragraph 4.2.1) and qualitative results (paragraph 4.2.2).

The last chapter, chapter 5, focusses on discussion points and the conclusion(s) of the pilot study. In paragraph 5.1 the results related to the different research questions are discussed. In paragraph 5.2 general discussion punts are described. Paragraph 5.3 provides topics for future research with the SRT-NGT-kids. The chapter finishes with a general conclusion of the whole pilot study I conducted for my master thesis (paragraph 5.4).

2. Theoretical background

2.1. Linguistic situation for DHH children

Special primary schools for DHH children in the Netherlands have a bimodal bilingual language policy, meaning they have both spoken Dutch and NGT as a target language as part of their curriculum and they make use of both languages as an instruction language (Kentalis Enkschool, 2021; Konlijke Auris Groep, 2021). This bimodal bilingual language policy started around 1980-1985 after decades of an oral educational language policy (Klomp, 2021). The bimodal bilingual language policy evolved from 'total communication' (1980-1995) to bimodal bilingual education in spoken Dutch and NGT (1995-2004), to a combination of a monolingual and bimodal bilingual language policy in which spoken Dutch, sign supported Dutch (NmG) and/or NGT (2004-now) is used (Schermer, 2012). The current combination of a monolingual and bilingual language policy instead of only a bimodal bilingual language policy is based on a couple of reasons: (1) The increase of DHH children who receive one or two Cochlear Implants (CI) within the first year after they have been diagnosed as deaf, (2) more parents, often supported by medical audiological specialists, want hearing teachers for their children in order to learn spoken Dutch or sign supported Dutch, (3) hearing teachers in the schools for DHH children are often not proficient enough in NGT to provide children with high quality NGT and (4) the Dutch government strongly stimulates children with special educational needs, including DHH children, to get education in mainstream schools where a bimodal bilingual language policy is not present (Klomp, 2021; Knoors, 2011; Schermer, 2012).

Besides the diverse linguistic situation for DHH children in (special) primary schools also the linguistic situation in the domestic situation is diverse. Only around 5 - 10% of DHH children are born into families with deaf parents that use a sign language as their L1. These children have full access to language from birth (i.e., sign language). Around 90-95% of DHH children are born in hearing families. Hearing parents are not (yet) proficient in a sign language when their DHH baby is born and have to learn the national sign language as a second language, if they wish to (Mitchell & Karchmer, 2004). Most hearing parents choose to use spoken language, their own L1, with their deaf child and only use signs as part of sign supported speech. This choice is often based on lack of robust information, which they receive from (medical) professionals they encounter, about the benefits of using sign language besides learning spoken language. If parents choose to use sign language with their DHH child there is, unfortunately, currently a lack of sufficient possibilities to learn sign language

up to a high proficient level (Baelemans et al., n.d.; Humphries et al., 2016). For DHH children born in hearing families sign language is often not offered enough and/or of a high enough quality.

Late sign language exposure in DHH children, in combination with only partial access to spoken language, can cause a situation of 'language deprivation'. Language deprivation is described as "an environment in which a child does not have maximal access to direct and indirect language" (Lillo-Martin & Henner, 2021, p. 16) and in itself can cause problems in cognitive functioning, social relations as well as psychological problems (M. L. Hall et al., 2019; W. C. Hall, 2017; Henner et al., 2018; Humphries et al., 2016; Lillo-Martin & Henner, 2021).

2.2. Sign language development

If we take the linguistic situation in which DHH children who are raised by DHH adults who have sign language as their L1 as a base, we know these children can acquire sign language in a similar way as hearing children acquire a spoken language. These DHH children follow more or less language development steps in the same order and at the same time as hearing children do (Brentari, 2019; Humphries et al., 2016; Lillo-Martin & Henner, 2021; Pichler, 2012). A rough description of L1 sign language acquisition is given in paragraph 2.2.1. below and summarized in table 1.

2.2.1. Sign language development in case of early access

Just as hearing babies start with vocal babbling, DHH babies start with manual babbling. Although it seems that hearing babies start their vocal babbling at an earlier age, around 4 months, the manual babbling of DHH babies might occur as early but is hard to distinguish from normal developing motor skills (Brentari, 2019; Lillo-Martin & Henner, 2021; Pichler, 2012). Petitto & Marentette (1991) found manual babbling in DHH children also follows a similar pattern towards the first signed words as vocal babbling to the first spoken words in hearing children. For both groups babbling exists of a subset of phonological elements (handshapes or sounds) out of all the phonological combinations possible in a signed or spoken language. The first signed or spoken words exists of a combination of the phonological elements used in babbling.

First signed words in DHH babies are, on average, found earlier, around 8.5 months Old. The first spoken words in hearing babies occur, on average, around 10-11 months. This early sign language advantage is because motor control of the hands develops faster than motor control of the spoken word articulators (Anderson, 2002; Caselli & Pyers, 2020; Lillo-

Martin & Henner, 2021; Pichler, 2012). The first signs by DHH children produced are high frequent used nouns and verbs, just as with hearing children's first words (Brentari, 2019; Pichler, 2012).

The ability to produce two-word sentences emerges around the same age for spoken language in hearing children and sign language in DHH children. Hearing children produce their first two-word sentences around 18-24 months old, DHH children produce their two-sign sentences around 17-21 months old (Lillo-Martin & Henner, 2021; Pichler, 2012). It is shown in several sign languages (ASL, NGT, Libras) that although DHH children are exposed to great variability in sign order and also produce a lot of variety in sign order, they also use the conventional sign order rules of their national sign language as soon as they start producing two-sign sentences (Lillo-Martin & Henner, 2021; Pichler, 2012).

After the two-sign utterance stage DHH children, just as hearing children, learn to produce longer utterances in which they also learn to use different morphological features at the same time. This language acquisition phase is sometimes called the 'grammar explosion' and is found between 3-5 years of age (Lillo-Martin & Henner, 2021). Acquisition of WH-questions in spoken language in hearing children starts on average around the age of two years old and can take up to several years to fully master the use of them (Valian & Casey, 2003). Questions in sign languages in which WH-elements are produced show more variation than one would normally see in spoken languages. This is the case because in sign language the WH-elements can vary in position within the utterance, based on the syntactic function of the WH-element in the utterance, or can even be doubled in one question as can be seen in examples 1-3 below.

1. LEAVE *WHY*
   'Why did he leave?' (Klomp, 2021; p. 275, example 16a)

2. *WHY* DANGEREOUS
   'Why is it dangerous?' (Klomp, 2021; p.275, example 16b)

3. *WHO* BOOK STEAL *WHO*
   'Who steals the book?' (Klomp, 2021; p. 275, example 17)

Production of WH-questions has been found in ASL and LSB (Brazilian Sign language) data of (very) young deaf children from 1.1-3.0 years old but it takes several years to be used correctly in different contexts and forms (Brentari, 2019; Pichler, 2012).

The above information about sign language acquisition is focused on *lexical items* produced with the hands. In sign language DHH children must also acquire *non-manual elements of sign language* which can be part of grammatical aspects of sign language, like a head shake as part of negation. Non-manual elements are also part of sign language prosody (Sandler et al., 2020). Reilly (in: Schick et al., 2006) found an interesting phenomenon in sign language acquisition called 'hands before face'. If there is a choice of conveying a meaning with a manual sign or through non-manual marking, young children acquire the manual form first. Full acquisition of the non-manual elements as part of sign language prosody can take up to 7-9 years old (Brentari, 2019).

The *use of three-dimensional space* is another aspect that DHH children must acquire as part of their sign language acquisition. Use of space is part of productions of pronouns, directional verbs, and use of classifiers. Use of space as part of pronouns is acquired around the age of two in which DHH children first point to themselves and later also to other addressees (Lillo-Martin & Henner, 2021; Pichler, 2012). In a study by Petitto in 1987 (in: Pichler, 2012) it was found that two very young DHH signers of 0.6 - 2.3 years old started pointing to people, objects and locations very young, around 10 months old. Around 12-18 months old they started replacing their pointing towards people with lexical items like 'MOTHER' or other kinship terms and returned to pointing as a start of using pronouns around 21-23 months old. They reached a proficient use of pronouns at the age of 27 months old. In the case of directional verbs children first have to designate a certain locus in space to a present or non-present referent after which verbs move between these loci and show agreement. Although verb agreement is seen quite early in sign language acquisition, around 2 – 2.5 years old, children of that age often omit to designate a locus in space to a referent. Around the age of three, directional verbs are acquired properly although it is still a challenge for children to use the right locus in space for a certain referent because of memory limitations (Pichler, 2012).

Classifiers are morphologically complex structures in which handshape, location, movement, and orientation of the hands in signing space represent the referent itself and the location and movement of the referents, causing all these components of the sign to express meaning. Classifiers are categorized in (whole) entity classifiers, size and shape classifiers, instrumental classifiers, body part classifiers and handling classifiers (Lillo-Martin & Henner, 2021; Marshall & Morgan, 2015; Zwitserlood, 2012). Earlier research on the acquisition of classifier construction by DHH children in different sign languages like ASL, BSL, Auslan (Australian Sign Language) and NGT shows that some aspects of these classifier

constructions are acquired at a very young age around 2.6 - 2.11 years old but that further development up to adult-like forms is acquired very gradually until 7-9 years old (Brentari, 2019; Lillo-Martin & Henner, 2021).

Table 1. Average age of acquisition linguistic elements.
(Anderson, 2002; Brentari, 2019; Caselli & Pyers, 2020; Lillo-Martin & Henner, 2021; Marshall & Morgan, 2015; Petitto & Marentette, 1991; Pichler, 2012; Schick et al., 2006; Valian & Casey, 2003; Zwitserlood, 2012)

Acquired elements	**Average age of acquisition**	
	Spoken language	**Signed language**
> manual babbling	4-5 months	4-5 months (but hard to distinguish from other motor movements)
> first lexical signs	10-11 months	around 8.5 months
> two sign utterance	18-24 months	17-21 months
> 'grammar explosion'	3-5 years old	3-5 years old
> WH-questions	Start around 2 years old - full acquisition gradually.	Start around 1.5 years old – full acquisition gradually.
> non-manual elements as part of SL prosody	n/a	Up to 7-9 years old
> use of space: - pronouns - directional verbs - classifiers	n/a	 - start around 10 months – until around 2.7 years old - around 2.6 - 3 years old - start early (2.6 – 2.9 years old), full acquisition very gradually (up to 7-9 years old)

2.2.2. Signed language development in case of delayed or inadequate input

When early access to high qualitative sign language is available for DHH children, acquisition will approximately develop along the lines described above. For many DHH children this is not the case because, as mentioned before, they are born in hearing families where parents are not (yet) fluent in sign language or parents choose not to use it in the communication with their DHH child (M. L. Hall et al., 2019). In those cases, DHH children might receive spoken language input which is (partly) accessible due to use of technical hearing devices such as hearing aids or cochlear implants. Some of the DHH children of hearing parents do get in

contact with sign language, sometimes from an early age on but often later in age. This can be because their parents (later on) choose to learn and use sign language in their homes. At a somewhat later age DHH children can encounter sign language if they go to special toddler groups or schools for DHH children where there is a bimodal bilingual language policy. Another group of DHH children gets in contact with sign language at an even more later age if they choose to learn and use it themselves (Lillo-Martin & Henner, 2021).

Studies on sign language attainment of deaf adults who are late learners of sign language show that, as a group, they perform significantly less accurate than native learners of sign language, even if these native learners are hearing learners of a sign language like coda's (children of deaf adults). For example, Lillo-Martin & Henner (2021) mention a study on ASL grammaticality judgement (by Boudreault & Mayberry, 2006) which showed that adult native signers of ASL as a group performed significantly better than the group of adults who learned ASL at a rather young age (first exposure between 5-7 years old). The latter group on the other hand performed significantly better on the grammaticality judgement task than late learners of ASL (first exposure between 8-13 years old). What is not yet clear is whether late(r) exposure to a sign language causes lower proficiency in sign language *overall* or that it only has a greater effect on specific sign language structures (Lillo-Martin & Henner, 2021; Mayberry & Kluender, 2018).

Lillo-Martin & Henner (2021) describe some case studies by Berk & Lillo-Martin (2012) in which DHH participants are followed during their process of late(r) learning of ASL. These case studies showed that the late learners went through the typical developmental stages of e.g., two-sign utterances as very young learners of ASL do but that their semantics was sometimes already more advanced because of their older age. They also mention a study by Henner et al. (2016) on larger groups of DHH learners of ASL between 7.5 – 18.5 years old in which native learners, early learners, and late learners of ASL were compared conducting an ASL analogical reasoning task and an ASL grammaticality judgement task. The researchers found that there were significant effects of native sign language exposure and of age of entry into a signing school environment on the results of the ASL tasks. DHH non-native learners of ASL entering a signing school environment up to six years of age were most likely to have comparable scores as native signers than late learners. Besides age of acquisition of ASL or language used in the home environment, ASL lexical and syntactic skills were highly correlated to the outcome of the ASL analogical reasoning task.

Based on the studies mentioned above and information from other additional literature about the importance of early access to signed language for DHH learners (M. L. Hall, 2020;

Marshall & Morgan, 2015) it is clear that early exposure to a fully accessible language, which sign language is for DHH children, is of highly importance to reach the best possible outcome on linguistic level but also on cognitive and social level.

2.3. Monitoring sign language development

In different countries, for different sign languages, sign language tests have been developed. Tobias Haug, on his website http://www.signlang-assessment.info/home-en.html, provides an overview of sign language tests that have been developed over the last years. A lot of these tests have been developed for linguistic research and are not commercially available. Some of the sign language tests are specifically made for testing sign language development in adult L2 learners of sign language, others are specifically focused on sign language development in DHH children. These tests can be used for DHH children who acquire sign language from a very early age onwards but also for children who learn sign language at a later age. This is also the case for instruments that focus on acquiring NGT. Some of these instruments are being discussed in the following paragraphs.

2.3.1. Available instruments for monitoring NGT acquisition in DHH children.

In the Netherlands two instruments are currently available for following up NGT acquisition of (young) DHH children: (1) The NGT-OP (Baker & Jansma, 2005) and (2) the T-NGT (Hermans et al., 2010). These instruments are used e.g., within special daycare groups for young DHH children and in schools for DHH children. Professionals who use these instruments are NGT-teachers, (sign language) linguists or other professionals who are fluent in sign language themselves and are trained to work with the instruments.

The NGT-OP, 'NGT Observatiepakket voor Peuters' (Baker & Jansma, 2005), is a structured checklist that provides the professional a broad view of DHH children's NGT and general communicative and language abilities. The target age group of the NGT-OP is 2-4 years of age but can also be used for older children with a (suspected) NGT level within that age range. The NGT-OP is divided into eight linguistic and non-linguistic sections: non-verbal communication, communicative skills, general mastery of language, phonology, syntax, morphology, phantasy/point of view and creative language use. The checklist can be used at different times, at least six months apart, to follow up on children's NGT development. An example of an item in the checklist is given in figure 1.

Localization – Fill in what is applicable, 1), 2), or 3) (tI, tII, tIII: 3 different points of time to assess Localization)			
tI	tII	tIII	
			1) The child refers only to persons or objects that are really present.
			2)The child assigns a concrete location (really present persons or objects) to not present referents.
			3) The child assigns abstract locations (in signing space) to not present referents.

Figure 1. Example of an observation item from the NGT-OP (Baker & Jansma, 2005; p. 26, copied from (Haug, www.signlang-assessment.info)

The items in the checklist are based on acquisition studies in several sign languages e.g., ASL, BSL and NGT. There are no age norms available for the items on the checklist, but the checklist can be used to follow DHH children in their own NGT development and compare them to other DHH children. One of the mentioned weak points of the NGT-OP is the influence of the possible lack of knowledge of linguists about NGT development in general and influence of insufficient NGT proficiency of the professional who use the checklist on the scoring (Haug, 2008). Recently Royal Dutch Kentalis (2020) constructed a successor of the NGT-OP, the 'INDEX$_1$, GEBAREN ZO!'. Items of the NGT-OP are included in this new observation instrument, complemented with items from other, already existing national and international observation checklists for early sign language development e.g., 'The standardized Visual Communication and Sign language Checklist for Signing Children' (Simms, Baker & Clark, 2013). Figure 2 shows an example of some observation items from the INDEX$_1$, GEBAREN ZO!

Kind: **Groep:** **Datum 1:**		**Geboortedatum:** **Leeftijd:** **Datum 2:**		**Ingevuld door:** **Functie:**			
PRODUCTIE				**12 – 24 maanden**			
? = weet niet		- = niet aanwezig		+/- = in ontwikkeling		+ = beheerst	
Item				**?**	**-**	**+/-**	**+**
3.	Verwijst met een vast, nog niet correct gebaar naar een concreet concept						
4.	Richt de aandacht van de volwassene op een voorwerp (bijv. door het omhoog te houden of door ernaar te wijzen)						

Figure 2. Example of observation items from the observation list for DHH children 12 – 24 months old (copied from: Jansma et al., 2020; Form 12-24 month old children, page 2).

The 'INDEX$_1$, GEBAREN ZO!' is up to the moment of writing this thesis not yet released and therefore not possible to use within all the DHH toddler groups and schools for DHH children in the Netherlands.

The T-NGT, 'Testbatterij Nederlandse Gebarentaal', (Hermans et al., 2007) and its revised versions (2019, 2021) is an instrument used to evaluate NGT development of DHH children from 4 to 12 years old in the Netherlands but can also be used for older DHH people with an estimated NGT language level within the age range of 4-12 years. Earlier (digital) versions of the test were available on CD-ROMs. However, the latest version of the test is only available in a digital form on the online platform 'BergOp' (https://www.bergop.info/). The T-NGT can be used by NGT teachers or other professionals with enough sign linguistic knowledge and who are proficient in NGT themselves. The instrument consists of both receptive and productive subtests across four linguistic domains: phonology, vocabulary, morpho-syntactic and narrative skills. The test can be conducted each (school)year as part of the overall academic tracking system used in the schools but can also be used as part of a broad linguistic assessment of DHH children. The test can be conducted completely using all nine subtests, but a suggested subset of the subtests (5-6 subtests) is often enough to get an overall view of the NGT development of DHH children. The T-NGT does have norms scores for all subtests. One of the downsides of the T-NGT is that conducting and administering all subtest results takes up a lot of time of professionals. Another downside of the T-NGT, mentioned by NGT-teachers who use this test in the schools for DHH children, is that children fairly easy reach the highest level of proficiency. This might be caused by the fact the norm scores of the T-NGT are based on a norm group of DHH children that attended special primary schools for DHH children. This norm group only partially consisted of DHH children from DHH parents who used sign language at home (32 out of the total of 330 children). This latter group tends to have, on average, a higher level of sign language proficiency than DHH children who grow up in families with hearing parents who do not use sign language at home (Hermans et al., 2010). An NGT sentence repetition task for children has the potential to be a useful complement to the two instruments for following up NGT acquisition in DHH children. An elaboration on this this is provided in the following paragraphs.

2.4. Sentence repetition tasks

Sentence repetition tasks (SRT) are often part of standardized (spoken) language assessments for children to follow up their language development. Because a full standardized language assessment, through e.g., the use of the whole T-NGT, takes up a lot of time conducting and administering them, they are less usable in educational settings. An SRT as a stand-alone test has the potential of being a useful instrument in educational settings because of organizational

and content-related advantages: low costs, taking up less time, easier to administer, it can take up different sentence types, and the possibility of scoring the test results in both a quantitative and a qualitative way (De Jong et al., 2021; Palmer, 2020; Polišenská et al., 2015).

In an SRT people need to repeat a sentence, in exact the same way and immediately after the sentence is provided to them. The sentences become longer and morphologically more complex during an SRT (De Jong et al., 2021; Palmer, 2020; Schüller, 2018). The underlying assumption behind an SRT is that it reflects people's linguistic knowledge on several levels of both language perception and production and that it provides information on peoples lexical and grammatical skills (Bogliotti et al., 2020; Rinaldi et al., 2018). Klem et al. (2015) state that to perform well on an SRT you need all aspects of language processing: perceiving the sentence, creating a conceptual representation of the sentence, activating lexical knowledge, grammatical encoding (morpho-syntactic) and processes involved in language production e.g., phonological planning and speech production. Sentences in an SRT need to be long and complex enough so people cannot reproduce the sentence merely using their short-term memory capacity (De Jong et al., 2021). Although there is some relation between short term memory capacity and performance on an SRT, Klem et al. (2015) in their longitudinal study on 216 children did not find a significant support for the hypothesis that sentence repetition is a distinct measure of short-term memory capacity that has a predictive relationship with language development at a later age. On the contrary, they did find a significant relation between language development at test time 2 and performance on the SRT at test time 3 which suggests that higher linguistic abilities can predict performance on an SRT at a later age.

2.4.1. Sentence repetition tasks for spoken languages

In spoken language assessments SRT's can be used to screen general linguistic abilities on different aspects: phonology, lexicon, morphology, and syntax. It can be used for different population groups e.g., children, adults, second language learners, bilingual children. An SRT can test specific linguistic elements depending on the specific linguistic structures present in the SRT. Through a qualitative analysis of the mistakes made one can determine which linguistic elements test takers have not (yet) acquired properly (Bogliotti et al., 2020; De Jong et al., 2021; Polišenská et al., 2015).

Problems with performing well on an SRT for spoken languages is regarded as a clinical marker for a possible developmental language disorder (De Jong et al., 2021; Marshall et al., 2015; Polišenská et al., 2015). Polišenská et al. (2015) in their study with 50 English-speaking and 50 Czech-speaking 4–5-year-old children investigated which

underlying linguistic processes had most influence on the performance on an SRT by manipulating sentences in seven conditions: (1) grammatical sentences, (2) sentence with list prosody, (3) semantically implausible sentences, (4) ungrammatical sentences because of a random word order, (5) pseudo-sentences with content non-words, (6) pseudo-sentences with function non-words and (7) pseudo-sentences with all words replaced by non-words). They found that in both languages children's ability to repeat sentences is mostly influenced by their knowledge of morpho-syntax, function words and lexical phonology rather than semantic or prosodic knowledge. This study, in line with other studies, showed that immediate sentence repetition, depending on the structures that are represented in the SRT, is a very sensitive way to assess different aspects of children's linguistic abilities.

The standard way of scoring an SRT is an absolute scoring by receiving a score for a 'correct' or 'incorrect' repetition of the model sentence (Polišenská et al., 2015). However, scoring can also be done a different way. De Jong et al. (2021) mention qualitative ways to score an SRT as they did when constructing a new (spoken language) SRT for Dutch children, 'the LITMUS SRep', as part of the European partnership COST Action ISO804: 'Language impairment in a multilingual society: Linguistic patterns and the road to assessment'. Besides absolute scoring, scoring on the LITMUS SRep can also be done on (i) content and function words, (ii) grammaticality and (iii) target structure. (Bogliotti et al., 2020) also mention qualitative elements on which errors in an SRT can be analyzed: phonological errors, omissions, deletions, and substitutions. Which way of scoring one chooses depends on the goal the test is used for; a general impression on the ability of repeating sentences or a more specific goal related to the ability to repeat certain grammatical structures. The qualitative way of scoring and analyzing the sentence repetitions also provides an opportunity to compare the ability to repeat certain grammatical structures in different languages in bi-/multilingual children. The LITMUS SRep e.g., is translated for different spoken languages and can be used that way to see if there is an indication for a DLD in bilingual children (De Jong et al., 2021).

2.4.2. Sentence repetition tasks for sign languages

Sentence repetition tasks for sign languages have been made for several sign languages e.g., ASL, BSL, LIS, LSF, DGS, HKSL, NGT and SASL. The target groups of the SRT's are adults and/or children and either L1 or L2 users of the specific sign language.

The first SRT for sign language was the ASL-SRT (Hauser et al., 2008). The construction of this SRT was based on a proficiency (sub)test for spoken language, the 'Speaking/Grammar subtest' of the 'Test of Adolescent and Adult Language – Third Edition

(TAOL-3), constructed in 1994. In the SRT subtest of the TAOL-3 participants had to repeat 30 sentences and were scored either correct (‘1’) or incorrect (‘0’) resulting in a global proficiency score. In the initial ASL-SRT, 40 ASL sentences were recorded showing a native user of ASL signing the sentences. In later versions of this test the number of sentences has been reduced to 30 sentences and even 20 sentences in 2014. The lower number of sentences that remained in the final versions were the sentences that were most sensitive to chronological age-related linguistic skills and had the highest predictive factor on ASL proficiency. Lowering the number of test sentences was also based on the wish to keep the time needed to perform the test and to score it as short as possible. The sentences build up in length and morphological and syntactic complexity but also become more complex by including fingerspelling, numeral incorporation, and low frequency lexical signs. The results of the initial pilot with this SRT showed, based on absolute scoring, it could differentiate between different groups of signers: deaf native signers from hearing native signers, deaf native signers from deaf non-native signers and deaf adults from deaf children. From the literature describing the ASL-SRT it is not clear if non manual features of the sentences were taken into account scoring the repetition of the sentences (Hauser et al., 2008; Supalla et al., 2014; Sze et al., 2020).

The ASL-SRT has been adapted to other sign languages e.g., BSL, DGS, Swedish sign language, DSGS and NGT. The BSL-SRT (Cormier et al., 2012) is a direct translation from the ASL-SRT with only some adaptations related to social and cultural aspects. Also, the scoring was the same as the ASL-SRT. In the pilot study, just as with the ASL-SRT, a significant difference in test scores were found between deaf native signers, using BSL from birth on, and deaf non-native signers but no difference was found between late signers that started using BSL between 2,5-6 years of age and late signers that started using BSL after 11 years old. One of the explanations mentioned was the small pilot group in all three groups of BSL-users.

For the design of the first version of the NGT-SRT-kids, the NGT-SRT (Schüller, 2018), the SASL-SRT (Palmer, 2020) and the LIS-SRT (Rinaldi et al., 2018) were the main sign language SRT’s influencing this test. For that reason, these three SRT’s are discussed more extensive in the following paragraphs. The NGT-SRT was a test developed for adult learners of a sign language (NGT in this case), in contrast to the other two SRT’s, which were made for DHH children.

2.4.2.1. The NGT-SRT.

Recently, Schüller (2018) constructed an NGT-SRT under the supervision of dr. E. Ormel from the Radboud University Nijmegen. The construction of the NGT-SRT was done according to the guidelines for adaptation of sign language tests by Haug (2011), presented in appendix 1. The sentences used in the NGT-SRT are mostly adopted from the ASL-SRT just as a lot of other SRT's in sign language. Main reason for this choice was that in this way sentences from different SRT's are more comparable to each other. Adaptations to the sentences were made on the level of lexical items, adapting them to Dutch social and cultural aspects, but also on syntactic level as the basic constituent order in ASL is SVO compared to SOV in NGT. In total 39 NGT-sentences were created. In the development phase of the first version of the ASL-SRT (Hauser et al., 2008) the original number of 40 test sentences was already reduced to 39 test sentences based on the results from the first pilot with 8 ASL users with varying ASL proficiency levels. Schüller (2018) took these 39 sentences as the base for the NGT-SRT. She divided the NGT sentences in three complexity levels, simple – moderate – complex, based on sentence level indications for spoken language tests and levels of ASL sentence types used in research on the effect of age of acquisition on ASL skills of DHH children by Rachel Mayberry et al. (under construction), given to Schüller personally. The three sentence levels of the NGT-SRT are given in table 2 below. Schüller, in the discussion section of her master thesis, indicates this ranking of sentence types might need adaptations based on results of pilots with the NGT-SRT with different pilot groups (Schüller, 2018).

Table 2. Level of sentences of the NGT-SRT based on sentence type (Schüller, 2018, p.34-35).

#	**Sentence types**
Level 1 'simple'	Simple clause using basic SOV order containing 1 verb Oral component → non manual Short, declarative sentences Topicalization → non manual (OSV, OVS)
Level 2 'moderate'	Coordinating clause Conditional clauses Classifier constructions Modal verbs + negation → simultaneous non-manual marking Verbal agreement/ verbal inflection
Level 3 'complex'	Subordinated clause Numeral incorporation Causal relations → non-manual Multiple clauses using reference Combination of all of the above

The 39 sentences of the NGT-SRT were equally divided over the three complexity levels. Examples of sentences belonging to each one of the categories is given in examples 4

(simple), 5 (moderate) and 6 (complex). The sentences are given in Dutch glosses with a Dutch and English translation.

4. _____RE___
   GISTEREN INDEX$_1$ OUD HUIS KOPEN (sentence 1)
   'Gisteren heb ik een oud huis gekocht'
   'Yesterday I bought an old house'

5. _____RE _____RE _____hn___
   VANDAAG INDEX$_1$ ZIEK^GEVOEL / WERKEN / KAN^NIET. (sentence 13)
   'Vandaag voel ik me ziek dus ik kan niet werken.'
   'Today I feel sick therefore I cannot work.'

6. _____RE
   VORIG JAAR INDEX$_1$ 3-WEKEN #G-A-M-B-I-A KLAAR GAAN^NAAR
   'Vorig jaar ben ik 3 weken naar Gambia geweest' (sentence 26)
   'Last year I went three weeks to Gambia'

The NGT-SRT was piloted with 12 second language learners of NGT whose L1 was a spoken language, so called L2M2 learners. This abbreviation indicates that they learn a second language (L2) in a different modality (M2) than the modality of their first language. The participants were all students of (the only) higher education in the Netherlands that provides a four-year curriculum to become a sign language teacher or a sign language interpreter. As part of that curriculum students are monitored on their NGT proficiency using the CEFR guidelines (Leeson et al., 2019) and based on an assessment classified in one of the six CEFR levels between A1 (poorly proficient) and C2 (highly proficient). Scoring on the NGT-SRT was done on both manual signs and non-manual features. As for the non-manual features only deviations resulting in change of meaning of the sentence was scored as incorrect e.g., no head shake with negation. Differences in eyebrow features like raised eyebrows or frowned eyebrows were not taken into consideration during scoring. Other scoring guidelines Schüller (2018) used are presented in table 3.

Table 3. Scoring guidelines for incorrect responses in the NGT-SRT (Schüller, 2018; p. 64)

1	Adding a lexical sign
2	Omitting a lexical sign
3	Substitution of a lexical sign (without semantic overlap)
4	Change of sign order
5	Use of deviating classifiers

6	Deviation of reduplication
7	Fingerspelling mistakes (omitting, adding, change of fingerspelled letters)
8	A different sentence
9	Phonological mistakes
10	Morphological mistakes (e.g., on aspect or plurals)
11	Semantic mistakes
12	Lexical variants
13	Non-manuals: deviations resulting in change of the meaning of the sentence

The absolute scoring results, 'correct' or 'incorrect', of the NGT-SRT for the twelve students who participated in the study, showed a significant correlation with the CEFR-level they obtained. The pilot also showed the NGT-SRT was sensitive to significant differentiation between the three levels of complexity. Regardless of the results of the pilot, Schüller (2018) suggests to have a closer look at the sequence of the sentences in the test and the distribution of the sentences over the levels of complexity as some participants with low(er) CEFR-levels (A2-level) were not able to imitate sentences from complexity level 1 correctly but were able to do so with sentences from complexity level 2. In other words, the distribution of the test sentences over the complexity levels is likely not yet the most appropriate one.

The NGT-SRT does not contain any interrogative sentences using WH-signs because they were not present in the original version of the ASL-SRT. In the discussion of the NGT-SRT Schüller recommends adding these types of questions in a newer version of the test as WH-questions are a substantial sentence type used in sign language, just as in spoken language.

2.4.2.2. The SASL-SRT.

The NGT-SRT is meant to be used for adult learners of NGT, just as many of the other SRT's aim at adult learners, often L2M2 learners of sign language. There are also SRT's specifically constructed and/or tested on DHH children. One of these SRT's is the first version of a SASL-SRT for DHH children between 7 and 11 years old constructed by Amy Palmer (2020) under supervision of dr. K. Huddlestone and prof. A. Baker of the Stellenbosch University in South Africa. Palmer (not published), as part of an honours research program at the Stellenbosch University in South Africa, did a first attempt in 2018 to create a SASL-SRT for adult L2 learners of SASL, aimed to determine SASL proficiency. The SASL-SRT for children described in this paragraph is a continuation of that initial project (Palmer, 2020).

Construction of the SASL-SRT for children was done to have an assessment instrument which could measure SASL proficiency of DHH children in special schools for

DHH learners in South Africa and follow their acquisition process over time. Currently there is no SASL assessment instrument for DHH children as there is also no thorough information about what SASL acquisition in DHH children looks like. One of the main research questions of Palmer was to find out which SASL elements should be included in an SRT for DHH children who acquire SASL.

Palmer constructed an SRT of 20 SASL sentences distributed over three complexity levels, similar to the NGT-SRT. She explicitly mentions that the distribution of the SASL sentences over the three complexity levels "does not have a solid foundation in research" (Palmer, 2020, p. 33).

The indication of complexity of the test sentences was based on grammatical structure in combination with number of manual signs. Simple sentences contained 3-5 signs (mean 3.7), moderate sentences 3-6 signs (mean 4.8) and complex sentences 4-7 signs (mean 6.4). In table 4 example sentences of the three level of sentences are shown.

Table 4. Example of sentences of the SASL-SRT divided in complexity level (Palmer, 2020, p.34-37)

level	**number**	**Sentence + translation**	**Number of manual signs**	**Clauses/sentence type**
simple	1	__hs INDEX$_3$ MILK LIKE 'She doesn't like milk'	3	Main; declarative; negative
moderate	10	_____re INDEX$_1$ KING SWEETS FREE 'If I were king, sweets would be free'	4	Conditional clause + main: declarative
complex	19	_____re INDEX$_3$ ASK INDEX$_1$ INDEX$_2$ ANGRY 'She asked me if you are angry?'	5	Complement clause + main: yes/no-question

Scoring of the SASL-SRT for children was done in a more or less similar way as with the NGT-SRT. There was an absolute scoring, 'correct' or 'incorrect', complemented with categories for 'unanalyzable' or 'skipped'. A sentence was scored 'skipped' when participants did not iterate a sentence at all and 'unanalyzable' when children produced to many other signs in comparison to the example sentence resulting in a response that shows to little resemblance with the example. Besides the direct scoring of the test a qualitative analysis was done on the incorrect responses.

For a 'correct' response, sign order, lexical items and non-manual features were taken into consideration. In addition to the presence of non-manual negation, as in the NGT-SRT, Palmer also looked at non-manual marking of questions, WH-clefts, imperatives, and conditional phrases as a criterion for direct scoring. The latter group of non-manual markers

was not a part of the scoring in the NGT-SRT because the sentence type is not present in the NGT-SRT or because mistakes with the non-manual marker did not change the meaning of the sentence in NGT. Because the scope of these non-manual markers over the number of lexical signs can vary, only presence of the markers was accounted for. Criteria for incorrect responses on the SASL-SRT mentioned in the text of Palmer's paper are given in table 5.

Table 5. Scoring guidelines for incorrect responses in the SASL-SRT, retrieved from the text (Palmer, 2020).

1	Deviation of sign order
2	lexical substitutions or omissions
3	Phonological substitutions/mistakes of more than one phonological parameter
4	Non-manual features: omissions/mistakes that have a direct influence on the grammaticality of the sentence

Palmer piloted the SASL-SRT on 71 students, aged 7;0 - 9;11 years old, from two different schools for DHH children in South Africa. Results of 40 students were used for the analysis. The results of the other 31 students were excluded from the study because of various reasons e.g., additional impairments, no parental consent, etc.

Results of the direct scoring showed a significant effect of age on the results of the test. The youngest children (7 years old) imitated less sentences correct (3%) than the children of 8 years (9%) old and 9 years old (18%). A notable result of this pilot was that a subset of the students of one of the schools ('school 1') showed less correct responses and significantly more unanalyzable and skipped items than students from the other school ('school 2'). Although the subset of students mentioned above were all between 7 – 8 years old it was still worth debating how this strong difference between the two schools could have come about. One of the possible reasons mentioned is that in school 1, students are not used to be exposed to language tests similar to the SASL-SRT. Another possible reason mentioned is that students were afraid of negative consequences if they would perform poorly on the test and therefore chose to fill in gaps they didn't know with other lexical items.

Looking at the direct scores of the repeated sentences and their distribution over the three complexity levels approximately the same result pattern was found as with the NGT-SRT. Overall, the SASL-SRT seemed to be sensitive enough to discriminate between the simple complexity level and the other two complexity levels as the percentage of correct responses in this level is 22.08% compared to 6.67% and 5.35% for the moderate and

complex levels. There is a difference in percentage of correct responses for the latter two complexity levels, but it is not described by Palmer whether these differences are significant or not.

Some sentences of a higher level of complexity were repeated correctly more often than some sentences of lower complexity levels. Palmer states distribution of the sentences over the different complexity levels therefore must be rediscussed.

One of the main discussion points in the qualitative analysis of the results of the SASL-SRT was about lexical variation. Not much lexical substitutions were made but those that were all came from students from school 1 and were (regional) lexical variants. Palmer states it is of utmost importance to choose lexical items *all* participants are familiar with. DHH children of a young age might not have been in contact with lexical variants and therefore should be avoided. Another discussion point was about production of non-manual markers. It was found that non-manual markers for negation (head shake) were produced frequently and correctly whilst other non-manual markers like raised eyebrows in a conditional clause were produced much less. This raises the question on how to take on non-manual markers in a, to be developed, scoring grid for a future version of the SASL-SRT.

2.4.2.3. The LIS-SRT.

Rinaldi et al. (2018) describe the development of a new LIS-SRT to analyze LIS skills of two age groups of DHH children, 4-7 year old and 7-11 year old. Their results on the LIS-SRT were compared to those of deaf adult LIS users. The researchers chose not to take another SRT, spoken and/or signed, as a starting point. They chose to construct a completely new SRT in which they took specific LIS features into account as well as cultural aspects of the Italian deaf community. Out of 40 LIS sentences, which were taken out from videorecorded conversations between deaf adult signers, 20 sentences were chosen for the new LIS-SRT. Finally, a total five sentences from the ASL-SRT and BSL-SRT were translated into LIS and added to the test items for possible cross-linguistic comparison studies in the future. Two versions of the LIS-SRT were made, exclusive the five translated sentences from ASL and BSL, both containing fifteen sentences each: one for 4- to 7-year-old DHH children and one for 7- to 11-year-old DHH children.

The two age related versions of the LIS-SRT contained ten overlapping sentences and five unique sentences for that particular age related version. The described analysis in Rinaldi et al. (2018) was only done on the ten overlapping sentences. The 10 overlapping sentences of the two versions of the LIS-SRT are shown in figure 3. Degree of complexity of the sentences was based, for instance, on presence of non-manual markers, agreement using

signing space and/or indices and use of the non-dominant hand. In total 33 participants did the LIS-SRT: 8 younger children, 15 older children and 10 adults. All children came from the same bimodal bilingual school for DHH children.

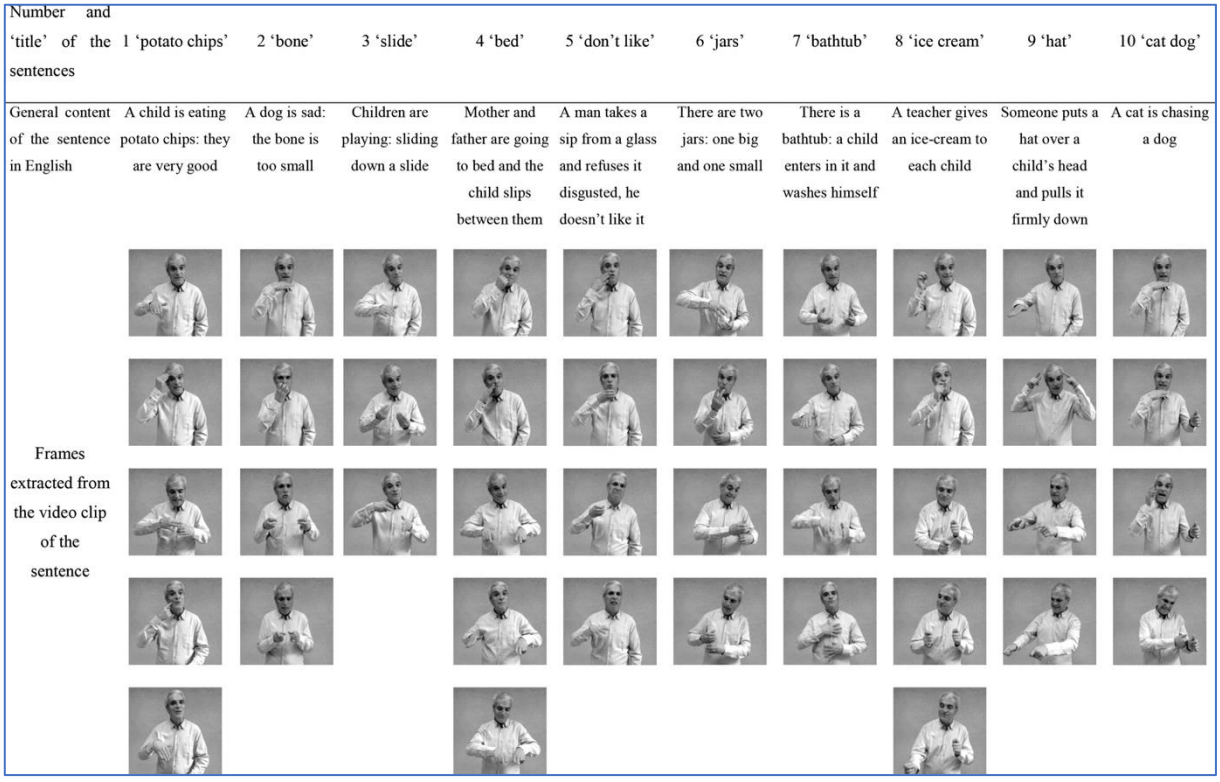

Figure 3. Title, general content and video clips for each sentence of the LIS-SRT (Rinaldi et al., 2018; p. 411, figure 2)

Rinaldi and his colleagues constructed a scoring grid in a vertical way to make it possible to score each produced sign separately. An example of a part of the scoring grid is shown in figure 4. First a direct scoring was done and if the signs were imitated wrong a further qualitative analysis was made. A sign was counted as 'incorrect' if there was a deviation from the example on: manual parameters (handshape, location, movement, and orientation), agreement and/or use of space, use of the non-dominant hand and non-manual components (facial expression, eye gaze, mouthing/mouth gestures and body movement or role shift). Also, omissions and substitutions of lexical signs were considered as incorrect. On the sentence level they looked at the sign order, adding of signs and mirroring but those mistakes were not scored as incorrect. Compared to the scoring on the NGT-SRT and SASL-SRT, the scoring on the LIS-SRT was stricter as they took more (non-manual) elements into account.

In the quantitative results on sentence level (total number of correct reproductions of the whole sentence) and sign level (total number of correct reproductions of single signs) Rinaldi et al. found that the (mean) number of correct reproductions went up per age group. However, only a significant difference ($p < .01$) was found between the results from the youngest group children and the other two groups. No significant difference in results was found between the group of older children and the deaf adults. The qualitative analysis of the results showed correct sign order was violated in some of the sentences. The group of younger children violated sign order significantly ($p < 0.5$) more frequent than the older children and adults just as they omitted significantly ($p < 0.1$) more signs than the other two groups. As for the non-manual components all together, the youngest group of children showed significantly more errors in that category than the older children ($p = 0.2$) and the adults ($p < 0.1$). The older children subsequently showed a significant difference with the adult group ($p = 0.2$). According to the researchers this result is in line with earlier research about acquisition of non-manual elements of a sign language and production of these elements simultaneously with manual signs and in more complex sign language structures.

Frames from the model (Units)	Participant's production Glosses/SW/Frames	Is the unit produced?	If produced, is it CORRECT?	If uncorrect, what is DIFFERENT?	Scores
		YES	YES		1
		NO	NO	Different sign	
				Handshape	
				Movement	
				Orientation	
				Use and/or maintainance of the non dominant hand	
				Agreement and/or use of the space	
				Facial expression	
				Eye gaze	
				Mouthing / Mouth gesture	
				Body movement / Role taking	

Figure 4. Example of the scoring grid used for the LIS-SRT (Rinaldi et al., 2018; p. 413, figure 3).

In their discussion Rinaldi et al. mention they knowingly did not put the test items in an increasingly order of complexity as the other SRT's did because they didn't want to frustrate participants with consecutive difficult sentences. In case of an SRT without beforehand determined complexity levels they claim it is better to score the whole test instead of working with start and end thresholds. They say this is also related to the fact that sign language often shows a lot of accepted linguistic variations and establishing a specific level of difficulty of specific constructions is difficult. This does seem in accordance with some results of the NGT-SRT and SASL-SRT where participants with an established lower sign language proficiency or younger children were able to imitate sentences from an assumed high(er) complexity level correctly but imitated sentences with an assumed lower complexity level

incorrectly. Whether or not a categorization of complexity levels is made for test sentences, in the construction phase of a new SRT, as the construction of the SRT-NGT-kids, discussion about the grammatical construction of the sentences in relation to the order of the sentences within the test must be done. If the order of test sentences in a future SRT is not random it is important to put the simpler test sentences at the beginning of the test building up to test sentences with more difficult grammatical constructions.

As an overall conclusion Rinaldi and his colleagues state the LIS-SRT is sensitive enough to differentiate between the linguistic skills of the three different age groups as the youngest group had the lowest results, and the older children subsequently performed worse than the adult group. From the qualitative analysis they found that the non-manual features of the sentences are the latest and hardest ones to acquire. Although this study by Rinaldi et al. (2018) was done with a relatively small number of participants, the researchers do think that the results of this study indicate that in assessing sign language acquisition and/or proficiency with an SRT, all elements, manual and non-manual, should be considered when scoring the test.

2.4.3. Use of sign language SRT's as a clinical marker for SLI in sign language users?

Approximately 7% of all normal hearing children have a specific language impairment despite not showing any deviations in e.g., non-verbal IQ, motor development. Deviation from normal hearing normally rules out the diagnosis of SLI because of associated delays in spoken language development in case of auditory impairments. Notwithstanding, there are DHH children who use sign language as their L1 from birth but whose sign language acquisition does not develop as expected. Some case studies have been presented about DHH children that display markers of an SLI (Marshall et al., 2015; Quinto-Prozos, 2022).

It is possible to establish the diagnosis of a specific language impairment (SLI) in deaf people when information about all languages used is taken into consideration and when one is very much aware that and understands how language deprivation can interfere with the SLI diagnosis (Henner et al., 2018). Whether a sign language SRT can be used as a clinical marker for SLI in deaf children using sign language in a similar way as with spoken SRT's for normal hearing children using spoken language is according to (Baker, 2022) still an unanswered question.

Marshall et al. (2015) conducted a study on sign language sentence repetition skills with 11 DHH children (age 7;4 – 12;9) who showed signs of an SLI in BSL and 11 DHH children (age 6;10 – 13;0) without any signs of an SLI as a control group. In this study they wanted to find out if children with a presumptive SLI in sign language would have difficulty

with a sign language SRT and what elements of the SRT would be particularly impaired. All the children from the test group had hearing parents but had been exposed to BSL provided by native signers during a mean period of time of 6.1 years. The children from the control group had been exposed to native signers of BSL during a mean period of 5.7 years.

The researchers describe they constructed an SRT in BSL of 20 sentences with different levels of complexity. No description is given about these levels of complexity. In the appendix of the article showing the test sentences only 17 sentences are presented. Also scoring is done on those 17 sentences. Absolute scoring was done on the sentences, lexical signs, sign order, accurately reproduced meaning of the sentence, facial expression, and verbal morphology. Any omissions, substitution or addition to sentences or signs as well as changes in sign order were scored as incorrect. In case of lack of facial expression or changes to it that caused a change in meaning of the sentence were also counted as incorrect.

The results on correct whole sentence repetition in this study for both groups were very low, respectively a mean number of 1.36 repetitions for the SLI group and 3.55 for the control group. Despite these very low scores there was a significant difference between these two results ($p = 0.044$). There was a marginal correlation ($p = 0.055$) between the age of the children and the overall score in both groups. Looking at the different elements of the sentences significant differences were found between the test group and control group for lexical content, sign order, expression of meaning, and facial expressions. There were no significant differences between the groups on verbal/spatial morphology although when they looked more specifically significant differences were found for imitation of classifiers and agreement verb morphology.

In their discussion Marshall et al. (2015) mention not having any norm scores for how children within the age range of the test and control group should perform on this sentence repetition task. Nevertheless, it remains clear the test group had significantly more difficulties in correctly repeating the sentences. The reported difficulties did show high resemblances with difficulties in spoken language sentence repetition in children with normal hearing and therefore a sign language SRT can be used as a clinical marker for SLI in sign languages.

In my master thesis, presenting a very first version of an NGT-SRT for children, I will not directly focus on DHH children with a presumed SLI in NGT. But that doesn't mean that the NGT-SRT for children might not be usable for testing DHH children with a presumed SLI in the future.

3. Methodology

In this methodology section I first describe the participants involved in the pilot of the NGT-SRT-kids. In the paragraph about the materials (paragraph 3.2) the test items itself are described (paragraphs 3.2.1 – 3.2.2) as well as the characteristics of the NGT grammatical elements included in the test items (paragraph 3.2.3). In the last two paragraphs the procedure of the pilot (paragraph 3.3) and the statistical elements used in this pilot are described (paragraph 3.4).

3.1. Participants

All the participants in the pilot study of the NGT-SRT-kids are DHH participants who use NGT on a daily basis. The participants are a group of young adults and another groeup of children who attend one special primary school for DHH children in The Netherlands. Besides the participants in the pilot study one deaf adult L1 user of NGT was involved for recording the test items and five other deaf adults were consulted during the first stage of composing the test sentences of the SRT-NGT-kids.

3.1.1. Adult deaf L1 user of NGT

The deaf adult L1 user of NGT is a research assistant at the Center for Language Studies and the Department of Language and Communication of the Radboud University Nijmegen. He was involved in discussing the sentence constructions of the test items and he is the person that is visible in the videoclips of the test sentences. He recorded the test sentences himself after which they were discussed again and approved or recorded again. Some sentences were recorded again before the pre-pilot with the deaf young adults. This was mostly done because we were not satisfied with the quality of the videoclip. Two sentences were recorded again after the pre-pilot with the young adults and before the pilot with the DHH children. This was done based on the feedback from the young adults. The deaf research assistant was also involved in the discussions about the participants responses.

3.1.2. DHH young adult NGT users

Five deaf young adult users of NGT (average age 27, ranging from 22 to 34) were involved in a so-called ‘pre-pilot’ with the NGT-SRT-kids. The pre-pilot was done before the pilot with the DHH children. Based on the results of the pre-pilot it was possible to make some changes to the form and order of the test sentences before the pilot with the DHH children. It was a deliberate choice involving only young adults (age between 18 – 35 years old) because they all attended a bimodal bilingual educational setting similar to the one of children in special primary schools for DHH children nowadays. All five participants attended one of the

bimodal bilingual special schools for DHH learners in the Netherlands most of their primary school years. Two of the five young adults also attended a regular primary school. They did so in the highest grades of primary school. Details of the five participants are given in appendix 2a.

3.1.3. DHH primary school children

Initially nine primary school aged children participated in the pilot study. During the period of this study one of the children became seriously ill and was therefore unable to finish the pilot study. All eight remaining participants attend the same special primary school for DHH children in Rotterdam in The Netherlands. This school has a bimodal bilingual language policy (Koninklijke Auris Groep, 2021). Classes are given in both spoken Dutch, always accompanied with supporting signs, and NGT. Amongst the students spoken language and/or sign language is used both, in different degrees, inside and outside the classrooms. The DHH children attend different educational grades, ranging from grade 3 to 7. One child attends grade 3, two children grade 4, three children grade 6, and two children attend grade 7. All participants started their school career at this school in grade 0 (at three years old) or grade 1 (at four years old) and therefore received NGT classes for at least 2 years. Two of them are hard of hearing (HH) and use hearing aids. Another HH participant is using a combination of a hearing aid and a bone conducted hearing device (BCD). Five participants are deaf and use one or two Cochlear Implants (CI). Four participants have one or two DHH parents, the other four participants only have hearing parents. The linguistic situation at home of the children is very divers; mostly a combination of a spoken language (e.g., Dutch, English, Arabic) with supporting Dutch signs is used in the home situations. With four participants (who have one or two DHH parents) NGT is also used at home but always in combination with spoken Dutch. Details of the eight DHH children are given in appendix 2b.

3.2. Materials

Materials used in this pilot study are the first version of the SRT-NGT-kids and the sub-tests ‘zinsvorming’ (‘sentence production’) and ‘zinsbegrip’ (‘sentence comprehension’), which are part of the T-NGT, (Testbatterij Nederlandse Gebarentaal, Hermans et al., 2010). These two subtests were included in the study to be able to answer the sub-research question: What is the relationship between the scores on the SRT-NGT-kids and concurrent scores on the T-NGT sub-test ‘zinsvorming’ (sentence production) and ‘zinsbegrip’ (sentence comprehension)? All test materials are described in more detail in the following paragraphs.

3.2.1. The T-NGT subtests 'zinsbegrip' and 'zinsvorming'.

The T-NGT, 'Testbatterij Nederlandse Gebarentaal', consists of nine sub-tests divided over different linguistic levels: phonology, vocabulary, morpho-syntax, and narration. Both receptive and expressive sign language skills are tested. The test is made for children aged 4-12 years old. The T-NGT is (partially) used in the special primary school of the group of DHH children of this study to follow up their NGT development once per school year (Hermans et al., 2010). In this yearly linguistic follow-up only a limited set of subtests are used because of a limited amount of time.

For this study the sub-tests 'sentence comprehension' and 'sentence production' are used to relate to the results of the pilot version of the SRT-NGT-kids. The choice for the subtest 'zinsbegrip' is based on the assumption that children need to understand what is produced in NGT to be able to repeat the NGT sentence of the SRT-NGT-kids. The choice for the subtest 'zinsvorming' is based on that we want to find out if this subtest and the SRT-NGT-kids measure the same linguistic skills or not.

The subtest '*sentence comprehension*' consists of 47 test items. The items are divided over three blocks of 12 items and one block of 11 items. For each item participants see a short videoclip of an NGT sentence or phrase on a computer screen produced by a deaf adult user of NGT. After this clip they see three or four pictures on the screen and must choose the picture that represents the meaning of the NGT sentence best. The children are allowed to see the video clip of the NGT sentence twice if they wish to. An example of a parctice item of this subtest is shown in figure 5. Scoring of this sub-test is done automatically in the online test environment BergOp. If a child scores incorrectly on three out of eight subsequent items, the test automatically stops. This is also the case if four items in one of the blocks of items are chosen incorrectly.

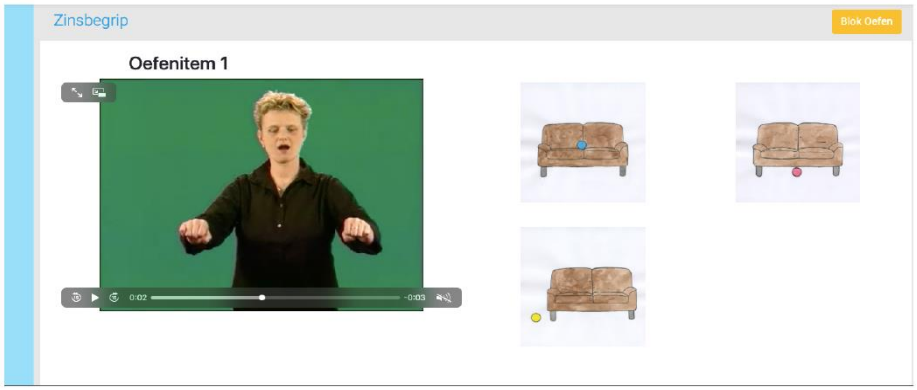

Figure 5. Example item T-NGT sentence comprehension (Hermans et al., 2021, page 40-figure 23)

The sub-test '*sentence production*' consists of 24 items. For each item participants see a picture on the screen. Next to the picture, a short clip is shown in which a deaf adult user of NGT describes the picture, using one simple sentence. After the clip another, different picture is shown which can be described by using a sentence which is grammatically similar to the NGT sentence in the initial videoclip. The participants are invited to produce one simple sentence which describes the second picture. An example of a practice item of this subtest is shown in figure 6. Scoring of this sub-test is done in the online test environment BergOp. The test administrator scores for the aimed grammatical construction in the test item. Because NGT allows for several grammatical variants as 'correct' answers, criteria for a correct answer are given per item. The test items are grouped for different syntactic and morphological structures:

- 3 items: adapting nouns for size (use of a classifier or adding an adjective)
- 10 items: producing spatial relations (locative use of classifiers or use of index)
- 4 items: production of 'verbs of motion' (use of classifier)
- 4 items: production of a sentence with a subject and indirect object (use of directional verb)
- 3 items: production of a sentence with a subject, direct object, and indirect object (use of directional verb).

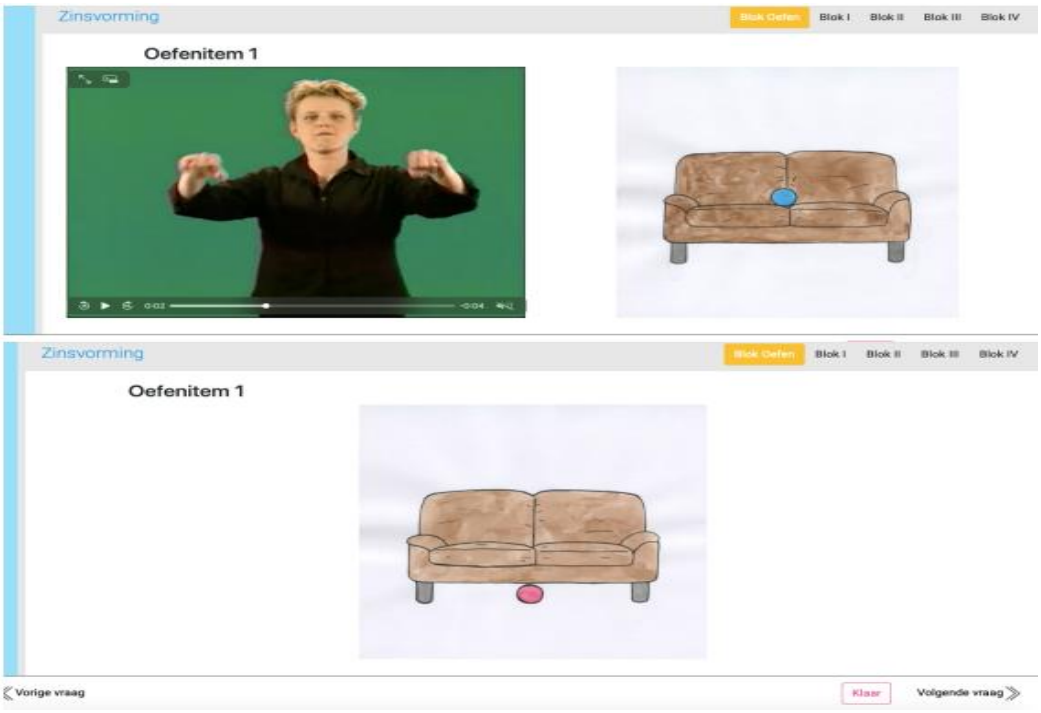

Figure 6. Example item T-NGT sentence production (Hermans et al., 2021, page 43-afbeelding 25)

For both sub-tests the scoring profiles look the same. When all items are scored a sub-test profile is provided with the number of correctly produced items ('raw score'), the standard deviation, and a norm scoring category (category I – V). Norm scoring category I is the lowest category, category V the highest. An example of a sub-test profile is given in figure 7. It is also possible to see which item is produced correctly or incorrectly per group of items (Hermans et al., 2021).

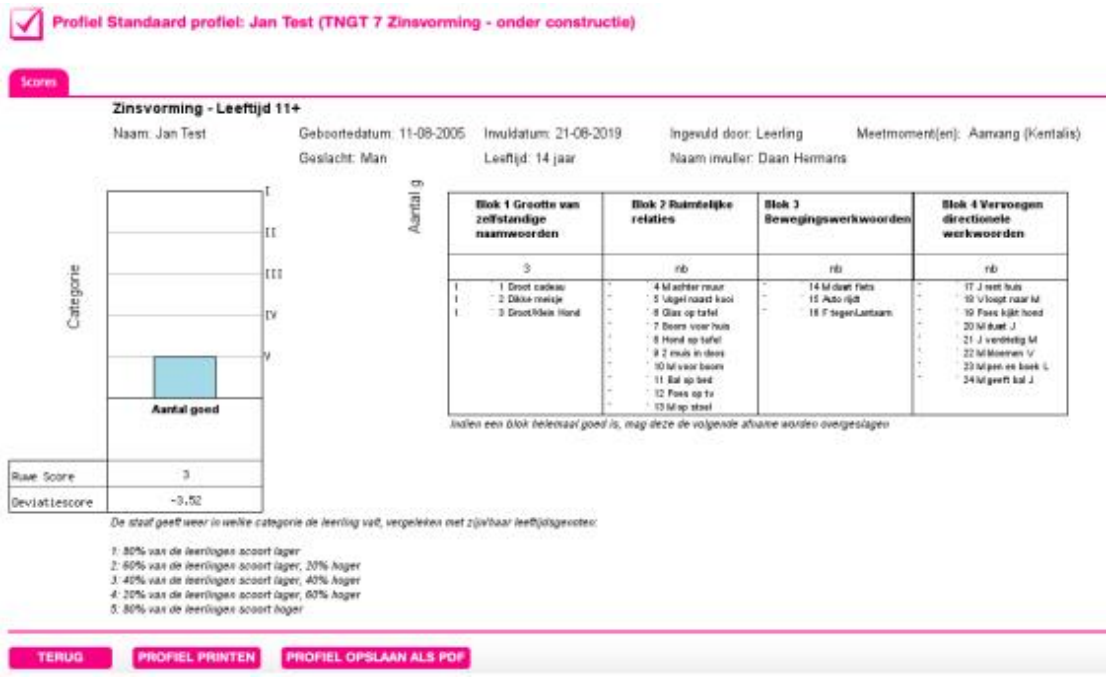

Figure 7. Example of sentence production the sub-test profile (Hermans et al., 2021, page 46-figure 27)

3.2.2. Pilot version SRT-NGT-kids

When constructing the first pilot version of the SRT-NGT-kids, steps and procedures as described by Haug (2011) and given in appendix 1are followed. Table 6 provides an overview of the steps specific for the SRT-NGT-kids.

Table 6. Steps constructing pilot version NGT-SRT-kids according steps and procedures by (Haug, 2011).

Steps	Description	Procedure/Method
1. Test items (SRT-NGT-kids)	- Gathering test items from other SRT's - Identification of lexical items suitable for children	- Literature study - Consultation deaf native users of NGT - Consultation linguists / thesis supervisor

	- Identification of topics suitable for children - identification specific NGT-elements	
2. Test materials	- Translation of items from other SRT's to NGT - Construct final pilot test items of the SRT-NGT-kids - Sub-tests 'sentence comprehension' and 'sentence production' T-NGT	- First draft of test items - Consultation deaf native user of NGT - Consultation linguists - Preparing sub-tests T-NGT
3. Construct definition	- Decide about order of test sentences - Adjustment of order test sentences after pre-pilot with young adults. - First scoring grid	- Order pre-pilot young adults based on results from original studies with the other SRT's - Order pilot DHH children based on results from pre-pilot young adults - Discussing items scoring grid
4. Adaptation test items	- Translation test items to NGT + suitable for children - Adjustments to test items after pre-pilot young adults	- Consultation deaf native user of NGT - Check literature - Use of feedback on test items from young adults
5. Technical realization	- Filming of the test sentences - Constructing a test format in PowerPoint	- Collaborate with deaf native user of NGT for filming the test items
6. (Pre-) Pilot	- First a pre-pilot with deaf young adults - Second a pilot with deaf children	- Preparing the (pre-)pilot - Conducting the pilots: 1. Young adults, 2. Deaf children
7. Analysis (pre-)pilots	- analysis of the results of the two pilots. - Recommendations for adjustments to	- Quantitative and qualitative analysis of the results.

	the test items/order/ scoring etc. - Recommendation for future studies / a second (larger) pilot	- Back to earlier steps to improve the test items and test itself.

As mentioned in the descriptions of the three SRT's a few important suggestions were given when constructing a new SRT: (1) rethink the *order of the test items* based on grammatical complexity, (2) use of lexical items that have *no or only one used variant and are suitable for children*, (3) insert *question sentences*, and (4) determine whether and which *non-manual elements* to take into account when scoring the test. These four points are elaborated on in the subsequent paragraphs.

The 32 items of the pilot version of the NGT-SRT-kids are mainly based on items from the NGT-SRT (24 items) - the adult version (Schüller, 2018). Not all 39 sentences from the NGT-SRT (adult version) are used. Mostly complex-level sentences are omitted because these sentences are too long and complex for children 6-10 years old. The suitable 24 sentences were complemented with some items from the SASL-SRT (7 items), children's version (Palmer, 2020) and LIS-SRT (1 item), children's version (Rinaldi et al., 2018). These SRT's are described in paragraph 2.4.2.1 – 2.4.2.3. The different sentence types and other morphological NGT features mentioned in table 2 were taken as the main guideline when collecting and constructing the sentences for the NGT-SRT-kids. From the SASL-SRT several interrogative sentences were translated into NGT, as these sentences were not present in the NGT-SRT. Also, a sentence containing fingerspelling, sentences with a temporal or conditional clause and sentences with negation were copied and translated from the SASL-SRT. From the LIS-SRT a sentence with a subordinated clause was copied and translated. An overview and description of all the items from the pilot version of the NGT-SRT-kids is given in appendix 3.

3.2.2.1. Order of the test items

The items of the pilot version of the NGT-SRT-kids that was presented to the DHH young adult participants are divided in three levels of complexity. These three levels of complexity are based on descriptions of the sentences in the original studies and the percentage of correct responses of participants in the original pilot studies of the three SRT's. It can therefore be that a test item that was first categorized as a 'moderate difficult' item in the original study is now categorized as a 'simple' item based on the percentage of correct repetitions in these studies. After the pre-pilot with the DHH young adults in the current study, the order of the

test sentences for the primary school participants were rearranged based on the percentage of correct responses of the DHH young adults. 'Simple' sentences in the test version used in the subsequent pilot with the DHH children had a percentage of correct responses in the pre-pilot with the young DHH adults of 100-80%, 'moderate' sentences 60-40%, and 'complex' sentences 20-0%. The categorization of levels of complexity of the test items of the NGT-SRT-kids might get rearranged in subsequent versions, based on new data from more children in future studies. Also, the number of items in this pilot version does not have to be the number of items in subsequent versions of the test, all depending on the results of this pilot study and some additional studies. The order of the test sentences in the pilot with the young adults and primary school participants is given in table 7.

Table 7. Order of test sentences SRT-NGT-kids in the two pilot versions.

Sequence test sentences DHH young adults ('pre-pilot')	**Complexity level**	**Sequence test sentences DHH primary school participants ('pilot')**
1	S1	14
2	S2	1
3	S3	2
4	S4	22
5	S5	3
6	S6	4
7	S7	8
8	S8	15
9	S9	9
10	S10	10
11	S11	16
12	M1	17
13	M2	18
14	M3	19
15	M4	23
16	M5	20
17	M6	31
18	M7	24
19	M8	11
20	M9	25
21	M10	5
22	M11	6
23	M12	21
24	C1	26
25	C2	32
26	C3	27
27	C4	7

28	C5	28
29	C6	29
30	C7	12
31	C8	30
32	C9	13

As reported in the original studies of the different SRT's complexity levels are amongst other factors also based on the number of manual lexical signs within a sentence. In appendix 3 the number of manual lexical signs in the SRT-NGT-kids is given per sentence. The mean number of manual signs per sentence for each complexity level is given in figure 8.

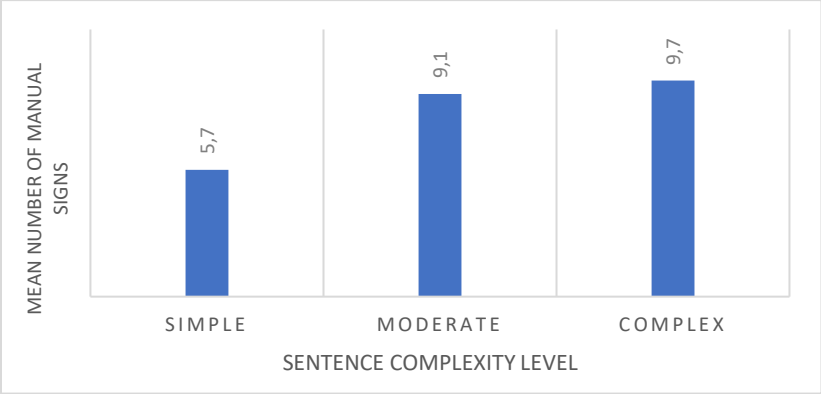

Figure 8. Mean number of manual signs per sentence per complexity level (pre-pilot DHH young adults).

Based on the quantitative results of the pre-pilot with young DHH adults the order of the test sentences for the subsequent pilot with the DHH children is re-arranged as is presented in table 7. This resulted in a different distribution of the sort of sentence types and other morphological features over the three complexity levels as earlier presented earlier in table 2 in paragraph 2.4.2.1. The description of sentence type and morphological features per sentence are given in appendix 3. A summary of the sentence types and morphological features grouped per complexity level as present in the pilot version for the DHH children are given in table 8.

Table 8. Description of sentence types + morphological features of the SRT-NGT-kids children's version per complexity level.

#	**Sentence types + morphological features**
Level 1 'simple'	Topicalization → non manual (OSV, OVS) Short, declarative sentences Interrogatives – polar questions / wh-questions Complement clauses Classifier constructions Oral component → non manual Verbal agreement / verbal inflection

	Numeral incorporation Modal verbs + negation → simultaneous non-manual marking Negation – non manual Conditional clauses Fingerspelling
Level 2 'moderate'	Topicalization → non manual (OSV, OVS) (short) Declarative sentences Interrogatives – polar questions / wh-questions Complement clauses Classifier constructions Oral component → non manual Verbal agreement/ verbal inflection Numeral incorporation Temporal clauses Reason clause Embedded clause Question-answer pair Plural marking Aspect/manner marker
Level 3 'complex'	(no short declarative sentences – only complex/multiple sentences) Question-answer pair Coordinating clause Reason clause Temporal clauses Multiple clauses Modal verbs + negation → simultaneous non-manual marking Verbal agreement/ verbal inflection Numeral incorporation Plural marking Aspect/manner marker Classifier constructions

The re-ordering of the sentences over the three complexity levels also resulted in a change of mean number of manual lexical items per complexity level. The mean number of lexical items per complexity level for the 'new' order of the sentences as in the pilot version for the DHH children is given in figure 9 below.

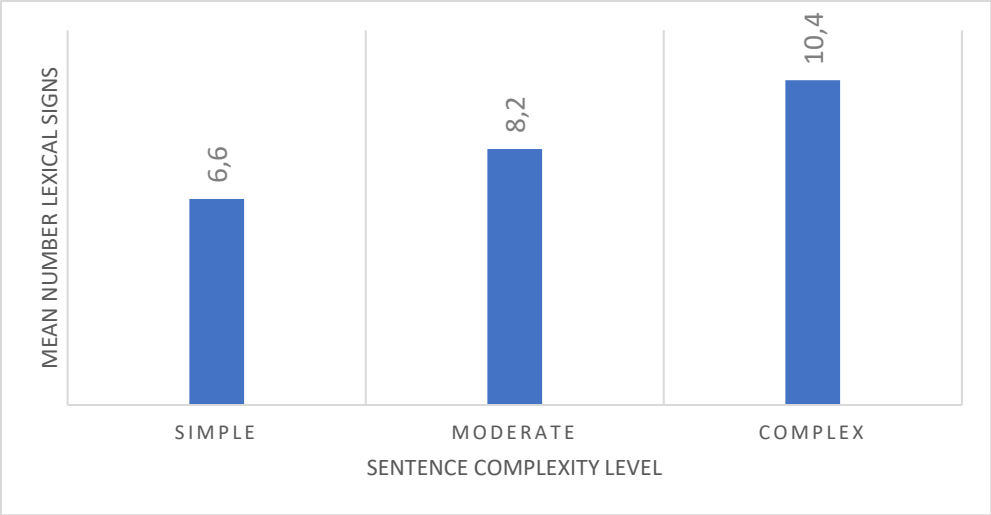

Figure 9. Mean number of manual signs per sentence per complexity level (new order).

3.2.2.2. Choice of lexical items

As mentioned in paragraph 2.4.2.2, Palmer (2018) states it is of utmost importance to choose lexical items for an SRT for children all participants are familiar with. When constructing the test items for the NGT-SRT-kids, this point was taken into consideration and explained in this paragraph.

The original test items from the NGT-SRT for adults contained a lot of topics and lexical items that were not suitable for children. When I was re-writing the test items for children, I searched for topics that should be familiar for children from 6 years and older. An example of a topic that is replaced is given in examples 8 + 9 below.

8. ‘Mijn dochter is 3 jaar oud’ (SRT-NGT-adults)
   ‘My daughter is three years old’

9. ‘Mijn poes is 3 jaar oud’ (SRT-NGT-kids)
   ‘My cat is three years old’

All lexical items were compared to the BAK-list (‘Basic word list Amsterdam toddlers’) (Mulder et al., 2009). This word list contains 2000 Dutch words that are considered as a minimal vocabulary children should have acquired before entering primary school grade 3 in which official reading instruction starts. Most children are 5 or 6 years old when they enter grade 3 of primary school. This is also the minimum age of the primary school participants in this pilot study. The list also contains 1000 extra words that are seen as ‘preferably acquired’ words. Of the lexical items used in the pilot sentences, only 6 of them were not present in the BAK-list: having lunch, fidget, Amsterdam, building, causing, to flood (see table 9).

Table 9. Lexical items not present in the BAK-list (Mulder et al., 2009)

Lexical item + translation	**Type of sign**
LUNCHEN – having lunch	Initialized sign (handshape is 'L', first letter of the word.
FRIEMELEN – to fidget	Iconic sign – depicting sign
AMSTERDAM-ns - Amsterdam	Name sign
GEBOUW - building	Iconic sign
GEVOLG - causing	Arbitrary sign
OVERSTROMEN – to flood	Iconic sign

For the NGT-SRT-kids test items that are based on items from the SASL-SRT and LIS-SRT, I checked whether cultural aspects present in the sentences might not be suitable for the Dutch situation, but this was not the case.

A second issue regarding the choice of lexical items is *lexical variety*. In NGT lexical items can often be produced with different, regional, lexical variants of one sign. In the online dictionary of the Dutch Center for Sign Language (Nederlands Gebarencentrum: https://ow.gebarencentrum.nl/) all variants of lexical items are shown. Some lexical items have several regional variants, others have only one (standard) variant. An example of regional variants of signs is the sign for FATHER (see figure 10a). The lexical item 'vader' (father) is present in the BAK-list and could therefore possibly be used in the SRT-NGT-kids. The fact that there are 2 regional variants of this lexical item which are mainly used in the specific region they originate from, I chose to replace 'father' with 'papa' (figure 10b) in one of the test sentences. For the lexical item 'papa' also two variants are mentioned in the online dictionary of the Dutch center for sign language but the variant I chose is used and known in all regions of the Netherlands.

Figure 10a. FATHER-v1

FATHER-v2

Figure 10b. PAPA-v1

(Copied from: https://mjegb.gebarencentrum.nl)

For alle the lexical items in the SRT-NGT-kids I chose items that only have one variant or, in the case of two variants, both variants are used in different regions of the Netherlands. Lexical items that have more than two variants mentioned in the online dictionary were taken out of the test sentences and replaced with a lexical item with less variants. For the numerals in the test sentences, I chose numerals below five for two reasons. First, numerals below five can be considered known for children of six years old. Second, the signs for the numerals 1-5 have only one variant in NGT.

3.2.2.3. Insert of questions

The SRT-NGT for adults does not contain interrogative test sentences because this type of sentences was also not present in the SRT-ASL, which formed the basis for the SRT-NGT. Schüller (2018), in the discussion section of her master thesis, recommends inserting interrogative sentences into a future version of the NGT-SRT. The SASL-SRT does contain interrogatives. These sentences were translated into NGT for the SRT-NGT-kids. Two types of interrogatives are included in the test sentences: polar interrogatives (example 10) and interrogatives including a WH-sign (example 11).

10. $^{\text{\_\_ER\_\_\_\_\_}}$ $^{\text{\_\_\_\_\_EF\_\_\_\_\_}}$ $^{\text{\_ER\_}}$
    BOOM INDEX$_3$ GROOT-oc INDEX$_3$ PU (Appendix 3, sentence S2)
    'Is die boom groot?'
    'Is that a big tree?'

11. $^{\text{\_\_ER\_}}$ $^{\text{\_\_\_EF\_\_\_\_\_}}$ $^{\text{\_\_\_\_\_ER\_\_\_\_\_}}$
    BABY INDEX$_3$ VERDRIETIG-oc INDEX$_3$ WAAROM PU? (Appendix 3, sentence S7)
    'Waarom is de baby verdrietig?'
    'Why is the baby sad?'

3.2.2.4. Non-manual elements

Non-manual elements are an important element of sign languages. They convey grammatical information as well as prosodic information, like intonation (Baker et al., 2016). In the description of the test sentences of the SRT-NGT-kids (appendix 3) the produced non-manual facial expressions as well as mouth gestures are given as superscript above the lexical glosses. In chapter 4, an explanation is given which non-manual elements are taken into account when scoring the test results in this pilot study. The explanation of the abbreviations of the non-manual elements in the superscripts are given in the abbreviation list on page V.

3.2.3. Syntactic and morphological structures in NGT

The pilot version of the NGT-SRT-kids contains test sentences with a variety of syntactic and morphological structures. Most test sentences (24) are taken from the SRT-NGT. As those

sentences are already in NGT the syntactic and morphological structures did not have to be adjusted for the SRT-NGT-kids. On the other hand, some of the test sentences were taken over from SASL and LIS and these sentences had to be translated and adjusted, both syntactically and morphologically, to NGT. A short description of syntactic structures and morphological features used in the SRT-NGT-kids are described in the following paragraphs (Klomp, 2021).

3.2.3.1. Syntactic structures in NGT

- Simple declarative sentences: In NGT two constituent orders can be used for simple declarative sentences, SOV or SVO.
- Polar interrogatives (yes-no questions): The constituent order is the same as simple declarative sentences, either SOV or SVO. The non-manual elements 'raised eyebrows' (re) and 'forward head movement' (hm-f) are mandatory in polar interrogatives. The 'PALM_UP' (PU) interrogative particle can be used in combination with polar interrogatives in NGT but is not mandatory. It is often used in a sentence final position but can also be produced in a sentence initial position. Below is an example of a NGT polar interrogative (example 12) and a picture of the PALM_UP particle (figure 11).

12. _____re + hm-f_____
IX$_2$ VEGETARIAN PALM_UP
'Are you a vegetarian?' (Klomp, 2021)

Figure 11. The PALM_UP particle. (Klomp, 2021, p. 266, figure 4.1)

- Interrogatives including a WH-sign: NGT has different WH-signs like 'WHY', 'WHEN', 'WHAT' etc. Depending on the syntactic function (an adjunct or an argument of the verb) the WH-sign can be placed in a sentence initial or sentence final position and/or be used in the position of the sentence if it was a declarative sentence ('in-situ'). In the SRT-NGT-kids the WH-signs WHY, WHERE, WHAT, WHO are included in the test items. Sometimes signers double those signs in both sentence

initial and sentence final position (see example 13) but this is not obligatory. Combinations of the manual signs with non -manual marking in the form of raised eyebrows or frowned eyebrows (fe) and/or head tilt backward (ht-b) are possible. The non-manual marking is used variably by native signers of NGT and sometimes not used at all. The non-manual marking therefore doesn't seem to be mandatory. Similar to the use of the PALM_UP particle in polar interrogatives, the PALM_UP particle can also be used in the WH-interrogatives.

13. _____fe + ht-b ____
WHY COCHLEAR_IMPLANT WHY
'Why a cochlear implant?' (CNGT0130, S08, 00:50.200-00:51.680)
(Klomp, 2021; page 268)

- Imperatives: There are different types of imperatives which may have its influence on the verb form or on the constituent order. In the SRT-NGT-kids only one imperative clause is inserted, in this case as an instruction in a complement clause (see example 14). With an imperative sentence often imperative particles are used although they don't seem to be mandatory. One of these particles used in NGT is the REQUEST-particle ('VERZOEK') which is produced in a sentence initial position.

14. _ER_ __ER___ _____ER_____
JUF INDEX$_3$ / INDEX$_3$ $_3$VRAGEN$_1$: VERZOEK INDEX$_2$ LAMP LICHT^AAN INDEX$_2$
'The teacher asks me: "would you please turn on the light"'
(sentence M1, NGT-SRT-kids, appendix 3)

- Negative declarative sentences: In NGT negative declarative sentences can be produced by using manual negative signs, non-manual marking, and a combination of both. An example of a manual negative sign is the negative particle for NOT. This particle can take on a couple of forms depending on the context. The position of a negative particle is most of the time post verbal and sentence final although it has been found in the NGT-corpus (Crasborn et al., 2008) that a negative manual sign is produced before the verb, but it seems less common. The mandatory non-manual marking for negatives is a headshake. The headshake always spreads over the verb and manual negative sign (if produced) but might also spread over other manual signs in the sentence. Sometimes another non-manual marker for negation, a tense mouth spread, can be used but is not mandatory. Negation in NGT can be expressed by

adding morphological morphemes to (modal) verbs and is also present in some sentences of the NGT-SRT-kids. This construction is further described in paragraph 3.2.3.2.

- Coordinated and subordinated clauses:

- Question-answer clauses: Question-answer pairs contain an interrogative clause with a specific discourse function. The question is posed and answered by the speaker himself to provide fore- and background information. It is a specific syntactic structure used in sign languages. Below is an example (example 15) of a question-answer pair as present in the SRT-NGT-kids.

15. _____SE_____ _____ER_____
VANDAAG INDEX$_1$ ZIEK^GEVOEL-oc / INDEX$_1$ SCHOOL GAAN KAN
____ER___ _____HS____
INDEX$_1$ PU? / KAN^NIET
'Today I'm not feeling well. Can I go to school? No, I cannot'
(Sentence M6, SRT-NGT-kids, appendix 3)

- Conditional clauses: In a subordinated conditional clause a condition or truth-statement is present. The outcome of the main clause is dependent on the conditional clause. Conditional clauses always carry a non-manual marker if a manual marker is not present. Non-manual marking can be raised eyebrows, a head movement forward or a head tilt forward. If a manual marker is present, non-manual marking is not obligatory. An example of a manual marker for a conditional clause is a sign that is glossed as STEL ('SUPPOSE') or ALS ('IF'). This sign can be accompanied by an oral component FFF or mouthing 'stel' ('suppose') or 'als' ('if'). Sentence M11 of the SRT-NGT-kids contains a conditional clause (example 16).

16. _____ER_____ _____HS_____
ALS-oc:FFF MORGEN REGEN/ INDEX$_1$ ZWEMMEN GAAN INDEX$_1$
'If it is raining tomorrow, I won't go swimming'
(Sentence M11, SRT-NGT-kids, appendix 3)

- Temporal clause: In the case of a temporal clause there is a temporal relationship between the events expressed in the main and subordinated clause. The temporal relationship between the clauses can be expressed through manual and/or non-manual marking. Non-manual marking of temporal clauses is commonly produced but is not mandatory. Non-manual marking for temporal clauses can be done with eyebrow

movement, squinted eyes or head movement. Sentence S11 of the SRT-NGT-kids (see appendix 3) contains a temporal clause.

- Reason clause: In a reason clause, as in sentence M2 of the SRT-NGT-kids (see appendix 3), a reason of the event in the main clause is given. The manual sign OMDAT ('BECAUSE') or DAAROM ('THEREFORE') is used as the conjunction between the main clause and reason clause. The sign for both lexical items is the same but with different mouthings (see figure 12). There are no dedicated non-manual markers that are produced with reason clauses. In case of production of a reason clause, the main clause always precedes the reason clause.

Figure 12. Conjunction OMDAT (BECAUSE)/ DAAROM (THEREFORE) (Klomp, 2021, p. 371, figure 4.23)

- Indication of time: In NGT, as for word order, time indication is mostly produced in a sentence initial position using a time adverb e.g., GISTEREN (YESTERDAY), NU (AT_THIS_MOMENT). Sentence M4, M6, M9, C2, C3 and C7(see appendix 3) have an indication of time in a sentence initial position. Sentence M11 (see example 16 above) also contains a time related adverb but not in a sentence initial position because of the manual sign ALS (IF) that indicates a conditional clause. The time related adverb MORGEN (TOMORROW) takes in the second position in the clause.
- Topicalization: With topicalization phrases of a sentence are put at the beginning of the sentence to give them more emphasis. Through this construction phrase order can deviate from the standard phrase order. In NGT the standard phrase order is SOV. Topicalization is non-manually marked with raised eyebrows and often a short hold of the last sign of the phrase. Below are two examples of topicalization in the test sentences of the SRT-NGT-kids, one without change of standard phrase order (example 17) and one with change of standard phrase order (example 18).

17. _____ER / T_____
MIJN POES INDEX$_3$ DRIE JAAR OUD INDEX$_3$
'My cat is three years old'
(Sentence S10, SRT-NGT-kids, appendix3)

18. _____ER_____
OMA INDEX$_{3B}$ / DRIEEN VAAK 3aBEZOEKEN3b++ /
___ER__
DRIEEN ETEN KOKEN $_1$HELPEN$_3$
'The three of us often visit grandma to help cook dinner'
(Sentence C6, SRT-NGT-kids, appendix 3)

3.2.3.2. Morphological features in NGT:

Several morphological features are present in the test sentences of the SRT-NGT-kids. These features are described below.

- Negation of (modal) verbs: In NGT a few (modal) verbs can be negated by modifying the movement and/or handshape of the sign e.g., CAN^NOT (KAN NIET), WANT^NOT (WIL NIET), NEED^NOT (HOEFT NIET). In the SRT-NGT-kids the negative irregular verbs CAN^NOT and WANT^NOT are included. With these verbs the negative particle NOT is in some form added to the verb sign in the form of a bound morpheme. In figure 13a and 13b the plain verb and morphological changed negative form of the verb is shown. Although it is not (yet) known at what age exactly native signers acquire this morphological feature, the negative form of the verbs is used a lot by professionals like teachers working with deaf children.

Figure 13a. CAN CANNOT (Klomp, 2021, p. 220, figure 3.48)

Figure 13b. WANT WANT_NOT (Klomp, 2021, p. 221, figure 3.49)

- Directional verbs: Directional verbs are verbs that are adjusted in movement and orientation, so the start and end point of the movement indicates the subject and (indirect) object of the sentence. Sentence M10 of the SRT-NGT-kids for example, contains the directional verb GIVE_TO which movement of the plain verb is adapted from the subject of the sentence (GIRL) to the indirect object (BOY) of the sentence.
- Intensive marker: Some adverbs or verbs in NGT can be marked for intensity meaning that the state of activity is more intense than usual. The intensive marker is produced non-manually through frowned eyebrows, puffed cheeks, squinted eyes, and blowing out air (see example 19).

19.
___SE + oc: pfff_ _____ER_____
INDEX$_1$ 2^UUR^LANG FIETSEN++ / EINDELIJK AANWEZIG-locatief /
____HN_____
INDEX$_1$ MOE INDEX$_1$!
'After two hours of cycling I finally arrived. I'm very tired'
(Sentence M7, SRT-NGT-kids, appendix 3)

- Diminutive and augmentative marker: Diminutive and augmentative markers are bound non-manual morphemes attached to nouns and/or size-and-shape specifiers to express the entity is (very) small or (very) big. The diminutive marker can be expressed by tongue protrusion, frowned eyebrows and/or squinted eyes (see figure 14). The augmentative marker can be expressed by puffed cheeks, squinted or wide-open eyes and a backward body lean (see figure 15).

Figure 14. Diminutive marker (frowned eyebrows + squinted eyes) combined with the sign BIRD → 'small bird' (Klomp, 2021, p. 191, figure 3.23)

Figure 15. Sign MEAT + squinted eyes followed by an augmentative marker (puffed cheeks + squinted eyes) combined with a size and shape specifier → 'big piece of meat' (Klomp, 2021, p. 191, figure 3.24)

- Plural marking: In the SRT-NGT-kids plural marking is expressed several times (sentence S1, M2, M7, M8, M12, C1, C2, C6, C7 & C8). In NGT plural marking can be done using different manual markers. These manual markers are not obligatory. In table 10 the manual plural markers that are used in the SRT-NGT-kids are described. There are no obligatory non-manual markers for plural marking. Often mouthing that accompanies plural manual marking is adjusted to the plural form of the spoken word of the lexical item.

Table 10. Type of plural marking in sentences SRT-NGT-kids (description types taken from: Klomp, 2021, p. 229)

	Plural manual marking - type	**Sentence SRT-NGT-kids**
1	Zero marking	M12
2	The stem and the reduplicant(s) are articulated at the same location	M8, C6, C8

3	The stem is reduplicated sideward	S1, M2, M12. C1
4	The stem is reduplicated at different locations, and the reduplications further indicate spatial distribution	M2, M8, C1, C2
5	The stem is reduplicated by using two hands for one-handed signs	C8
6	Numeral incorporation	M7, C6, C7

- Aspect marking: Sentence C6 of the SRT-NGT-kids contains a verb that has aspectual marking. Aspect marking provides information about event's internal temporal structure e.g., if an action is ended suddenly, repeated regularly, or is continued for a longer period of time. Aspect marking on verbs in NGT is produced by modification of the movement of the sign. In the case of sentence C6 (see example 18 above) the movement of the verb TO_VISIT is repeated several times, which is known as habitual aspect marking, indicating the grandmother is visited regularly. In sentence C2 a form of durative aspect marking is produced with the verb RAIN++ in combination with adding the lexical item DOOR++ (CONTINOUSLY) which forms the meaning of 'it rained continuously'.
- Classifiers: In paragraph 2.2.1 information is given about what classifiers are and what type of classifiers there are. Classifiers handshapes entail some semantic form-related features of the entities they represent and are often highly iconic. In the SRT-NGT-kids different classifiers are present in the test sentences. In a similar way as done with plural marking, table 11 below shows which type of classifier is present in which sentence.

Table 11. Classifier types in sentences of the SRT-NGT-kids.

	Classifier type	**Sentences SRT-NGT-kids**
1.	Whole entity classifier	C4, C5, C88
2.	Body part classifier	S11, M8, M12, C5, C8
3.	Handling classifier	M1, M2, M8, M10, C3, C5
4.	Size and shape specifier	M12, C2

3.3. Procedure

Before conducting the pilot with the SRT-NGT-kids on the group of DHH children two test sentences, sentence M9 and C2, were adjusted and recorded again. This was done based on

the qualitative analysis of the results of the pre-pilot with the DHH young adults (described in chapter 4). The adjusted sentences are used in the pilot with the DHH children. The qualitative analysis also had its influence on the scoring grid for the pilot with the primary school participants. Based on the results of correct and incorrect repeated sentences, the 'absolute score', in the pre-pilot with the young deaf adults (described in chapter 4) the sentence order for the pilot with the primary school participants was adjusted.

Both the young adults and children performed the SRT-NGT-kids individually. They were all filmed during the test for which they gave formal permission beforehand. For the children their parents gave formal permission. The information and permission documents are presented in appendices 4 and 5. The special primary school for DHH children all child participants attend also gave permission to perform the pilot in the school during school hours (appendix 5d). The parents of the children also filled in a background questionnaire about e.g., the audiological background, used hearing devices and language(s) used at home (appendix 6).

The actual test situation is presented in figure 16. The participant sits behind a table opposite to the camera. The laptop on which the test sentences are presented is slightly diagonally opposite to the participant.

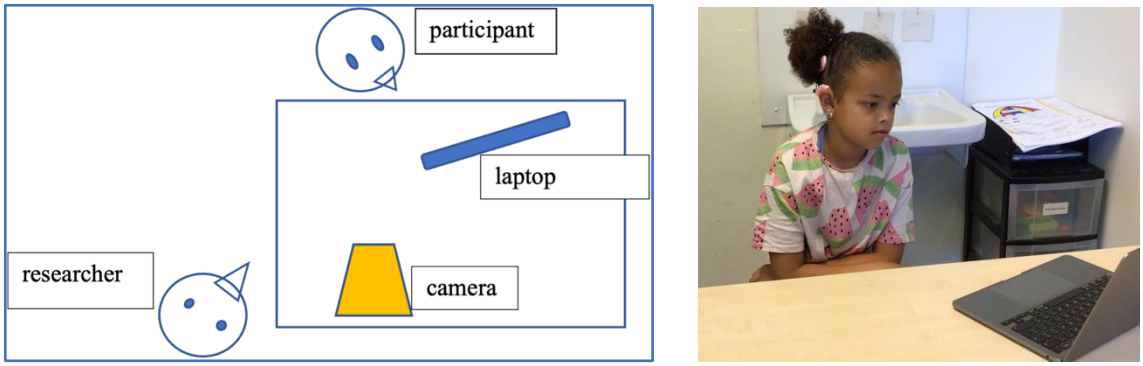

Figure 16. Test setup SRT-NGT-kids – adults & children

The test is introduced by the researcher (myself). Information and instructions are given in either sign supported Dutch or NGT depending on the linguistic preference and /or needs of the participants. Test sentences are presented once at a time in a PowerPoint. Participants see the test sentence once and are asked to repeat the sentence in the exact same way as presented in the video clip for both manual and non-manual elements. After every five test sentences a short break is given. When all test sentences are presented and repeated participants are finished with the test. Total test time for both young adults and children was between 12-17 minutes, including the short breaks in between.

The primary school participants also conducted two sub-tests of the T-NGT, ‘sentence comprehension’ (‘zinsbegrip’) and ‘sentence production’ (‘zinsvorming’). All of the participants performed the sub-test ‘sentence comprehension’ during the annual testing period of the school, in May-June of 2022. Two of the participants also performed the sub-test ‘sentence production’ during this annual testing period of the school, in May-June of 2022. The other six participants did this sub-test in August 2022 specifically for this pilot study. For this sub-test the test setup was the same as for the SRT-NGT-kids. Instructions were also given by the researcher (myself) in either sign supported Dutch or NGT.

3.3.1. Scoring of the SRT-NGT-kids.

Scoring of the repeated sentences of the participants was done in an Excel-file. An example of one sentence in the Excel-file is given in figure 17.

zin S2	Is die boom groot?				
non-manuee	er	er	ef	ef	er
GLOSS L	boom		groot		PU
GLOSS R	boom	index3	groot	index3	PU
orale component			pam		
overig					
respons					

zin S2	Is die boom groot?				
non-manueel/gezicht	er	er	ef	ef	er
GLOSS L	boom		groot		PU
GLOSS R	boom	index3	groot	index3	PU
orale component			pam		
overig					
	er	er	ef	er	
respons	boom	index3	groot	PU	
	boom		groot	PU	
			pam		

Figure 17. Response notation document in Excel – empty + scored

Scoring of the SRT-NGT-kids was done in two ways: an absolute scoring, a ‘correct’ or ‘incorrect’ repetition of the test sentence, and a qualitative scoring. If a sentence was repeated correctly, it was highlighted green, when it was repeated incorrectly, it was highlighted red.

In the absolute scoring some modifications of the repeated sentence compared to the original test sentence were accepted e.g., deletion of a pronoun copy. The boundaries of what is scored as a correct or incorrect repeated sentence were discussed with the deaf research assistant mentioned in paragraph 3.1.1. Because a lot of syntactic and morphological structures of NGT are not very strict in form and certain non-manual elements are not always obligatory, a lot of repeated sentences could, theoretically, be scored as ‘correct’. In the result section strict absolute scoring results are given as well as less strict absolute scoring. In the qualitative analysis, I will elaborate on the choices what is accepted as a ‘correct’ score in the less strict absolute scoring. In the Excel-file color codes were used for certain types of ‘mistakes’ in the sentence repetition. The color codes are given in table 12.

Table 12. Color coding for types of mistakes.

Type of mistake
Lexical variant
Adding an extra lexical element
Deletion of a lexical element
Replacement of a lexical element (no variant)
Change in lexical order
Deletion of a non-manual element (changing meaning)
Self-correction

3.4. Statistics

Because of the small pilot groups all statistical results should be interpreted with care and caution. The statistical results can be interpreted as 'an indication'. All the statistical analyses must be done again in future studies with bigger pilot groups. In this study foremost descriptive analyses are done.

For the consecutive sub-questions, the null-hypothesis and alternative hypothesis are given plus the statistical tests used:

- Sub-question 1:
- H_0: there is no relation between the SRT-NGT-kids test score – chronological age
- H_1: The SRT-NGT-kids test score gets higher in relation with the increase of chronological age.

Because of the very small pilot group with only 1-2 children per age group only a descriptive analysis is done followed by an indication for a trend related to the relation of chronological age to results on the SRT-NGT-kids. As an extension to the original research questions a similar descriptive analysis is also done on the relation between educational grade and score on the SRT-NGT-kids.

- Sub-question 2:
- H_0: Grammatical complexity level and sentence length are not related to the SRT-NGT-kids score.
- H_1: The SRT-NGT-kids test score decreases in relation to increase of complexity level and sentence length.

For this sub-question two separate statistical tests are done. For testing the relation between grammatical complexity level and SRT-NGT-kids score a repeated ANOVA is done with the three grammatical complexity levels as independent variables and the SRT-NGT-score as dependent variable. In this study only a descriptive analysis is done for the relation of the

SRT-NGT-kids score and sentence length. In future studies a correlation test should done to test this relation with sentence length as independent variable and SRT-NGT-kids score as dependent variable.

- Sub-question 3:

- H_0: The NGT-SRT-kids test score is not correlated to the T-NGT subtest scores.
- H_1: There is a negative correlation between the NGT-SRT-kids test score and the T-NGT subtest scores (negative correlation because a 'low' level on the T-NGT means children performed well on the subtest of the T-NGT).

For this sub-question two Spearman's rho correlation tests were done with the SRT-NGT-kids score as dependent variable and the scores on the T-NGT subtests as independent variable.

In this study one statistical test for reliability is performed, a test on internal consistency of the SRT-NGT-kids. This is done by performing a 'two halves test' in which the sentences of the three complexity levels are split in two halves and treated as two different tests. For this test a Spearman's rho correlation test was used.

4. Results

In this chapter results of the pre-pilot with the young DHH adults (paragraph 4.1) and the pilot with the DHH primary school children (paragraph 4.2) are presented. For both groups quantitative and qualitative results are given immediately followed by possible explanations. Both the pre-pilot with DHH young adult NGT users (N = 5) and the pilot with the DHH primary school children (N = 8) was done with a small number of participants. I am well aware that with these small numbers of participants trends in the results of the data can be caused by the results of only one individual participant and are therefore not necessarily informative. Nevertheless, I did find some possible informative trends in the results that I would like to present and elaborate on.

4.1. Pre-pilot with 5 DHH young adult NGT users

Absolute scoring of the SRT-NGT-kids sentences was first done in a strict way similar to the way the scoring was done with the SRT-NGT for adult second language learners (Schüller, 2018). A repeated sentence was scored as 'correct' when they were repeated exactly the same as the example. Any changes in the sentences e.g., in order of the signs, adding a sign, changing non-manual elements, or not repeating an INDEX at the end of a sentence (pronoun copy) was scored as 'incorrect'. This strict way of scoring resulted in very low numbers of correctly repeated sentences. Only sentence S6 (see appendix 3) was repeated correctly by all deaf young adults. Results of this strict way of scoring is given in figure 18.

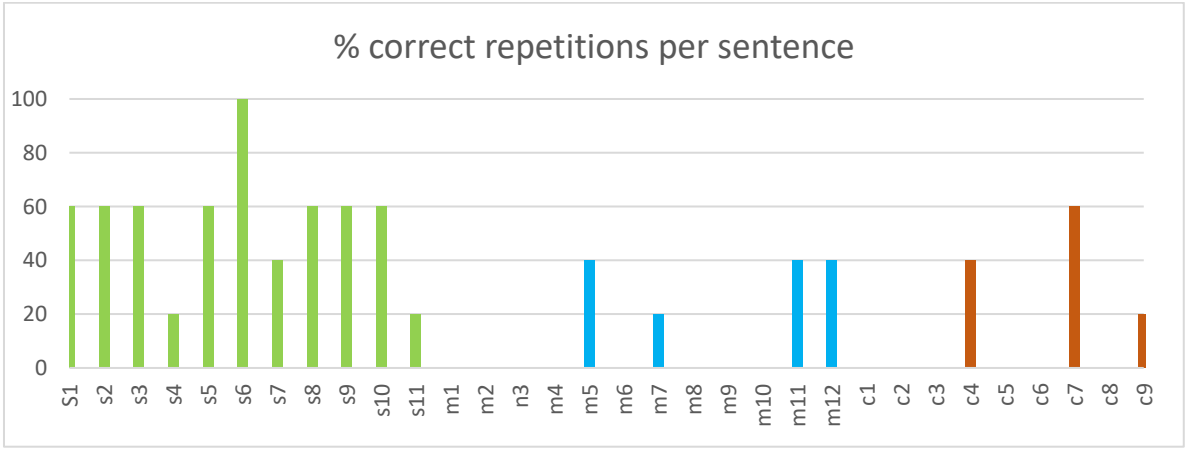

Figure 18. Percentage correct repetitions per sentence for young adult DHH NGT users – strict scoring.

Based on the first feedback from the young DHH adults on the test sentences and the fact NGT shows a lot of variability in what is seen as correct NGT (see paragraph 3.2.3.), in

combination with the low absolute test scores from de young DHH adults, made us rethink the absolute scoring of the SRT-NGT-kids. Table 13 provides an overview of all the elements that were considered as acceptable changes in the repetitions of the test sentences and which elements were obligatory to repeat as presented in the test sentences.

Table 13. Scoring table for absolute scoring.

Accepted variations	Mandatory elements
Not producing a pronoun copy or adding a pronoun copy	Negation with a headshake
Change in sign order for INDEX-NOUN or NOUN-INDEX / NOUN-ADJECTIVE or ADJECTIVE-NOUN	Polar interrogative with non-manual marking (raised eyebrows or frowned eyebrows)
Using a lexical variant (same semantic meaning)	Production of the PALM UP particle
WH-signs without non-manual marking	Copy of phrase order (SOV or SVO)
Self-corrections and restarts	Time indication in initial position (except with the conditional clause)
Deletion of non-manual elements without change of meaning	Non-manual intensive marking
Adding an adjective within a noun phrase	Diminutive and augmentative non-manual marking
	Aspect marking
	Copy of classifiers
	Correct copying of plurals
	Numeral incorporation
	Correct use of CAN^NOT and WANT^NOT

Some of the NGT elements from table 13 that are considered as mandatory elements or that are accepted variations, are discussed below in more detail.

One of the major feedback points from the young DHH adults on the test sentences in the SRT-NGT-kids was that they contain a high amount of *pronoun copy*. Although pronoun copy is used a lot in NGT it is not mandatory (Klomp, 2021). As mentioned in paragraph 3.3.1. not repeating a pronoun copy or adding one was therefore not scored anymore as 'incorrect'.

As for *the non-manual features* in the test sentences, the young DHH adults all repeated the *headshakes for negative sentences* correctly and are considered mandatory. *Head nods* in confirmative phrases were not always repeated. *Eyebrow raises and eyebrow frowns* were produced interchangeable in interrogative sentences. This is in line with what is written about use of these non-manual features in Klomp (2021), are not obligatory in NGT, and

therefore both counted as correct. The *PALM UP* question particle in interrogative sentences was repeated correctly most of the times.

Striking was the high amount of change in order of *NOUN-INDEX* to INDEX-NOUN in which the index does not function as a (possessive) pronoun. Coons (2022) states both sign orders are used in NGT, at least when the INDEX functions as a demonstrative. Brunelli (2011), in her comparison study between LIS and NGT, states the basic order of noun and index in NGT is NOUN-INDEX when the index functions as a locative marker. It can also be that the index in these particular constructions is produced both pre- and post-nominal in which only the post-nominal index is obligatory.

In the same line of sign order changes also the order of *NOUN-ADJECTIVE* to ADJECTIVE-NOUN was seen a lot. This might be caused by the influence of the basic word order in spoken Dutch, which is adjective-noun. Coons (2022) provides information about the order of noun an adjective for different sign languages amongst which NGT. Although NGT examples are not given in the text it can be concluded from visual information presented in het article (Coons, 2022: page 10, figure 2) the default order in NGT would be ADJECTIVE-NOUN. Brunelli (2011), on the other hand, states that in NGT the order of adjective and noun can be produced in both ways, ADJECTIVE-NOUN, and NOUN-ADJECTIVE. In her study, she could not detect what influenced these two possible orders. Because no further information about this subject was found and both sign orders were used by the participants in the pre-pilot, the deaf research assistant was consulted. The deaf research assistant stated both sign orders are used frequently in NGT and were therefore henceforth both scored as 'correct'. Examples 20 and 21 below shows a sentence repetition in which a change of order for noun-adjective can be seen. The total sentence repetition as given in example 21 however, was eventually scored as 'incorrect' because time indication must be produced sentence initially.

20. GISTEREN $INDEX_1$ *HUIS OUD* KOPEN $INDEX_1$ (original sentence)
'Yesterday I house old buy (pronoun copy)'

21. $INDEX_1$ GISTEREN *OUD HUIS* KOPEN $INDEX_1$ (repetition Participant 1)
'I yesterday old house buy (pronoun copy)'

Changes in order or deletions of complete phrases, as in examples 22 and 23 were sometimes produced. This would result in an 'incorrect' repetition because they would deviate from the standard phrase orders in NGT and/or the meaning of the sentence changed.

22. JUF INDEX$_3$ JARIG INDEX$_3$ DAAROM INDEX$_3$ KIND+++ IJS GEVEN+++ INDEX$_3$
'Teacher she birthday (pronoun copy) therefore she children ice cream give (pronoun copy)' (original sentence)

23. INDEX$_3$ JUF INDEX$_3$ JARIG INDEX$_3$ DAAROM IJS GEVEN+++ INDEX$_3$
'She teacher (pronoun copy) birthday. She therefore ice cream give (pronoun copy)'
(repetition participant 5)

When creating the test sentences much attention was given to avoid use of lexical items with multiple (regional)variants. Despite this fact still some *lexical variants* were produced by participants. One of these lexical items is 'MY/MINE' (INDEX$_1$). In the example sentence this item is produced with a x handshape (figure 19a). Participant 2 produced this lexical item with a bent B handshape (figure 19b). Both variants are scored as 'correct' repetitions because they do not change the meaning of the sentence or the grammatical construction.

Figure 19a. 'MY' with B_0 handshape
(Original test sentence)

Figure 19b. 'MY' with 1-handshape
(lexical variant participant 2)

Another example of a lexical variant is the repetition of participant 3 for the item WATER. Figure 20a shows the variant used in the test sentence, figure 20b the lexical variant from participant 3. For the same reasons as above both variants are scored as 'correct'.

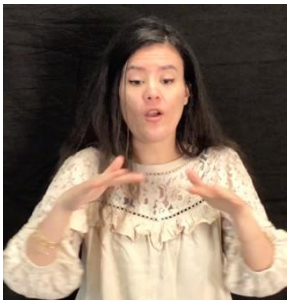

Figure 20a. 'WATER'
(original test sentence)

Figure 20b. 'WATER' – variant
(lexical variant participant 3)

After the reconsiderations, what is scored as 'correct' or 'incorrect' in the less strict way of absolute scoring are the elements mentioned in table 13. After determining the less strict way of absolute scoring all sentence repetitions of the deaf young adults were re-examined. This resulted in different percentages of 'correct' and 'incorrect' scores compared to the strict way of scoring. The percentages of these scores are provided in figure 21a and 21b. Figure 21a shows the percentages of correct repetitions per sentence in the order of the sentences in the SRT-NGT-kids as they were provided to the young adults. In figure 21b the sentences are grouped per amount of percentage correct repetitions.

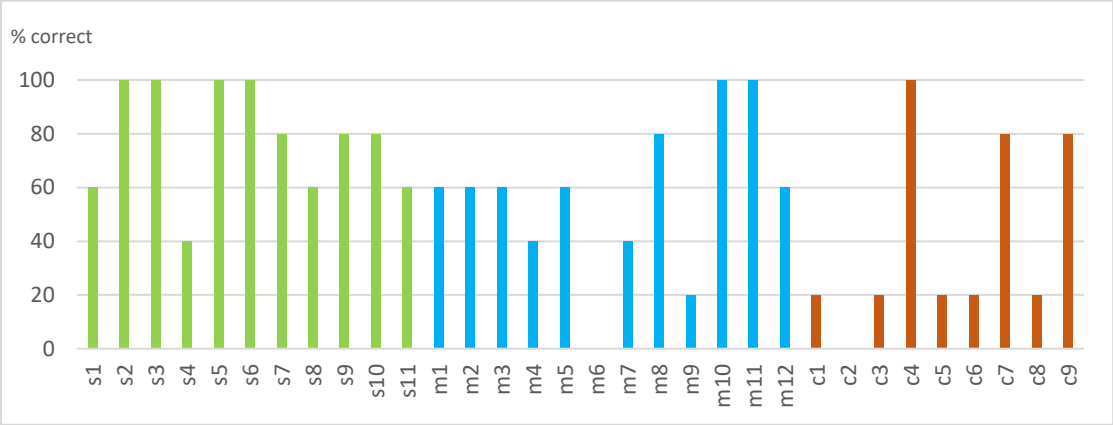

Figure 21a. DHH young adults percentage correct repetitions per sentence in order of the sentences in the SRT-NGT-kids.

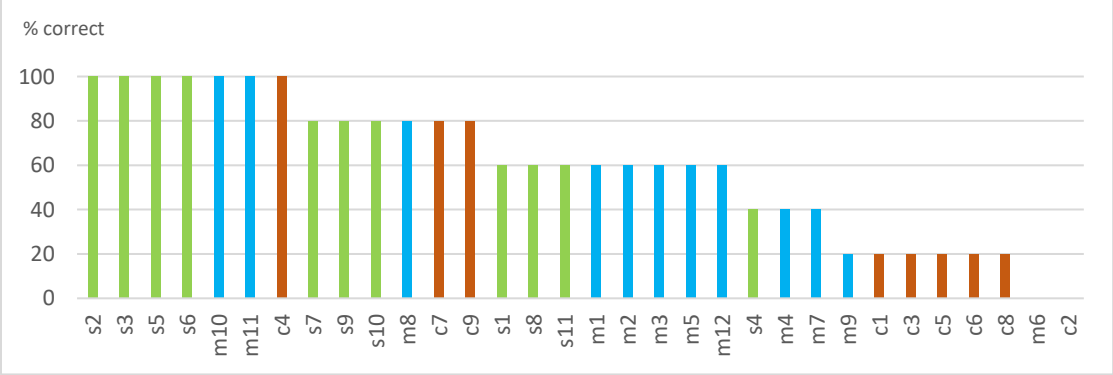

Figure 21b. Percentage correct repetitions per sentence, grouped per percentage level.

The average percentage of correct repetitions per complexity level is given in figure 22. Just as the adult L2 learners in the study by Schüller (2018) also the young DHH adult participants in this study scored, on average, less correct repetitions per increasing complexity level.

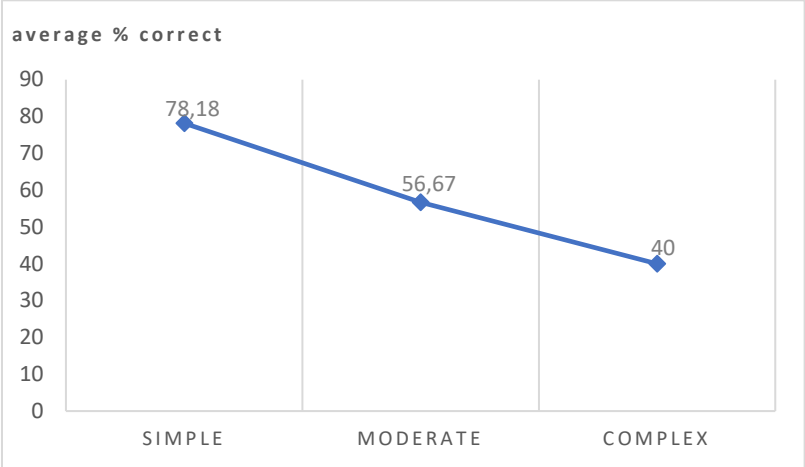

Figure 22. Average percentage correct sentence repetitions young DHH adults per complexity level.

Another feedback point from the young DHH adults was that some sentences, especially sentence M9 and C2, were too complex. The form of these sentences was in such a way the young DHH adults would never produce themselves in daily conversations. After consulting the deaf research assistant from the Radboud University, we decided to adjust the form of these two sentences for the pilot with the DHH children. In table 14 the adjustments in these two sentences are presented. These two adjusted sentences were recorded again and replaced the original sentences as presented in de pre-pilot version for the young DHH adults.

Table 14. Adjustment to the original test sentence based on feedback young DHH adults (explanation of the abbreviations of the non-manual features above the glosses are given in the abbreviation list on page v).

NR.	Original sentence form (pre-pilot DHH young adults)	Adjusted sentence form (pilot version DHH children)
M9	_____RE____ 1^UUR TIJD JUF INDEX$_3$ _____RE_____ LUNCH ETEN INDEX$_3$ WAT PU? AHH BOTERHAM KAAS OP INDEX$_3$	_____RE_____ 1^UUR JUF LUNCHEN INDEX$_3$ WAT PU? BOTERHAM KAAS OP INDEX$_3$
C2	____RE__ __SE__ _____FE____	_____RE_____

	VORIGE WEEK REGEN++ DOOR++ _____RE___ GEVOLG WATER _____RE + PC____ _____RE__ WATER^STIJGEN-cl BETEKENT _____NU____ VOETBAL^VELD-cl+++ _____SE_____ ___FE + NU__ OVERSTROMEN++ ZO JAMMER!	VORIGE WEEK REGEN++ DOOR++ ____RE___ GEVOLG VOETBAL^VELD-cl+++ WATER OVERSTROMEN+++ JAMMER!

4.2. Pilot with primary school DHH children.

Nine DHH children initially participated in the pilot of the SRT-NGT-kids. One of the children became seriously ill during the period of writing this master thesis and could not finish the pilot. The results of that child were therefore taken out of the analysis. The results of the other eight participants were used for the quantitative (paragraph 4.2.1) and qualitative analysis (paragraph 4.2.2) given in the paragraphs below.

4.2.1. Quantitative analysis.

For the DHH primary school children an absolute scoring was done first, similar as with the deaf young adults. For the group of DHH children only the less strict way of absolute scoring was done based on the scoring grid given in table 13 in paragraph 4.1. The absolute scoring per sentence is given in figure 23. In this figure the original sentence order, same as in the pre-pilot for young DHH adults, is given.

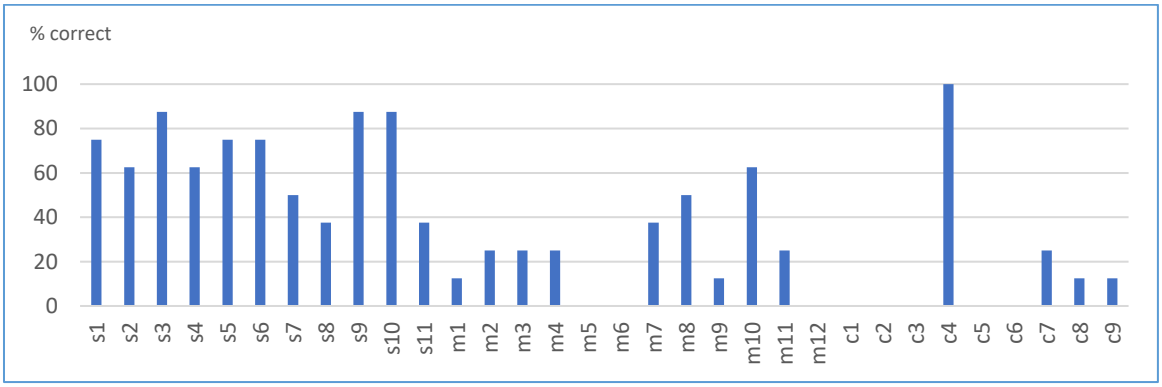

Figure 23. DHH children percentage correct repetitions per sentence in the original sentence order.

Only one sentence is repeated correctly by all DHH children, sentence c4 (example 24). This was also one of the sentences the DHH young adults all repeated correctly. The number of sentences that are repeated incorrectly by all the DHH children is seven, in comparison to two sentences for the young adults. The latter, sentence m6 and c2, are also part of the seven incorrectly repeated sentences by the DHH children.

24. _____ER____ _____ER_____
AUTO INDEX$_{3a}$ BOOM INDEX$_{3B}$ / AUTO^BOTSEN^TEGEN^BOOM-cl-oc
'The car crashes against a tree'

In figure 24 the percentage of correct sentence repetitions in the new order and complexity levels, as used in the pilot with the children, is shown. The sentence numbers in this pilot are still the same as in the pre-pilot with the young DHH adults so they can be compared. The complexity levels related to the numbers of the sentences are now sometimes different. The different colors in figure 24 represent the new complexity levels where green is the 'simple' level (13 sentences), bleu the 'moderate' level (11 sentences) and red the 'complex' level (8 sentences). As mentioned before in paragraph 3.2.2.1 the new complexity levels are based on the percentage of correct repetitions per sentence in the pre-pilot with the deaf young adults.

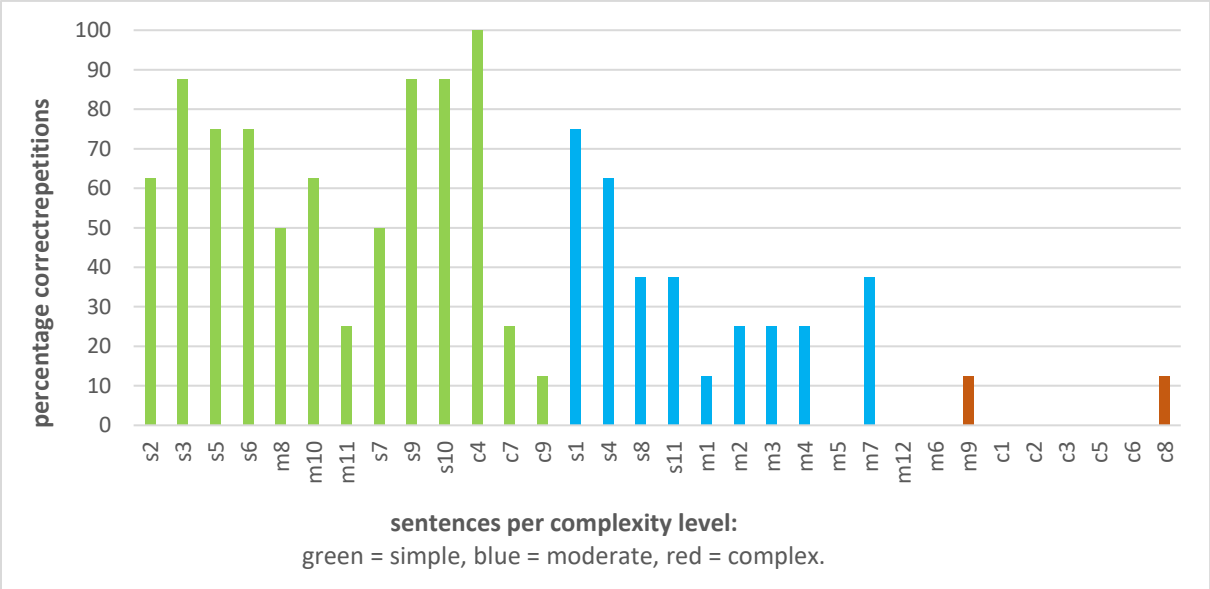

Figure 24. DHH children percentage correct repetitions per sentence in the new sentence order.

The average percentage of correct repetitions per complexity level is calculated in two ways. The first way was keeping the complexity level of the sentences as in the original complexity levels, the same as in the pre-pilot of the young DHH adults. The second way was re-ordering the complexity level of the sentences based on the results from the pre-pilot with the DHH young adults. That 'new' sentence order is also mentioned in table 7 in paragraph 3.2.2.1. In both ways the average percentage of correct repetitions decreases as the complexity level increases. The results of these two ways of calculating the average percentage correct repetitions is given in figure 25 below.

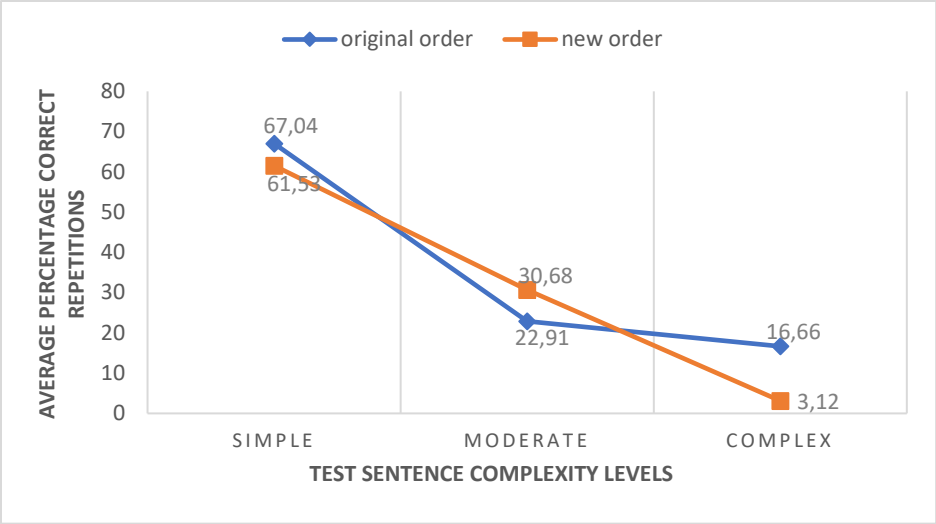

Figure 25. Effects of two different sentence orders on average percentage of correct repetitions for the DHH primary school children.

The absolute scoring results of the sentence repetitions per complexity level (new order) were compared by using ANOVA repeated measures to see whether the SRT-NGT-kids differentiates between the three levels of sentence complexity. The three complexity levels are accounted for as a 'within subject factor'. An assumption check is done with Maughly's test showing that the data is met for sphericity $X^{2(2)} = 1.047$, $p = 0.593$. The repeated ANOVA shows that the SRT-NGT-kids significantly differentiates between the three complexity levels ($F = 54.199$, $p < .001$). A post hoc analysis shows the DHH children, as a group, had significantly more correct repetitions with the simple sentences (M = 8.0, SD = 2.673) in comparison to correct repetitions with the moderate sentences (M = 3.375, SD = 2.387). The same was true for the comparison of correct repetitions between the moderate sentences and complex sentences (M = 0.250, SD = 0.463). The results of the post hoc analysis can be seen in table 15 below.

Table 15. Post Hoc Comparisons - complexity level

		Mean Difference	SE	t	p_{holm}	
simple	moderate	4.625	0.749	6.175	< .001	***
	complex	7.750	0.749	10.347	< .001	***
moderate	complex	3.125	0.749	4.172	< .001	***

** $p < .01$, *** $p < .001$

Note. P-value adjusted for comparing a family of 3

Besides looking at the absolute scoring in relation to the complexity level of the sentences, another analysis was done in which the absolute scoring was compared to the length of the

test sentences. The length of the sentences is defined by the number of manual lexical items per sentence including the indexes for a pronoun copy. The length of the sentences ranged from 4 to 12 manual lexical items. Figure 26 provides an overview of the percentage of correctly versus incorrectly repeated sentences divided for the different lengths of the sentences. What can be seen is that the percentage of correct repetitions decreases as the length of sentences increases. The sentences with 4 (two sentences) or 5 (four sentences) lexical items have the same percentage of correct repetitions. Five of these sentences are part of the 'simple' sentences and the fifth one is the first sentence of the 'moderate' sentences. The sentences that consist of 10 lexical items (six sentences) do not completely follow the trend shown in figure 26. They show a slight increase in percentage of correct repetitions. All these sentences are part of the 'moderate' or 'complex' sentences except one, sentence c8 (see appendix 3). This sentence was placed in the category of 'simple' sentences after the pre-pilot with the young DHH adults. Out of all the sentences with 10 lexical elements this is the sentence with the most correct repetitions. Four out of eight children repeated this sentence correctly which had its influence on the total percentage of correct repetitions for sentences consisting of 10 lexical items.

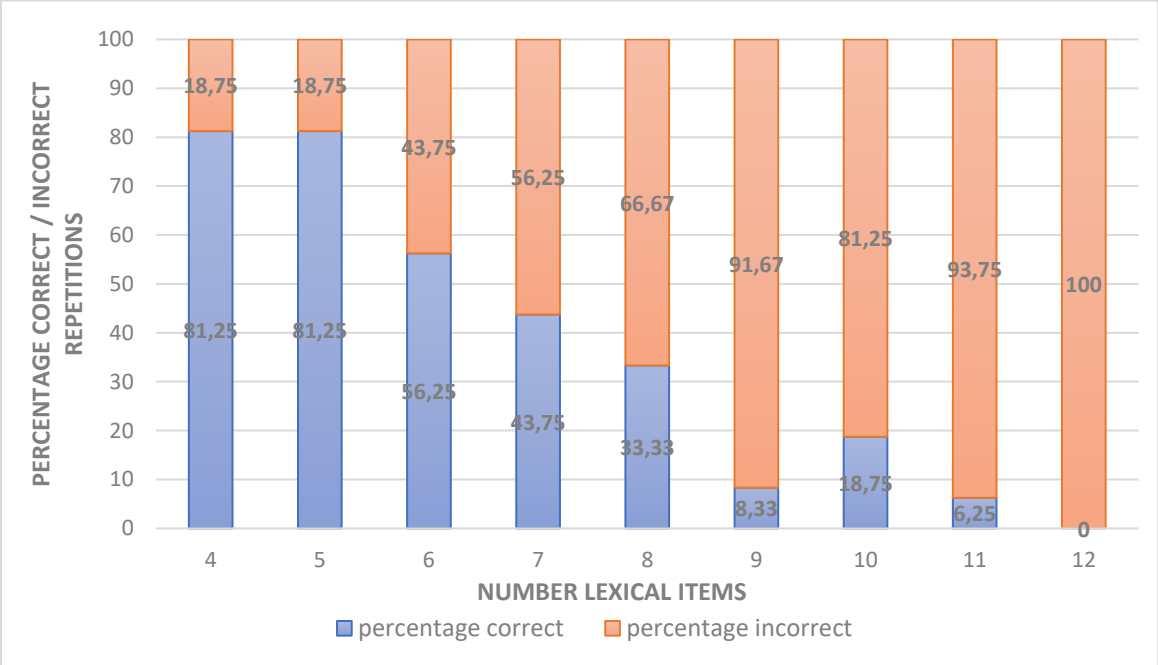

Figure 26. Percentage of correct versus incorrect repetitions per number of lexical items in a sentence.

As can be seen in appendix 2b., the eight DHH primary school children varied in age from 6-11 years old. The educational grade they belong to, grade 3-7, does not always match with

their chronological age. For example, child 1 (k1) is 11 years old and belongs to grade 7 whilst child 3 (k3) is also 11 years old but belongs to grade 6. Child 2 (k2) does also belong to grade 6 but is only 8 years old. Because of the small group of participants in this pilot, a comparison of mean percentage of correct repetitions of the SRT-NGT-kids per age group does not provide much useful information. In most age groups there is only one participant. Only in age group 8 and 11 there are two participants. In age group 8 one participant scored much less correct repetitions (5) as the other participant (14) causing the mean percentage of correct repetitions to become lower as the child in age group 7 who had 12 correct repetitions. The participant in age group 9 was the child that scored the highest number of correct repetitions (21) of all DHH children in this pilot. This participant is one the 4 four participants with deaf parents. The other participants with deaf parents are 6, 8 and 10 years old. As can be seen in figure 27 no real trend can be found for percentage of correct and incorrect repetitions per age group.

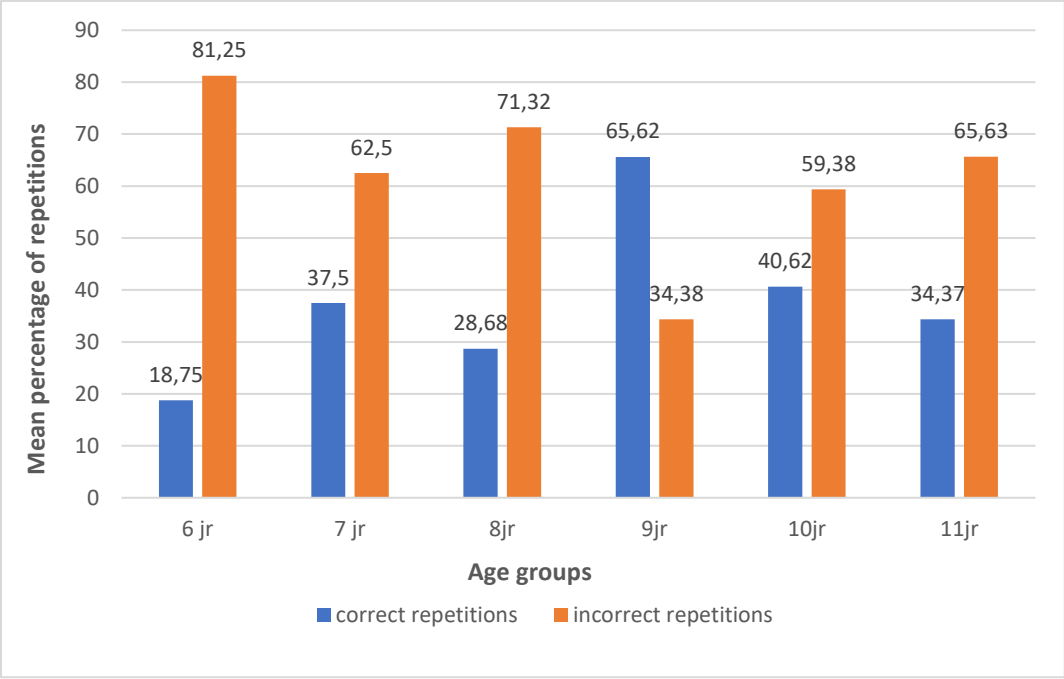

Figure 27. Mean percentage of correct/incorrect sentence repetitions per age group.

A comparison of the mean percentage of correct/incorrect sentence repetitions per educational grade (figure 28) does indicate a trend of increasing numbers of correct repetitions with increase of educational grade. Unfortunately, there were no children in this pilot group that attended educational grade five. Striking is the fact that the (two) children in the highest educational grade, grade 7, do not follow the trend. One of the two participants in this

educational grade is 11 years old, the other participant is 10 years old. An explanation for the deviation from the trend for the two children in this educational grade might be that they both function as 'hard of hearing' and prefer to use spoken Dutch, sometimes in the form of sign supported Dutch, as their main language. The educational grade they are part of mainly consists of hard of hearing children who all use spoken Dutch as their main language. They also have a teacher who uses sign supported Dutch as an instruction language. In the school environment these two children 'only' use NGT during the NGT language-classes (1.5 hours per week) and occasionally during the day when interacting with a deaf adult or deaf child in the school. On the other hand, one of these two participant's parents are deaf, and both use NGT, but also sign supported Dutch, at home.

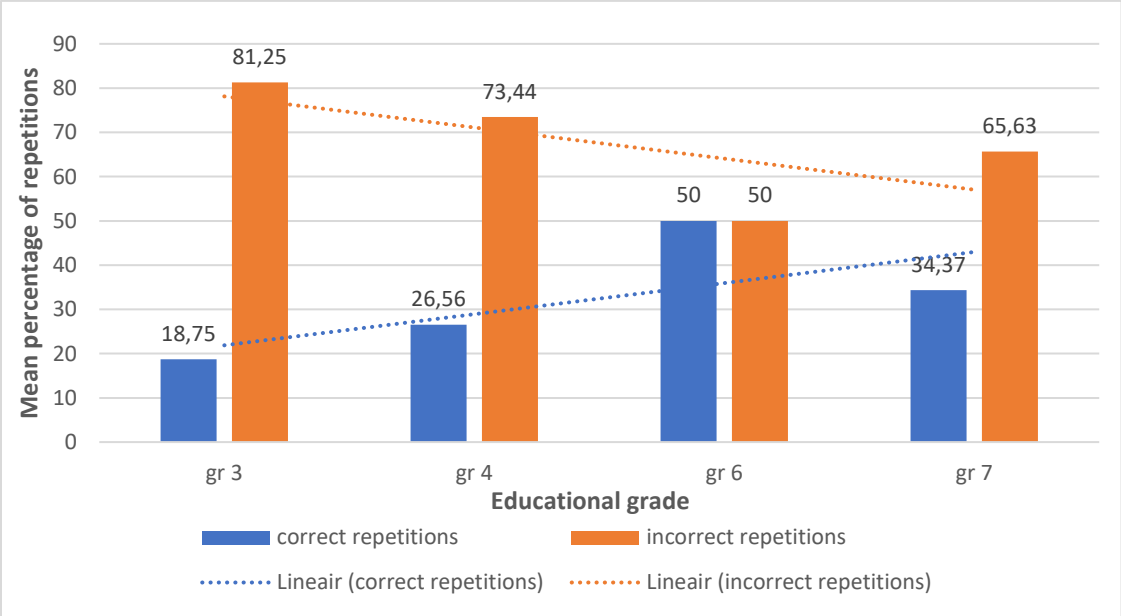

Figure 28. Mean percentage of correct/incorrect sentence repetitions per educational grade.

All DHH children also took two sub-tests of the T-NGT (Testbatterij Nederlandse Gebarentaal), namely 'zinsbegrip' (sentence comprehension) and 'zinsvorming' (sentence production). The raw score on the sub-tests is converted in norm scoring categories 1 – 5 related to age. Norm category 1 is the highest category, category 5 the lowest one. Because of the relation of norm category to chronological age it can occur two participants have an equal raw score on the T-NGT subtests but differ in norm score category. Therefore, the norm score categories are used for calculating a possible correlation between scores on the T-NGT subtests and the SRT-NGT-kids. The test results of the T-NGT subtests of the eight DHH children are provided in table 16.

Table 16. Raw scores and converted norm scoring categories for T-NGT subtests per participant.

DHH child	T-NGT sentence comprehension – raw score	T-NGT sentence comprehension – norm category	T-NGT sentence production – raw score	T-NGT sentence production – norm category
K1	31	4	23	1
K2	30	2	20	1
K3	32	3	20	3
K4	37	2	21	1
K5	32	3	21	2
K6	32	1	23	1
K7	27	2	13	3
K8	31	1	21	1

Because assumption checks on the data (Shapiro-Wilk test) before looking at possible correlations were not met ($p = 0.005$) a non-parametric test (Spearman's rho) was done. In case of a correlation between the score on the SRT-NGT-kids and the sub-tests of the T-NGT there is supposed to be a negative correlation as a lower norm category score on the sub-tests of the T-NGT means you achieved a higher level on the sub-test. The Spearman's rho test however did not find any significant correlations between the score on the SRT-NGT-kids and the sub-tests of the T-NGT as can be seen in table 17 and figures 29a and 29b. The reason for the absence of correlations between the two tests could be that the sentences in the sub tests of the T-NGT are much shorter than the sentences in the SRT-NGT-kids. The mean number of lexical signs in the sub test 'zinsvorming' of the T-NGT is 3.8 manual lexical signs per sentence with a range of 2 – 8 manual lexical signs. The SRT-NGT-kids has a mean number of lexical signs of 6.6 in the simple level up to 10.4 in the complex level. As mentioned in paragraph 2.3.1, one of the downsides of the T-NGT is that children often fairly easy reach a high level on the norm level score. For example, child k1 in this pilot study has a raw score of 9 correct sentence repetitions in the SRT-NGT-kids but scored a norm level 1 on the T-NGT subtest 'zinsvorming' based on 23 (out of 24) correct produced sentences.

Table 17. Correlations between score SRT-NGT-kids and sub-tests of the T-NGT for DHH primary school children.

	n	Spearman's rho	p
T-NGT zinsbegrip – niveau - SRT-NGT-kids	8	0.162	0.649
T-NGT zinsvorming – niveau - SRT-NGT-kids	8	-0.228	0.293

Note. All tests one-tailed, for negative correlation.

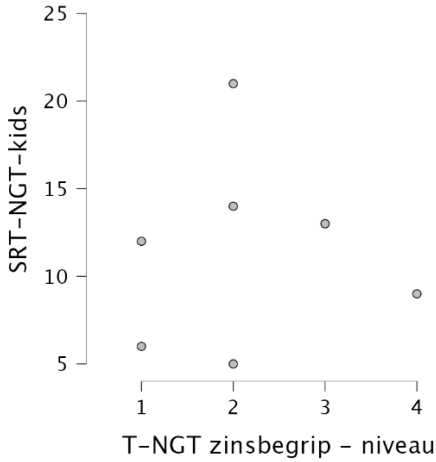

Figure 29a. Scatterplot raw score SRT-NGT-kids kids versus T-NGT zinsbegrip norming level.

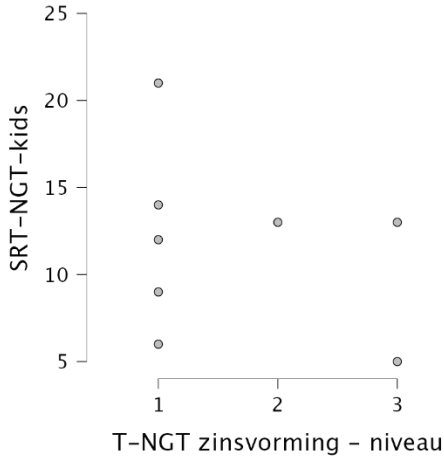

Figure 29b. Scatterplot raw score SRT-NGT- versus T-NGT zinsvorming norming level.

4.2.2. Qualitative analysis

The *main feedback* on the SRT-NGT-kids from the DHH children was that repeating the longer sentences was quite tough. They found it difficult to remember everything that was signed by the deaf adult signer.

The *second feedback point* from some of the children was the fact that the deaf adult signer had a beard in two of the videoclips compared to not having a beard in all the other videoclips. The children who noticed this were surprised and unable to repeat the sentence correctly. After an explanation why this was the case, they were allowed to look at the sentence once again. The two sentences in which the deaf adult signer had a beard were the two sentences (given in table 13 in paragraph 4.1) that were recorded again after the pre-pilot with the young DHH adults. The deaf adult signer did put on the same clothes as in the other videoclips but indeed now had a short beard. In subsequent versions of the SRT-NGT-kids the sentences must be recorded again making sure the signer looks the same in all the test sentences.

Although the DHH children did not openly comment about the amount of *pronoun copy* in the test sentences as the young DHH adults did, they also did not repeat them all the time. Just as with the young DHH adults this was not counted as 'incorrect'.

Head shakes, just as with the young DHH adults, were repeated correctly most of the times. Only one child (k7) replaced the non-manual head shake with a manual negative lexical item in two different sentences, sentence s6 and m11. Although using a negative element is allowed in NGT, as mentioned in paragraph 3.2.3.1, it still must be accompanied

with a head shake. In example 25 and 26 the negation part of the test sentences is given together with the replacement the child produced.

25. … MELK ____hs____ LEKKER ….. (sentence s6 – original version)
(… milk (head shake) nice ….)

… MELK NIET LEKKER … (sentence s6 – child repetition)
(… milk not nice …)

26. … $INDEX_1$ _____hs_____ ZWEMMEN GAAN … (sentence m11 – original version)
(… I (head shake) swim go …)

… $INDEX_1$ NIET ZWEMMEN GAAN … (sentence m11 – child repetition)
(… I not swim go …)

Just as with the young DHH adults some of the DHH children produced *(regional) variants of lexical items*. The lexical variants did have the same meaning and did not change the grammatical construction and/or meaning of the complete sentence. Therefore, these variants were scored as 'correct' repetitions in the absolute scoring. An example of the standard variant for the lexical item TREE is given in figure 30a. This is the variant the deaf adult signer used in the videoclip of sentence c4 (see appendix 3). In figure 30b child k2 uses a regional variant of the lexical item TREE. This child's parents are both deaf and they do use NGT at home. It could be the case his parents use this regional variant for TREE.

Figure 30a. standard variant for lexical item TREE (copied from: https://mjegb.gebarencentrum.nl).

Figure 30b. regional variant for lexical item TREE.

The same explanation can be given for the regional variant child k4 uses for the lexical item WHO (figure 31a) with a V-handshape (Y). This regional variant is also used by some of the older teachers in the school for DHH children this child attends. This child's parents are both

deaf and use NGT at home. It could be her parents use this variant for the lexical sign WHO. The 'standard' variant (figure 31b), with a 1-handshape (G), is the variant the deaf adult signer produces in the videoclip.

Figure 31a. Lexical item WHO with a V-handshape (Y).

Figure 31b. Lexical item WHO with a 1-handshape (G).

The *low frequent lexical items* that are not mentioned the BAK-list, presented in table 9 (paragraph 3.2.2.2), were at risk for a high percentage of incorrect repetitions. However, the results show there is only one lexical item that only one of the children repeated correctly. This is the verb LUNCHEN ('having lunch') as used in test sentence m9. It seems this lexical item is too difficult to repeat. It does seem that they do understand what the item is about as six of the eight children replaced it with ETEN ('to eat'). One child replaced it with the noun LUNCH and one child produced ETEN LUNCH ('eat lunch'). In a subsequent version of the SRT-NGT-kids this item could be replaced with EAT which does not change the grammatical construction or meaning of the sentence. The other low frequent words mentioned in table 9 were repeated correctly more than once.

Numeral incorporation, as used in sentence C7 (see table 18) is not repeated correctly by five of the eight children. The three children who repeated it correctly were either an older child and/or a child of deaf parents who also use NGT at home. Examples of mistakes the other children made are also given in table 18. Because three out of the five young adults in the pre-pilot repeated this sentence completely correct, and four out of five repeated the numeral incorporation correctly, this sentence was categorized as 'simple' in the children's version. This might have been too optimistic as the three out of the five DHH children who did not repeat the numeral correctly were younger children (age 6,7 or 8). In a subsequent version this sentence could better be categorized as 'moderate' or maybe even as 'complex'.

Table 18. Examples incorrect repetitions of numeral incorporation.

original test sentence:	3^WEKEN (3^WEEKS)
Child k2 + k6:	3 WEEK+++
Child k3 + k7:	3 WEEK
Child k8:	(no repetition of this element)

Another element almost all DHH children had difficulty with was *fingerspelling* in comparison to the young DHH adults in the pre-pilot who repeated the fingerspelling correctly. In sentence c9 the name of a dog is fingerspelled (#B-E-L-L-O). Only two children (child k2 and k5) spelled it correctly. All the other children spelled at least 2 letters correct but not the whole name. Reason for this can be that the children are too young, at least the children of 6-7 years old, or that fingerspelling is not explicitly practiced in the NGT classes by the NGT teacher. Fingerspelling is used by the regular teachers during interaction or classes but also not explicitly trained. Because this sentence was repeated correctly by four out of five young DHH adults it was categorized as 'simple' for the children's version of the SRT-NGT-kids. In a subsequent version this sentence could better be categorized as 'moderate' or 'complex'.

The last striking point when analyzing the children's incorrect sentence repetitions was a change in *phrase order in some sentences that contain the verb HEBBEN ('to have')* as in sentence m12 (example 27, partially) and c9 (example 28, partially). In these test sentences the phrase order SOV is used which is a basic phrase order in NGT.

27. $INDEX_1$ DRIE KONIJN KLEIN+++(locatief+OC) HEBBEN $INDEX_1$
'I three rabit little-plural(locative+oral comp) have (pronoun copy)'

28. $INDEX_2$ TANTE HOND HEBBEN $INDEX_2$
'Your aunt dog have (pronoun copy)'

Children either do not repeat the verb HEBBEN (3x for sentence c9, 2x for sentence m12) or change the order of the verb and the object (2x for sentence c9, 6x for sentence m12). In case of the latter the phrase order becomes SVO which is, in principle, also an accepted phrase order in NGT. This phrase order, SVO, resembles the phrase order as used in spoken Dutch. An explanation for not repeating the verb HEBBEN in sentence m12 could be the long form of the object in that sentence. Adding three times the adjective KLEIN ('little') to the object phrase might cause that children forget to repeat the verb. In sentence c9 however, this

explanation does not hold because here the object phrase only contains one lexical sign. An explanation for change of phrase order to SVO could also be the influence of sign supported Dutch. All children see and/or use sign supported Dutch a lot in school and daily communication at home. Question of course is whether this change of phrase order is 'incorrect' as it is an accepted and used phrase order in NGT.

All quantitative and qualitative results and related considerations above should be rediscussed for future versions of the SRT-NGT-kids.

4.3. Reliability

To see if there is an indication for an internal consistency of the SRT-NGT-kids (both original order and new order) the test results from the children were split in two half tests, 'test 1' and 'test 2'. The sentences from the test were split in half for each complexity level separately. Table 19 shows which sentences were part of test 1 and which sentences of test two for both versions of the test.

Table 19. Distribution of test sentences in two halves test (internal consistency).

		Test 1	**Test 2**
Version - original order (young adults)	Simple	s1 – s6	s7 – s11
	Moderate	m1 – m6	m7 – m12
	Complex	c1 – c4	c5 – c9
Version - new order (DHH children)	Simple	s2, s3, s5, s6, m8, m10, m11	s7, s9, s10, c4, c7, c9
	Moderate	s1, s8, s11, s4, m1	m2, m3, m4, m5, m7, m12
	Complex	m9, m6, c1, c2	c3, c5, c6, c8

A Spearman's rho correlation test was used to see whether there was a correlation between the two halves of the test. The outcome of the Spearman's rho correlation test showed there is a significant (moderate) positive correlation between the number of correct repetitions in the first half test and the number of correct repetitions in the second half test of the SRT-NGT-kids (original version): r_s (15) = .575, p =.020. For the new order version of the SRT-NGT-kids, the version that is used for the DHH children, there is also a significant (strong) positive correlation between the number of correct repetitions in the two halves: r_s (15) = .824, $p < .001$. The significant positive correlation in the SRT-NGT-kids test version with the new

sentence order is stronger than in the original version. Results of the statistical tests and related scatterplots are given in figure 32 and 33.

Two halves test / SRT-NGT-kids – original order

	Spearman's rho	p
1st half - 2nd half	0.575 *	0.020

* p < .05, ** p < .01, *** p < .001

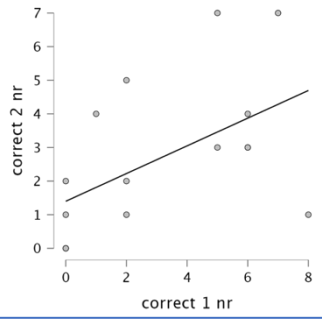

Figure 32. Results of the two halves test of the SRT-NGT-kids – version with original sentence order (Scatter plot: correct 1 nr = number correct repetitions 1st half, correct 2 nr = number correct repetitions 2nd half)

Two halves tes / SRT-NGT-kids – new order

	Spearman's rho	p
1st half - 2nd half	0.824 ***	< .001

* p < .05, ** p < .01, *** p < .001

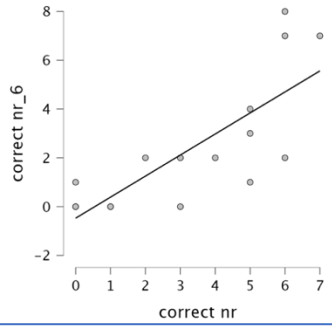

Figure 33. Results of the two halves test of the SRT-NGT-kids – version with new sentence order (Scatter plot: correct nr = number correct repetitions 1st half, correct nr_6 = number correct repetitions 2nd half)

5. Discussion and conclusion

In this chapter I will critically discuss and interpret the results, presented in chapter 4, as an answer to the research questions. This chapter will also provide thoughts and ideas for further development of the SRT-NGT-kids and possible use within the schools for DHH children in the Netherlands.

This master thesis describes the first steps towards the development of a sentence repetition task in NGT for DHH children in the Netherlands. I am very well aware that a lot of work still needs to be done before a final decision can be made about whether this instrument is a useful instrument to follow up on the NGT development of DHH children between 6 – 10 years old. All the results described in chapter 4 are based on two (very) small participant groups (N = 5 for the DHH young adults and N = 8 for the DHH children) and must therefore be interpreted with care and caution. On the other hand, the results that were found does provide us with very useful information for future development of the test.

5.1. Research questions.

With the results from the (pre-)pilot studies presented in this master thesis (chapter 4) I will answer the main research question and sub-questions in the following paragraphs. The main research question of this study is: *'What are the most important components to include in a new SRT for deaf and hard of hearing children aged 6-10 years old who are acquiring NGT?'*. The answer to this question is the combination of components related to form and content of the SRT-NGT-kids discussed in paragraph 5.1.1 – 5.1.3 and the results from the qualitative analysis given in paragraphs 4.1 and 4.2.2. First the sub-questions are answered and finally an answer is given to the main research question.

5.1.1. Sub-question 1.

The first sub-question of this study was: *'What is the relationship between the scores on the SRT-NGT-kids and the following internal test factors: 1) grammatical complexity of the sentences and 2) length of the sentences?'*. The two internal test factors mentioned in this question are related to each other in the SRT-NGT-kids which means that the length of the test sentences, defined by the number of manual lexical signs, increases alongside the increase of grammatical complexity of the sentences as shown in figure 8 and 9 in paragraph 3.2.2.1.

Looking at the factor of grammatical complexity, the mean percentage of correct sentence repetitions decreases as the level of complexity increases. This is true for the pre-pilot with the young DHH adults but also for the DHH children. For the DHH primary school children this holds in both ways of ordering the sentences (children (o) = original sentence

order, children (n)= new sentence order). A summary of these results, as earlier presented in figure 22 and 25, can be seen in figure 34.

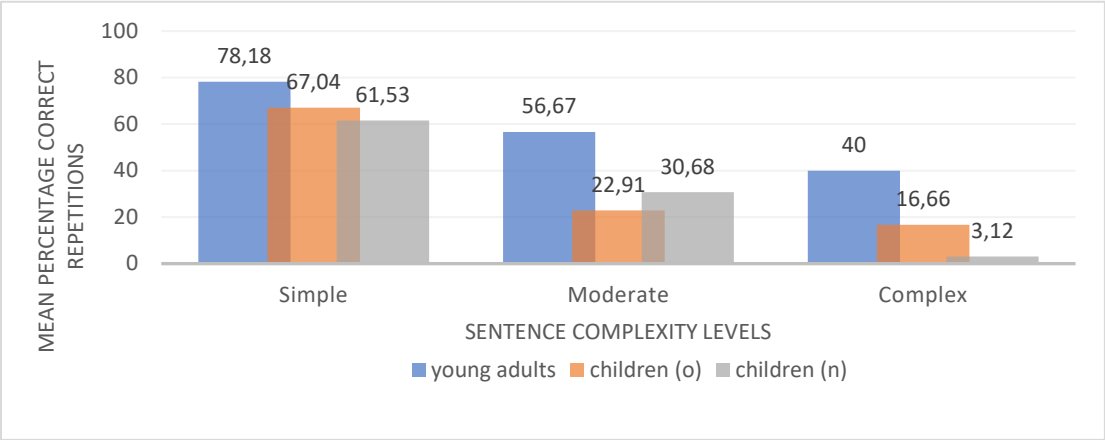

Figure 34. Mean percentage correct sentence repetitions per sentence complexity level for both pilot groups and in both sentence order.

A repeated ANOVA measure and post hoc analysis on the results from the DHH children with the new order of test sentences showed that the SRT-NGT-kids (significantly) differentiates between the three complexity levels. As a conclusion, it can be said that there is a relation between the scores on the SRT-NGT-kids and the grammatical complexity of the sentences.

There is also an indication that the second internal test factor, sentence length, is related to the mean percentage of correct sentence repetitions for the DHH children: As shown in figure 26 in paragraph 4.2.1, the percentage of correct repetitions decreases as the length of sentences increases.

Only the results for the five sentences with 10 lexical elements do not follow the trend shown in figure 26. One of these five sentences (sentence m8) was repeated correctly by half (four) of the children whilst the other sentences were repeated correctly by 0 - 2 children. Together this resulted in an overall higher percentage of correct repetitions for sentences with 10 lexical items in comparison with sentences of 9 lexical items. All sentences with 10 lexical items are complex sentences that exist of multiple coordinated clauses and contain a lot of indexes. These sentences with 10 lexical items must be evaluated again and possibly adapted to a form with less indexes.

The mean percentage of correct sentence repetitions by the DHH children for the test version with the new sentence order (figure 24, paragraph 4.2.1.) shows that hardly any of the sentences from the category of complex sentences is repeated correctly. A possible explanation can be that the sentences are too long for 6- to 11-year-old children. Some of

these sentences were also not (sentence m6) or hardly (sentence m9) repeated correctly by the young DHH adults. Maybe these sentences are too difficult overall and must be removed from the test. Another explanation can be that the longer and more complex sentences were tested last, and children became tired or less focused. Before coming to the complex sentences the children already repeated 24 sentences. To prevent the children from becoming tired there were 'break slides' in the PowerPoint with the test sentences after every 5 sentences. During the breaks children were allowed to communicate with me (the experimenter) or stretch their arms whatsoever. The average time of performing the whole test, including the breaks, was between 12 to 17 minutes per participant. Still, it must be evaluated again whether the total number of test sentences can be reduced. In that case the relationship between the test scores and the internal test factors must be evaluated again.

5.1.2. Sub-question 2.

The second sub-question of this study was: *'What is the relationship between the scores on the SRT-NGT-kids and the child factor chronological age?'*. The results related to this sub-question are shown in paragraph 4.2.1. and figure 27. There was no relation for the DHH children between the test score on the SRT-NGT-kids and their chronological age. The main reason for this is that the pilot group was too small, which resulted in only 1-2 children per age group. Because of this fact, the test results per age group is too sensitive to all kinds of confounding factors that are known about the heterogeneous group of DHH children e.g., degree of hearing loss, language use in the home environment, preferred language by the children themselves, degree of intelligence, etcetera.

Besides the child factor chronological age, the children were also grouped for their educational grade. The DHH children in the pilot group attended primary school grade three to seven. The number of children per educational grade varied between 1 – 3. Unfortunately, there was no child that attended grade 5. This are still very small numbers of children per educational group but an indication for a trend in the test scores related to the educational grades was found. As can be seen in figure 28 in paragraph 4.2.1, the results of the DHH children do indicate a trend of increasing mean percentages of correct repetitions with increase of educational grade. A possible explanation for deviation from this trend by the two children from grade 7 is given in the same paragraph. Just as with the factor chronological age, there might be all kinds of confounding factors that caused this deviating result. When bigger pilot studies are done with subsequent versions of the SRT-NGT-kids the two factors chronological age and educational grade must be evaluated again.

5.1.3. Sub-question 3.

The third and final sub-question of this study was: *'What is the relationship between the scores on the SRT-NGT-kids and concurrent scores on the T-NGT sub-test 'zinsvorming' (sentence production)?'*. As part of the normal annual language development evaluations for all children in the school the children of the pilot group attended, they all performed the T-NGT subtests 'sentence comprehension' and 'sentence production'. Comparing the scores on the SRT-NGT-kids and the scores of the T-NGT subtest 'sentence production' through the Spearman's rho correlation test it became clear there was no relation found between these two test scores (see table 17 and figure 29b in paragraph 4.2.1.). The explanation for the fact there is no correlation between the two test scores could be the (big) difference in number of lexical items per sentence. For the T-NGT subtest this number lies between 2 – 8 lexical items whilst in the SRT-NGT-kids this is between 4 – 12 lexical items. In the T-NGT subtest 'sentence production' multiple test items are focused on the same grammatical component and 'only' simple declarative sentences are tested. For example, the first 3 test items of this subtest all focus on the combination of a noun + adjective e.g., BALL BIG. The different grammatical categories that are tested with this subtest of the T-NGT are mentioned in paragraph 3.2.1. In the SRT-NGT-kids a combination of simple and complex sentences is tested. Some sentence types e.g., interrogative sentences are not tested at all in the T-NGT subtest but are tested in the SRT-NGT-kids. The question is whether the SRT-NGT-kids and the subtest 'sentence production' of the T-NGT are measuring the same linguistic skills. Maybe the same skills are tested but the SRT-NGT-kids is too difficult and/or too long in its current form or the T-NGT subtest 'sentence production' might be too easy? Of course, a combination of both is also a possibility.

One of the questions that came up during the evaluation of the results mentioned above was whether the children's ability to comprehend the meaning of the sentences of the SRT-NGT had an influence on the test scores. If children's NGT comprehension skills are low, you could expect lower scores on the SRT-NGT-kids. The children's NGT comprehension skills were tested during the annual language evaluations in the school. In a similar way as with the scores on the T-NGT sentence production subtest, to answer the question if there is a relation between the SRT-NGT-kids score and the concurrent score on the sentence production sub-test of the T-NGT, the scores of the SRT-NGT-kids were related to the test scores on the T-NGT subtest 'sentence comprehension'. Again, no correlation was found between the two test scores (see table 17 and figure 29a in paragraph 4.2.1.). A possible explanation could be that the form of these two tests differ. In the T-NGT subtest 'sentence

comprehension' the children first see a videoclip of a (simple) sentence and subsequently choose the right picture out of three or four pictures on the screen. Children are allowed to look at the test sentence twice and the test administrators are allowed to explain a lexical concept if the child does not know the sign of that lexical concept. In the SRT-NGT-kids see the test sentence only once and there is no visual support from pictures. It can therefore be that children have a (relatively) low score on the SRT-NGT-kids but a high score on the T-NGT subtest 'sentence comprehension' as was seen in four of the eight children.

5.1.4. Main research question.

As mentioned before, the main research question of this study is: *'What are the most important components to include in a new SRT for deaf and hard of hearing children aged 6-10 years old who are acquiring NGT?'*. In the following paragraphs some important components of a sign language SRT for children are elaborated on, such as length and complexity of the sentences, sentence types and morphological features and choice of lexical items.

As mentioned in earlier studies on SRT's in both spoken and signed languages, the test sentences in an SRT must be sufficiently long and/or complex to address the linguistic skills of the test takers instead of being able to copy the sentences purely on short term memory skills (De Jong et al., 2021; Klem et al., 2015). However, the test sentences in the present version of the SRT-NGT-kids might be too long. This is a factor that must be reconsidered in future studies on the SRT-NGT-kids.

Another important component of the SRT-NGT-kids is that it must contain both simple and more complex sentences that exist of coordinated and subordinated clauses to follow the development of the linguistic skills over a longer period of time. The current sentences of the SRT-NGT-kids are a combination of simple and more complex sentences. The amount of pronoun copy in the current version of some sentences is high. This can be reduced without affecting the grammatical structure or complexity of the sentences. The reduction of pronoun copy will have an influence on the (mean) sentence length and probably on the number of correct repetitions.

The SRT-NGT-kids must also contain different sentence types and morphological features to test different grammatical aspects of NGT e.g., declaratives, different kind of interrogatives, conditional clauses, plurals, use of classifiers, directional verbs, use of space, etcetera. Table 20 below provides a list of sentence types, morphological features, non-manual elements, and other elements that are present in the current version of the SRT-NGT-kids. If in future versions of the SRT-NGT-kids the test sentences are grammatically adjusted

to provide a better fit to the targeted age groups, the grammatical elements listed in table 20 must still be part of the test sentences in order to test a broad spectrum of grammatical elements that are part of the grammar of NGT.

Table 20. List of all the grammatical elements present in the SRT-NGT-kids.

Sentences	Morphology	Non-manuals	Other
Simple clause	Classifiers (whole entity, handling, bodypart, size-shape)	Head shake	fingerspelling
Complement clauses	Different type of verbs / verbal agreement	Eyebrow raise/ frown	Palm Up-(request)particle
Conditional clauses	Modal verbs (confirmative + negation)	Oral components	Imperative particle
Temporal clauses	Negation / confirmation		
Reason clauses	Plural marking		
Embedded clauses	Diminutive / augmentative marking		
Declaratives	Marking for aspect and/or manner		
Interrogative – polar questions	Numeral incorporation		
Interrogative – WH-questions	Time indication		
Question-answer pairs	topicalization		
imperatives	Locative use of signs		
	Past participle		
	Noun-adjective		
	‘telhand’		
	Pronouns / pronoun copy		

The choice of lexical items and lexical variants in the SRT-NGT-kids seems to be quite accurate as there are not much lexical variants and/or substitutions used. Only a small number of lexical items as mentioned in table 9 might need to be changed amongst which the item LUNCHEN (‘having lunch’). An important question related to the choice and use of lexical variants is whether use of a lexical (regional) variant by the children must be counted as ‘incorrect’ or ‘correct’. I would suggest that lexical variants, that are mentioned in the NGT online dictionary (https://ow.gebarencentrum.nl/), are counted as ‘correct’ as long as they do not change the grammatical structure and/or meaning of the sentence. The main purpose of

the SRT-NGT-kids is to follow up the grammatical development of NGT in DHH children who are provided with NGT. Use of an accepted lexical variant (as mentioned in the NGT online dictionary) does not influence the grammatical structure of a sentence.

Another aspect related to the lexical items used by the participants is whether a substitution of lexical items, with a different meaning than the target item, should be counted as 'correct' or 'incorrect'. Substitutions do not necessarily have to change the grammatical construct of the sentence but do have some influence on the meaning of the sentence. If the substitution does change the grammatical structure of the sentence, it would automatically be counted as 'incorrect'. But if it doesn't and it also does not have a large influence on the meaning of the sentence, as shown in example 29 and 30, it could be counted as 'correct'

29	MAN	INDEX$_{3a}$	AARDIG	INDEX$_{3a}$	
	'man	he	(is) kind	(pronoun copy)'	(original sentence s9)

30	JONGEN	INDEX$_{3a}$	AARDIG	INDEX$_{3a}$	
	'boy	he	(is) kind	(pronoun copy)	(repetition P5)

5.2. General discussion points.

In this section general discussion points related to the digital test environment of the SRT-NGT-kids and test situation itself are described as well as some recommendations for future versions of the test.

The test sentences of the SRT-NGT-kids were based on earlier research on SRT's in other sign languages (e.g., Hauser et al., 2008; Palmer, 2020; Rinaldi et al., 2018; Supalla et al., 2014) and on the study of Schüller (2018) about the development of an SRT-NGT for adult second language learners of NGT. The first steps in adjusting the original test sentences to sentences that are appropriate for DHH children between 6-10 years old were based on a literature study on sign language development in DHH children and literature describing the grammar of NGT. The final step was consultations with a deaf adult NGT user working as a research assistant at the Radboud University. He is also the signer in the videoclips of the test sentences. After the construction phase of the test itself a pre-pilot with DHH young adults and a small pilot with DHH primary school children was done. The pre-pilot with young DHH adults and the pilot with the DHH primary school children itself was done by me. The DHH children in the pilot group all know me as I used to work as a teacher and now work as a linguist in that school. Although I am hearing I am proficient enough in NGT to give the instructions about the test in NGT and answer possible questions from the children. I am also

able to analyze the sentence repetitions from the children. Any person that wants to use the SRT-NGT-kids must be highly proficient in NGT to be able to analyze the test results.

Because the construction of the first version of the SRT-NGT-kids and the two pilots, as scope of my master thesis, are the first steps in the development process of a final version of the test, the online test environment was not yet fully developed. For example, the instruction for the test was now given in person by me. Although the content of the instruction was the same for all the participants (adults and children), I did make some adjustments or added extra comments to the instructions, based on the reaction from the participants. I have e.g., repeated the instruction and added some extra information about the structure of the test if necessary. The instruction as part of the digital test environment should be exactly the same for all participants. Extra comments as mentioned above, if necessary, can always be added by the researcher/professional. Practice items should be added to the test as well. In a future digital test environment, there should also be an automatic pause between the click for the next test sentence and the actual test sentence itself. In the pilots in this study the videoclip of the test sentence started immediately after the click for the next test sentence. This might have had an influence on the repetitions of the test sentences by the participants.

The test sentences in this study were shown once. Especially for the children it would have been helpful if they were allowed to see the test sentences twice, certainly for the longer sentences. The T-NGT subtests ‘sentence comprehension’ and ‘sentence production’ do allow the participant to view the test item twice (Hermans et al., 2021). Also spoken language tests often allow a test item to be presented twice. In the future version of the SRT-NGT-kids it must be reconsidered whether the test items can be shown once or twice.

In this study two versions of the SRT-NGT-kids are used. One version, called ‘original version/order’, is used with in the pre-pilot with the young DHH adults in which the order of the test sentences was mainly based on results from earlier research on the SRT-NGT for second language learners of NGT by Schüller (2018). A second version, called ‘new version/order’, is used in the pilot with the DHH primary school children. In this version the sentence order is based upon the results from the former pre-pilot. In the result section in chapter 4 it is mentioned which results are based on which version of the test. In testing subsequent versions of the SRT-NGT-kids on a larger pilot group one of the two versions must be chosen as ‘the’ SRT-NGT-kids. Based on the results presented this will most probably be the ‘new order version’, the version that was used in the pilot with the DHH children.

The scoring of the SRT-NGT-kids can be done in two ways, a quantitative absolute scoring and qualitative way of scoring. The scoring grid (table 13 in paragraph 4.1) provides guidelines for the absolute scoring. This way of scoring provides a quick way to follow up on the NGT acquisition of the children. For now, it is not (yet) possible to compare the test results of a single child with a norm group. This might become the case in the (near) future. It is possible to compare consecutive test results of the same child over time. The qualitative way of scoring is an optional way of scoring. It is recommended to perform a qualitative analysis of the test results if there is an indication NGT acquisition of a child does not go well. The qualitative provides information about which grammatical elements need extra attention and/or training.

When constructing a new language test, it is necessary to look at validity and reliability of the test as a whole and the separate test items. In the stage we are in now with the development of the SRT-NGT-kids, it was not yet possible to do this in a thorough manner. One of the instruments used for validity and reliability tests is TiaPlus, a psychometric computer program used for test and item analysis from Cito (Heuvelmans, 2013). Future studies on the SRT-NGT-kids with larger pilot groups must include a thorough way of testing validity and reliability. The answers on sub-question 3, the relation between the scores on the SRT-NGT-kids and the test scores of the subtests of the T-NGT, gives information about concurrent validity. As for reliability, in this study I only performed one reliability test, a two-halves test. The results of this test, presented in figure 32 and 33, showed the internal consistency of the test is sufficient.

5.3. Future research

For constructing a final version of the SRT-NGT-kids first a second round of evaluating the test items must be done in co-operation with deaf adult NGT users after which new videoclips of the test sentences can be made. A new digital environment which includes the new videoclips and an instruction video must then be tested on a bigger pilot group of DHH children from different special primary schools for DHH children in the Netherlands. In the new pilot, test results from the SRT-NGT-kids must be scored by more than one rater to indicate inter-rater reliability. This is part of a more thorough psychometric analysis of the SRT-NGT-kids.

One of the questions that need to be answered is what the minimum number of test sentences in the SRT-NGT-kids must be to get a reliable representation of the NGT development of DHH children between 6 -10 years old. The current test consists of 32 test

sentences of which the most complex and long ones hardly get any correct responses or no correct responses at all. Instead of decreasing the number of test sentences another choice could be to create criteria which determine the first sentence of the test for a specific child, based on chronological age and/or number of years children are exposed to NGT. The test can also be shortened through the creation of criteria when to abort the test, after a number of consecutive incorrect test sentences.

The age range of 6 – 10 years old should be discussed again as well. The age of 6 was chosen because we wanted the DHH children to be exposed to NGT in school for at least two years. For DHH children from hearing families this might have been the only exposure to NGT they have had until that age. The age of 10 years as a maximum age for this test might be too young. The test sentences become so long and complex that even the young DHH adults couldn't repeat all the sentences correctly. It can be discussed that the maximum age range for this test should be extended to 12 years old. In that case also DHH children in the final educational grade of primary school in the Netherlands, grade 8, can take this test.

In future research one other aspect needs to be studied and discussed. That aspect is what grammatical variations of the test sentences are scored as 'correct' and how to incorporate that in the scoring grid. As discussed in paragraph 4.2.2 some changes in order of phrases or single signs cause a phrase order as we know from spoken Dutch, an SVO order. This phrase can also be a phrase order that is used by NGT users. Most DHH children do have (some) access to spoken Dutch due to early fitting of hearing aids or implantation of cochlear implants. They often also get exposed to sign supported Dutch in their school and this might have its influence on the NGT sentences they construct. The main question related to this aspect is what is accepted as 'correct' NGT, as there is so much variability in what DHH adult signers produce, and who decides on this question. Discussions with other sign language linguists and deaf adult NGT users is desired.

5.4. Conclusion

For this master thesis I created a first version of an SRT-NGT for DHH children with a chronological age between 6 and 11 years old. The main research question of this study was what the most important components should be of an SRT-NGT for DHH children who are acquiring NGT. The concept 'components' can be interpreted in a qualitative and quantitative way. In a quantitative way an SRT-NGT-kids should be able to follow up on NGT development in an individual child over time and compare the results of an individual child with a norm group. In a qualitative way an SRT-NGT should be able to indicate which

grammatical NGT elements a DHH child is acquiring well, and which elements need extra attention and/or training. The work title of this SRT-NGT for DHH children is ‘SRT-NGT-kids’.

The currently created SRT-NGT-kids consists of 32 test sentences divided across three complexity levels: ‘simple’, ‘moderate’ and ‘complex’ sentences. This first version of the SRT-NGT-kids is tested with five DHH young adults and eight DHH children who attend a special primary school for children with a hearing impairment. The quantitative results indicate the SRT-NGT-kids does discriminate between the three complexity levels. The average percentage of correct sentence repetitions of all participants became lower when the level of complexity went up. The results also showed an increase in the percentage of correct sentence repetitions related to increase of educational grade. The results, however, did not show a relation between chronological age and percentage of correct sentence repetitions. The SRT-NGT-kids also gives the opportunity to analyze children’s sentence repetitions in a qualitative manner. This provides professionals with information about the specific grammatical elements of NGT a specific DHH child requires extra training on. Based on these results it can be concluded that the SRT-NGT-kids can be a useful instrument to follow up on DHH children’s NGT development over time. The development of the SRT-NGT-kids is not yet finished. A second round of evaluating and discussing the test sentences must done with subsequently a second, more extensive pilot. Eventually, a norm group is required to judge the individual test scores compared to specific ‘age and grade appropriate’ test scores.

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Appendix 1. Guidelines constructing sign language tests (Tobias Haug)

Steps and procedures for adaptation of sign language tests

(Haug, 2011)

Steps	Description	Procedure / Method
(1) Test items	(a) Identify test items of source language test and check their "equivalence" in target language (b) Identify vocabulary of age target group (c) Identify regional variations of different vocabulary items (d) Identify target language-specific structures (e) Identify developmental pattern of structures represented in test (e.g., review of acquisition studies of other sign languages) (f) Check suitability of distractors from the content side (not pictures, but what they represent, i.e. if they also represent a phonological, lexical, or morpho-syntactic distractor in the target language)	(a) – (e) Review of research literature & consultations with Deaf and hearing experts (linguists, native signers) (c) Small piloting (if needed)
(2) Test materials	(a) Test materials: check for cultural appropriateness of test materials and concept representation, also for distractors (b) Scoring sheets: check for appropriateness of scoring sheets for the target language (e.g., certain categories do not apply in target language	(a) Consultations with Deaf and hearing experts
(3) Construct definition	(a) Defining the construct (e.g. language development) (b) Ranking of item complexity	Results of literature review of steps (1) and (2) Results of consultations of steps (1) and (2)
(4) Operationalization of construct (adaptation of test items)	(a) Adaptation of source language items into the target sign language (b) Translation/adaptation of test instructions (c) Develop additional items for the target sign language (d) Decision of items order (based on ranking of item order and item order of source language test)	Results of previous steps (1) – (3)
(5) Technical realization	(a) Filming of adapted test items (b) Decision and realization of test format, i.e. Computer- or Web-based test format or on DVD/Video	
(6) Pre-pilot test	(a) Review of pre-pilot test version (b) Revisions - depending on (1)	(a) Panel of experts providing input
(7) Pilot with Deaf adults	(a) Conduct pilot study of the test with Deaf adults (b) Revisions to test structure, items, and materials	(a) Testing (a) Open-worded questionnaires/interviews for input
(8) Pilot test version	(a) Review of pilot by (Deaf) sign linguist(s)	(a) Prepared criteria for review
(9) Pilot with Deaf children	(a) Conduct pilot study with Deaf children (b) Obtain social-demographic information about the Deaf children and the teachers	(a) Testing (b) Questionnaires / interviews
(10) Analyses of pilot study	(a) Analyze the results of the pilot study with Deaf children (b) Check the effectiveness of the items (c) Check the effectiveness of the distractors (d) Check how well other variables explain differences in performance (e) Reliability (f) Validity (e.g., external variable) (g) Suggestions for revisions	(a) – (f) Statistical analysis (item and distractor analysis, different variables in relation to test performance)
(11) First test version	(a) Revision of pilot test version based on the results of pilot	
(12) Construct validation	(a) Deaf adults rank the ascribed age of acquisition of linguistic structures represented in items of first test version (b) This ranking should be compared with the original ranking of item order (see construct definition) and results of pilot (item analysis) as a source of validity (c) The results of (a) and (b) should be comparable	(a) Map *Ranking of Items Complexity*
(13) Pilot with hearing children (optional)	(a) Conduct pilot study with same aged hearing non-signing peers to investigate the effect of iconicity (b) Consequences of results?	(a) Testing (a) Questionnaires
(14) Standardization study	(a) Define criteria for norming sample (e.g., linguistic experience, age groups) (b) Conduct a standardization study	(b) Testing (b) Questionnaires / interviews
(15) Analysis of standardization study	(a) Analyzing the results of standardization study (b) Establishment of age-related norm	(a) & (b) Statistical analysis (same as above, plus standard scores)
	(c) Final revisions if needed	
(16) Publication	(a) Prepare for publication for practitioners in schools (manual, ease of test use etc.) (b) Decide on the format how the test should be delivered (e.g., DVD/video, computer- or web-based)	
(17) Stay in touch	(a) Stay in contact with schools, further obtain information of scoring (i.e. collect scoring sheets)	

Appendix 2a. Details young deaf adult participants.

Part. Nr.	gender	age	Primary education setting
1	F	25	special
2	M	22	Special + regular
3	F	29	Special
4	F	26	Special + regular
5	F	34	special

Appendix 2b. Details primary school participants.

Part. Nr.	**gender**	**age**	**grade**	**Hearing status child**	**Hearing status parents**	**Language(s) used at home**
1	m	11	7	D - CI	H	Spoken Dutch (including supporting signs)
2	m	8	6 (5)*	D - CI	D	Spoken Dutch (including supporting signs) + NGT + English
3	f	11	6	HH - HA	H	Arabic + spoken Dutch
4	f	9	6	D - CI	D	Spoken Dutch (including supporting signs) + NGT
5	m	10	7	HH - HA	D	Spoken Dutch (including supporting signs) + NGT
6	m	7	4	D - CI	H	Spoken Dutch (+including supporting signs) + English
7	f	8	4	HH – HA/BCD	H	Spoken Dutch (including supporting signs)
8	f	6	3	D - CI	D	Spoken Dutch (including supporting signs) + NGT + Esharani (Iranian sign language)

* This participant skipped a grade.

Appendix 3. Test items of the NGT-SRT-kids pilot version.

Sentence number + complexity level	**Sentence NGT (in GLOSSES)**	Number of manual signs	Clauses / sentence types/ morphological features / :
… = copied and adjusted from NGT-SRT (Schüller, 2018) … = copied and translated from SASL-SRT (Palmer, 2020) … = copied and translated from LIS-SRT (Rinaldi et al., 2018)	**__hn__= head nod = bevestiging** **__hs__ = head shake = negatie** **__er__ = Eyebrow raise** **__ef__ = eyebrow frown** **__nu__ = Nose Up = neus optrekken** **__se__= squinted eyes** **PU = Palm Up = algemeen vraaggebaar** **OC = orale component** **CL = classifier** **Or = oraal** **BLAUW = 2nd hand hold-locative** **#B-E-L-L-O = fingerspelling** **+++ = herhaald/meervoud** **Localisation (INDEX):** **2** **3B 3A** **1**		
S1	_____ER_____ _____HN TWEE SCHOEN++ HEBBEN INDEX$_1$ ‘Ik heb 2 schoenen’ ‘I have two shoes’	5	Main: declarative - affirmative Plural – reduplication Topicalisation
S2	__ER_____ __EF_____ _ER_ BOOM INDEX$_3$ GROOT-oc INDEX$_3$ PU ‘Is die boom groot?’ ‘Is that a big tree?’	5	Main: interrogative – yes/no question Oral component – mouth gesture (‘big’)
S3	_____ER__ FIETS INDEX$_3$ BAND LEEG/LEK-loc INDEX$_3$ ‘De fietsband is leeg/Lek’ ‘The tire of the bike is flat’	5	Main: declarative Locative use of signs
S4	___ER___ __ER__ GISTEREN INDEX$_1$ HUIS OUD KOPEN INDEX$_1$ ‘Gisteren kocht ik een oud huis’	6	Main: declarative Adverb - time

	‘Yesterday I bought an old house’		
S5	_____ER_____ ___ER_ ____EF + HS__ MIJN HOND INDEX$_3$-ETEN WIL^NIET INDEX$_3$ ‘Mijn hond wil niet eten’ ‘My dog does not want to eat’	6	Main: declarative – negative Modal verb-negation
S6	_____ER____ ___ER_ __NU+ HS__ JONGEN INDEX$_3$ MELK LEKKER-oc INDEX$_3$ ‘De jongen vindt melk niet lekker’ ‘The boy doesn’t like milk’	5	Main: declarative – negative Negation – non-manual
S7	___ER_ ____EF_____ BABY INDEX$_3$ VERDRIETIG-oc _____ER_____ INDEX$_3$ WAAROM PU? ‘Waarom is de baby verdrietig?’ ‘Why is the baby sad?’	6	Main: interrogative – wh-question
S8	_ER__ ___EF_____ PAPA INDEX$_2$ LEZEN INDEX$_2$ WAT PU? ‘Wat leest jouw papa?’ ‘What does your father read?’	6	Main: interrogative – wh-question
S9	__ER_____ ____HN_____ MAN INDEX$_3$ AARDIG- INDEX$_3$ ‘De man is aardig’ ‘The man is kind’	4	Main: declarative – affirmative
S10	_____ER_____ MIJN POES INDEX$_3$ DRIE JAAR OUD INDEX$_3$ ‘Mijn poes is 3 jaar oud’ My cat is three years old’	7	Main: declarative Topicalization
S11	INDEX$_1$ LOPEN-CL INDEX$_1$ / _____EF_____ HOND INDEX2 BLAFFEN^TEGEN^MIJ-CL-loc / __ER___ INDEX$_1$ EROMHEEN^LOPEN-CL	8	Temporal clause + main: declarative Classifier - bodypart

	‘Ik loop (op straat). Er staat een hond die tegen mij blaft. Daarom loop ik er omheen’ ‘I’m walking (in the street). There is a dog that barks to me. Therefore, I walk around it’		
M1	_ER_ __ER___ JUF INDEX$_3$ / INDEX$_3$ $_3$VRAGEN$_1$: _____ER_____ VERZOEK INDEX$_2$ LAMP LICHT^AAN-CL INDEX$_2$ ‘De juf vraag aan mij: ”wil je alsjeblieft de lamp aandoen”’ ‘The teacher asks me: “would you please turn on the light”’	9	Complement clause + main: imperative Imperative particle Directional (agreeing)verb – inflection Classifier - handling
M2	_____ER____ JUF INDEX$_3$ JARIG INDEX$_3$ / __ER_____ __ER____ DAAROM INDEX$_3$ KIND+++ IJS GEVEN-CL+++ INDEX$_3$ ‘De juf jarig is en daarom geeft ze ieder kind een ijsje’ ‘It’s the teacher’s birthday and therefore she gives every child an ice-cream’	10	Reason clause + main: declarative Plural – reduplication Classifier- handling + reduplication
M3	_ER___ HOND INDEX$_3$ / __NU + EF_____ ___EF__ INDEX$_3$ GROMMEN-CL-$_{OC}$ INDEX$_3$ / _____EF_____ INDEX$_3$ HOND INDEX$_3$ WIE PU? ‘Van wie is de hond die gromt?’ ‘The dog that growls, whose dog is it?’	10	Embedded clause + main: interrogative - wh-question Classifier - bodypart
M4	__ER_____ ____ER_____ GISTEREN INDEX$_1$ RESTAURANT _____HN_____ GAAN^NAAR INDEX$_1$ / ____NU + HN____ __SE_____ INDEX$_2$(=daar) / ETEN VIES INDEX$_3$ ‘Het eten van het restaurant waar ik gisteren ben geweest was vies’	9	Embedded clause + main: declarative Adverb - time

	‘The food in the restaurant I went yesterday was awful’		
M5	_____EF_ INDEX$_1$ TAS ZOEKEN WAAR? __HN_____ AAAH-or VINDEN-locatief _____ER____ OPGELUCHT-oc ‘Ik zoek de tas. Waar is ie? Gelukkig, gevonden’ ‘I’m searching for the bag. Where is it? Fortunately, I found it’	7	Question-answer pair Locative verb
M6	_____SE_____ VANDAAG INDEX$_1$ ZIEK^GEVOEL-oc _____ER_____ INDEX$_1$ SCHOOL GAAN KAN INDEX$_1$ PU? / ____HS___ KAN^NIET ‘Vandaag voel ik me niet lekker. Kan ik naar school? Nee, dat kan niet’ ‘Today I’m not feeling well. Can I go to school? No, I cannot’	10	declarative clause + question-answer pair Modal verb - negation Time indication
M7	__SE + oc: pfff__ INDEX$_1$ 2^UUR^LANG FIETSEN++ / _____ER_____ EINDELIJK AANWEZIG-locatief / ____HN_____ INDEX$_1$ MOE INDEX$_1$! ‘Na 2 uur lang fietsen ben ik er eindelijk. Ik ben erg moe’ ‘After two hours of cycling I finally arrived. I’m very tired’	8	Embedded clause + main: declarative Numeral incorporation Verb – aspect / intensive marker
M8	MEISJE^KIND INDEX$_{3A}$ PARK INDEX$_{3B}$ $_{3A}$LOPEN$_{3B}$ / ___ER_____ INDEX$_{3B(=daar)}$ BLOEMEN++ PLUKKEN-cl++ BOS^BLOEMEN-hanteerCL. INDEX$_{3A}$ ‘Het meisje loopt naar het park waar ze bloemen plukt’	10	Complement clause + main: declarative Directional (agreeing) verb Classifier – bodypart + handling

	‘The girl walks to the park where she picks flowers’		
M9	_____ER____ 1^UUR JUF LUNCHEN INDEX$_3$ WAT PU?/ BOTERHAM KAAS OP INDEX$_3$ ‘Wat eet de juf om 1 uur voor lunch? Een boterham met kaas erop’ ‘What is the teacher eating for lunch at one o’clock? A sandwich with cheese’	10	Question-answer pair Numeral incorporation Initialized sign
M10	MEISJE INDEX$_{3A}$ JONGEN INDEX$_{3B}$ BOEK $_{3A}$GEVEN$_{3B}$-cl INDEX$_{3A}$ ‘Het meisje geeft een boek aan de jongen’ ‘The girl gives a book to the boy’	7	Main: declarative Directional (agreeing) verb – inflection
M11	_____ER_____ ALS-oc:FFF MORGEN REGEN/ _____HS_____ INDEX$_1$ ZWEMMEN GAAN INDEX$_1$ ‘Als het morgen regent ga ik niet zwemmen’ ‘If it is raining tomorrow, I won’t go swimming’	7	Conditional clause + main: declarative Negation – non-manual
M12	___er___ INDEX$_1$ DRIE KONIJN KLEIN+++(locatief+OC-CL) _____hn_____ HEBBEN INDEX$_1$ / _____er_____ _____nu_____ INDEX^ZIJ ALTIJD FRIEMEL-CL INDEX^ZIJ ‘Ik heb drie kleine konijntjes die altijd friemelen met hun pootjes’ ‘I have three small rabbits that always fidget with their paws’	12	Complement clause + main: declarative clause Plural - Reduplication Diminutive marker Classifier – size & shape + bodypart
C 1	___ER___ STAD NAAM AMSTERDAM-naamgebaar INDEX$_3$ / __NU__ _____ER____ INDEX$_3$ VEEL GEBOUW+++	11	Coordinated clause + main: declarative Name sign Plural – reduplication ‘counting hand’

	___hn_____ _____se_____ AANWEZIG++ BIJVOORBEELD ZIEKENHUIS^GEBOUW _____se_____ ENZOVOORT^telhand 'In Amsterdam staan veel gebouwen, bijvoorbeeld een ziekenhuis enzovoorts' 'In Amsterdam are a lot of buildings like a hospital etcetera'		
C2	_____ER_____ VORIGE WEEK REGEN++ DOOR++. ____ER__ GEVOLG VOETBAL^VELD-cl+++ WATER OVERSTROMEN++ JAMMER! 'Vorige week bleef het maar regenen waardoor de voetbalvelden zijn overstroomd. Jammer!' 'Last week it continuously rained causing the football fields to flood. What a pitty!'	12	Reason clause + main: declarative Aspect Time indication Intensive marker Plural – reduplication Classifier – size & shape
C3	_____ER_____ BUURMAN INDEX$_3$ / ___NU_ INDEX$_3$ AUTO KAPOT INDEX$_3$. / __ER_ NU INDEX$_3$ AUTO GARAGE BRENGEN^NAAR^GARAGE-cl INDEX$_3$ 'De auto van mijn buurman is kapot. Nu brengt hij hem naar de garage' 'My neighbors' car is broken. He now brings it to the garage'	12	Two main clauses – declarative Classifier - handling
C4	_____ER____ _____ER_____ AUTO INDEX$_{3a}$ BOOM INDEX$_{3B}$ / AUTO^BOTSEN^TEGEN^BOOM-cl-oc 'De auto botst tegen een boom' 'The car crashes against a tree'	5	Main clause: declarative Classifier - entity
C5	____er_____ VROUW PAARD VROUW^OP^PAARD- ____er_____ CL. HEK INDEX$_{2.}$ / PAARDRIJDEN-cl GALOPPEREN-cl	9	Temporal clause + manin clause(s) Classifiers

	_____se_____ SPRINGEN^OVER^HEK-cl GALLOPEREN-cl 'Een vrouw ging paardrijden. Toen ze op het paard zat zijn ze naar een hek gereden en eroverheen gesprongen' 'A woman went horseback riding. When she was on the horse, they rode to a fence and jumped over it'		
C6	_____ER_____ OMA INDEX$_{3B}$ / DRIEEN VAAK 3aBEZOEKEN3b++ / ___ER__ DRIEEN ETEN KOKEN $_{1}$HELPEN$_{3}$ 'Wij gaan vaak met z'n drieën op bezoek bij oma om te helpen met eten koken' 'The three of us often visit grandma to help cooking dinner'	9	Numeral (incorperation) Verb – aspect Directional (agreeing) verb topicalization
C7	_____ER_____ VORIG JAAR INDEX$_1$ 3^WEKEN VAKANTIE KLAAR^GAAN^NAAR INDEX$_1$ 'Vorig jaar ben ik 3 weken op vakantie geweest' 'Last year I went on a three-week holiday'	8	Main clause - declarative Time indication Numeral incorporation Past participle
C8	____ER_____ 2 HOND++ KIJKEN^KIJKEN-cl GROMMEN^GROMMEN-cl AANVALLEN^AANVALLEN^ELKAAR-cl. / _____ER_____ 2 PERSOON^PERSOON-cl LOPEN^LOPEN^NAAR^ELKAAR-cl UIT^ELKAAR^HALEN INDEX$_{3A/3B}$ 'Twee honden kijken grommend naar elkaar en vallen elkaar aan. Twee personen lopen er naartoe en halen ze uit elkaar' 'Two dogs growling look at each other and attack each other. Two people walk up to it and separate them'	9	Coordinated clauses + main: declarative Plural – two handed sign Classifiers – body part + entity

C9	____ER_____ ___HN__ INDEX$_2$ TANTE HOND HEBBEN INDEX$_2$ / _____ER_____ INDEX$_2$ HOND NAAM #B-E-L-L-O INDEX$_2$ PU? ‘Is de naam van jouw tantes hond B-e-l-l-o?’ ‘Is the name of your aunts dog B-e-l-l-o?’	11	Polar question fingerspelling

Appendix 4a. Information letter pilot study – young adults

Radboud Universiteit

Mei 2022.

INFORMATIEBRIEF OVER HET ONDERZOEK '*NGT-zinsherhalingstaak voor kinderen*'.

Beste moedertaalgebruikers van NGT,

In de periode mei-juli 2022 voeren wij een onderzoek uit waarin we een eerste versie van zinsherhalingstaak Nederlandse Gebarentaal (NGT) maken om de NGT-ontwikkeling van dove en slechthorende kinderen te kunnen volgen.
Voordat je beslist of je wil meedoen aan dit onderzoek, krijg je hier uitleg over wat het onderzoek inhoudt. Lees deze informatie rustig door en vraag de onderzoeker uitleg als je vragen heeft.

Beschrijving en doel van het onderzoek
In dit onderzoek willen we een eerste versie van een nieuw ontwikkelde zinsherhalingstaak NGT voor kinderen gaan uittesten. Je doet mee aan het uittesten en daarmee aan het verbeteren van de test.

Wanneer dove en slechthorende (DSH) kinderen NGT als taal aangeboden krijgen en NGT gebruiken, dan is het belangrijk om de ontwikkeling in deze taal te volgen zoals we dat ook bij de gesproken taalontwikkeling doen. Door het volgen van de ontwikkeling van NGT kunnen we beter aansluiten bij de talige behoefte van DSH-kinderen. Op dit moment zijn er nog niet veel gestandaardiseerde testen om de NGT-ontwikkeling van DSH-kinderen mee te volgen. De nieuwe zinsherhalingstaak NGT is een uitbreiding op de enige NGT-test die er nu in Nederland bestaat.

Wat wordt er van jou verwacht?
In dit onderzoek ga je een aantal NGT-zinnen herhalen die verschillen in lengte en grammaticale moeilijkheid. De NGT-zinnen zijn speciaal gemaakt voor het testen van kinderen. De zinnen worden aangeboden via een laptop waarop een dove moedertaalgebruiker van NGT de zinnen voordoet. Je kan in eigen tempo de zinnen herhalen. Je zal gefilmd worden tijdens de test zodat we na afloop van de test kunnen scoren hoeveel zinnen je goed hebt herhaald.
De zinsherhalingstaak-NGT zal in totaal 15-20 minuten duren.

Na de zinsherhalingstaak wordt er een korte geheugentaak afgenomen waarbij je cijfers achterstevoren (dus van het laatste cijfer terug naar het eerste cijfer) moet herhalen.

Vrijwilligheid
Je doet vrijwillig mee aan dit onderzoek. Dit houdt in dat je op elk moment tijdens het onderzoek je deelname kan stopzetten en toestemming kan intrekken. Je hoeft niet aan te geven waarom het stopt. Je kunt tot twee weken na deelname ook de onderzoeksgegevens en persoonsgegevens van jezelf laten verwijderen. Dit kunt u doen door een mail te sturen naar (Hermans et al., 2010)

Wat gebeurt er met jouw gegevens?
De onderzoeksgegevens die we in dit onderzoek verzamelen, zullen door ons gebruikt worden voor datasets, artikelen en presentaties. De anoniem gemaakte onderzoeksgegevens zijn tenminste 10 jaar beschikbaar voor

andere wetenschappers. Persoonsgegevens die verzameld worden, blijven vertrouwelijk. Als we gegevens met andere onderzoekers delen, kunnen deze dus niet tot jou herleid worden.

In dit onderzoek worden naast de andere onderzoeksgegevens ook video-opnames gemaakt. Deze opnames worden gebruikt voor het scoren van de test (hoeveel zinnen worden goed of fout herhaald). Ook zal gekeken worden naar specifieke NGT-onderdelen die goed of fout worden herhaald. Deze gegevens worden gebruikt om de eerste versie van de nieuwe test te verbeteren.
Mimiek, bewegingen in het gezicht, is een belangrijk onderdeel van gebarentaal. Daarom is het noodzakelijk dat je herkenbaar in beeld bent. Bij het verwerken van de video-opnames zal verder geen naam o.i.d. gebruikt worden.
De video-opnames worden opgeslagen op een beveiligde omgeving van de Radboud Universiteit. Alleen de onderzoekers verbonden aan dit onderzoek hebben toegang tot de videobeelden. De videobeelden komen niet beschikbaar voor andere onderzoekers.

Je krijgt van ons een apart toestemmingformulier, waarop je al dan niet kunt instemmen met het maken en gebruiken van deze opnames. Ook kun je op het formulier aangeven voor welke specifieke situaties we de opnames wel of niet mogen gebruiken.

Voor de uitvoering van het onderzoek en registratie van deelname is het nodig dat wij persoonsgegevens verzamelen, gebruiken en bewaren. In het toestemmingsformulier is aangegeven om welke persoonsgegevens het gaat.

We bewaren alle onderzoeks- en persoonsgegevens op beveiligde wijze volgens de richtlijnen van de Radboud Universiteit.

Heeft u vragen over het onderzoek?
Als je vragen hebt of meer informatie over het onderzoek wilt hebben, kun je contact opnemen via de contactgegevens onderaan deze brief.

Ethische toetsing en klachten
Dit onderzoek is goedgekeurd door de Ethische Toetsingscommissie Geesteswetenschappen van de Radboud Universiteit (ETC-GW nummer 2021-2033)

Heb je klachten over het onderzoek, dan kunt u contact opnemen met de verantwoordelijke onderzoeker.

Ook kun je een klacht indienen bij de secretaris van de Ethische Toetsingscommissie Geesteswetenschappen Radboud Universiteit (etc-gw@ru.nl).
Voor vragen over de verwerking van gegevens in dit onderzoek kunt u contact opnemen met:
dataofficer@let.ru.nl

Toestemmingsverklaring
Als je akkoord gaat met deelname aan dit onderzoek, vragen we je bijgevoegde toestemmingsverklaring te ondertekenen. Het toestemmingsformulier kan ingeleverd worden bij de onderzoeker. Door je schriftelijke toestemming geef je aan dat je de informatie hebt begrepen en instemt met deelname aan het onderzoek.

Met vriendelijke groet,

Belinda van der Aa,
b.vd.aa@auris.nl
010-2041515 / 06-22558164

Appendix 4b. information letter pilot study – children

Radboud Universiteit

Aan: ouders/verzorgers van leerlingen van groep 3 t/m 7 van de Auris dr. M. Polanoschool.

Datum: 27-05-2022.

INFORMATIEBRIEF OVER HET ONDERZOEK '*NGT-zinsherhalingstaak voor kinderen*'.

Geachte ouders/verzorgers,

In juni 2022 voeren wij op de school van uw kind onderzoek uit waarin we een eerste versie van een zinsherhalingstaak Nederlandse Gebarentaal (NGT) maken waarmee we in de toekomst de NGT-ontwikkeling van dove en slechthorende kinderen te kunnen volgen. De schoolleiding heeft ingestemd met dit onderzoek. Voordat u beslist of u uw kind wilt laten meedoen aan dit onderzoek, krijgt u uitleg over wat het onderzoek inhoudt. Lees deze informatie rustig door en vraag de onderzoeker uitleg als u vragen heeft.

Beschrijving en doel van het onderzoek
In dit onderzoek willen we een eerste versie van een nieuw ontwikkelde zinsherhalingstaak NGT voor kinderen gaan uittesten. Uw kind doet mee aan het uittesten en daarmee aan het verbeteren van de test.

Wanneer dove en slechthorende (DSH) kinderen NGT als taal aangeboden krijgen en NGT gebruiken, dan is het belangrijk om de ontwikkeling in deze taal te volgen zoals we dat ook bij de gesproken taalontwikkeling doen. Door het volgen van de ontwikkeling van NGT kunnen we beter aansluiten bij de talige behoefte van uw kind. Op dit moment zijn er nog niet veel gestandaardiseerde testen om de NGT-ontwikkeling van uw kind mee te volgen. De nieuwe zinsherhalingstaak NGT is een uitbreiding op de enige NGT-test die er nu in Nederland bestaat.

Wat wordt er van uw kind verwacht?
In dit onderzoek gaat uw kind een aantal NGT-zinnen herhalen die verschillen in lengte en grammaticale moeilijkheid. De NGT-zinnen zijn speciaal gemaakt voor het testen van kinderen. De zinnen worden aangeboden via een laptop waarop een dove moedertaalgebruiker van NGT de zinnen voordoet. Uw kind kan in eigen tempo de zinnen herhalen. Uw kind zal gefilmd worden tijdens de test zodat we na afloop van de test kunnen scoren hoeveel zinnen uw kind goed heeft herhaald.
De zinsherhalingstaak-NGT zal in totaal maximaal 15 minuten duren.

De kinderen zijn al gewend om taaltesten te doen voor zowel het gesproken Nederlands als voor NGT tijdens de vaste testperiode op school in april. Deze extra zinsherhalingstaak zal voor de kinderen dus geen grote verandering en/of belasting zijn.

Vrijwilligheid
Uw kind doet vrijwillig mee aan dit onderzoek. Dit houdt in dat uw kind op elk moment tijdens het onderzoek zijn/haar deelname kan stopzetten en toestemming kan intrekken. Uw kind hoeft niet aan te geven waarom het stopt. Afzien van of stoppen met deelname heeft geen nadelige gevolgen voor uw kind. U kunt tot twee weken na deelname ook de onderzoeksgegevens en persoonsgegevens van uw kind laten verwijderen. Dit kunt u doen door een mail te sturen naar b.vd.aa@auris.nl.
Wat gebeurt er met de gegevens van mijn kind?

De onderzoeksgegevens die we in dit onderzoek verzamelen, zullen door ons gebruikt worden voor datasets, artikelen en presentaties. De anoniem gemaakte onderzoeksgegevens zijn tenminste 10 jaar beschikbaar voor andere wetenschappers. Persoonsgegevens die verzameld worden, blijven vertrouwelijk. Als we gegevens met andere onderzoekers delen, kunnen deze dus niet tot uw kind herleid worden.

In dit onderzoek worden naast de andere onderzoeksgegevens ook video-opnames gemaakt. Deze opnames worden gebruikt voor het scoren van de test (hoeveel zinnen worden goed of fout herhaald). Ook zal gekeken worden naar specifieke NGT-onderdelen die goed of fout worden herhaald door de kinderen. Deze gegevens worden gebruikt om de eerste versie van de nieuwe test te verbeteren.
Mimiek, bewegingen in het gezicht, is een belangrijk onderdeel van gebarentaal. Daarom is het noodzakelijk dat uw kind herkenbaar in beeld is. Bij het verwerken van de video-opnames zal verder geen naam o.i.d. gebruikt worden.
De video-opnames worden opgeslagen op een beveiligde omgeving van de Radboud Universiteit. Alleen de onderzoekers verbonden aan dit onderzoek hebben toegang tot de videobeelden. De videobeelden komen **niet** beschikbaar voor andere onderzoekers.

U krijgt van ons een apart toestemmingformulier, waarop u al dan niet kunt instemmen met het maken en gebruiken van deze opnames. Ook kunt u op het formulier aangeven voor welke specifieke situaties we de opnames wel of niet mogen gebruiken.

Voor de uitvoering van het onderzoek en registratie van deelname is het nodig dat wij persoonsgegevens verzamelen, gebruiken en bewaren. In het toestemmingsformulier is aangegeven om welke persoonsgegevens het gaat.

Voor het onderzoek is het ook nodig om bijzondere persoonsgegevens te verzamelen. Deze bijzondere persoonsgegevens zijn aangegeven in het toestemmingsformulier. Het gaat hier bijv. over mate en oorzaak van het gehoorverlies van uw kind.

We bewaren alle onderzoeks- en persoonsgegevens op beveiligde wijze volgens de richtlijnen van de Radboud Universiteit.

Heeft u vragen over het onderzoek?
Als u vragen heeft of meer informatie over het onderzoek wilt hebben, kunt u contact opnemen via de contactgegevens onderaan deze brief.

Ethische toetsing en klachten
Dit onderzoek is goedgekeurd door de Ethische Toetsingscommissie Geesteswetenschappen van de Radboud Universiteit (ETC-GW nummer 2021-2033)

Heeft u klachten over het onderzoek, dan kunt u contact opnemen met de verantwoordelijke onderzoeker.

Ook kunt u een klacht indienen bij de secretaris van de Ethische Toetsingscommissie Geesteswetenschappen Radboud Universiteit (etc-gw@ru.nl).

Voor vragen over de verwerking van gegevens in dit onderzoek kunt u contact opnemen met:
dataofficer@let.ru.nl

Toestemmingsverklaring
Als u akkoord gaat met deelname van uw kind aan dit onderzoek, vragen we u bijgevoegde toestemmingsverklaring te ondertekenen. Het toestemmingsformulier kan ingeleverd worden bij de leerkracht van

uw kind. Hij/zij zal deze doorgeven aan de onderzoeker, Belinda van der Aa. Door uw schriftelijke toestemming geeft u aan dat u de informatie heeft begrepen en instemt met deelname aan het onderzoek.

Met vriendelijke groet,

Belinda van der Aa,
Taalkundige Auris Dr. M. Polanoschool.
b.vd.aa@auris.nl
010-2041515.

Appendix 5a. General permission document – adult & children

Radboud Universiteit

TOESTEMMINGSVERKLARING

Naam onderzoek: NGT-zinsherhalingstaak voor kinderen
Verantwoordelijke onderzoeker: Belinda van der Aa, student MA General Linguistics.

Verklaring deelnemer
Ik heb uitleg gekregen over het doel van het onderzoek. Ik heb vragen mogen stellen over het onderzoek. Ik neem vrijwillig aan het onderzoek deel. Ik begrijp dat ik op elk moment tijdens het onderzoek mag stoppen als ik dat wil. Ik begrijp hoe de gegevens van het onderzoek bewaard zullen worden en waarvoor ze gebruikt zullen worden. Ik stem in met deelname aan het onderzoek zoals beschreven in het informatiedocument.

Naam: ……..... Geboortedatum: ……...

Handtekening: .... Datum: …….....

Verklaring uitvoerend onderzoeker
Ik verklaar dat ik de hierboven genoemde persoon juist heb geïnformeerd over het onderzoek en dat ik mij houd aan de richtlijnen voor onderzoekers zoals verwoord in het protocol van de Ethische Toetsingscommissie Geesteswetenschappen

Naam: ……..…..

Handtekening: .....

Datum:…….....

Appendix 5b. Permission document – children

Radboud Universiteit

TOESTEMMINGSVERKLARING

voor deelname aan het wetenschappelijke onderzoek: **'NGT-zinsherhalingstaak voor kinderen.'**

Verklaring ouder/voogd

Ik heb uitleg gekregen over het doel van het onderzoek. Ik heb vragen mogen stellen over het onderzoek. Ik begrijp dat ik op elk moment tijdens het onderzoek de deelname van mijn kind mag stopzetten. Ik begrijp hoe de gegevens van het onderzoek bewaard zullen worden en waarvoor ze gebruikt zullen worden. Ik stem in met deelname van mijn kind aan het onderzoek, zoals beschreven in het informatiedocument.

Daarnaast geef ik toestemming voor (s.v.p. aankruisen wat van toepassing is):

Ja	**Nee**	
☐	☐	Verwerken van de volgende (bijzondere) persoonsgegevens: leeftijd, gebruikte taal in de thuissituatie, leeftijd start gebruik NGT, mate van gehoorverlies, oorzaak van gehoorverlies, hoorapparatuur.
☐	☐	Maken van video-opnamen voor de uitvoering van het onderzoek.
☐	☐	Gebruik van identificeerbare foto's (zonder naam) uit de video-opname in (wetenschappelijke) artikelen
☐	☐	Gebruik van deze identificeerbare opnamen (zonder naam) voor wetenschappelijke presentaties (bijvoorbeeld op een conferentie)
☐	☐	Gebruik van identificeerbare foto's (zonder naam) uit de video-opname in Auris cursussen.
☐	☐	Gebruik van deze identificeerbare video-opnames (zonder naam) voor onderwijsdoeleinden (bijvoorbeeld in een hoorcollege en/of Auris cursus)
☐	☐	Uitschrijven van de NGT-uitingen in de video-opnamen (transcriptie) – anoniem.
☐	☐	Gebruik van de anoniem gemaakte geschreven transcripten voor wetenschappelijk onderzoek

Naam kind: .....

Naam ouder/voogd .....

Handtekening: ..... Datum:.....

Verklaring uitvoerend onderzoeker

Ik verklaar dat ik de hierboven genoemde persoon juist heb geïnformeerd over het onderzoek en dat ik mij houd aan de richtlijnen voor onderzoekers zoals verwoord in het protocol van de Ethische Toetsingscommissie Geesteswetenschappen.

Naam: .....

Handtekening: ..... Datum:.....

Appendix 5c. Permission document – adults

Radboud Universiteit

TOESTEMMINGSVERKLARING

voor deelname aan het wetenschappelijke onderzoek: '**NGT-zinsherhalingstaak voor kinderen.'**

Verklaring ouder/voogd

Ik heb uitleg gekregen over het doel van het onderzoek. Ik heb vragen mogen stellen over het onderzoek. Ik begrijp dat ik op elk moment tijdens het onderzoek mijn deelname mag stopzetten. Ik begrijp hoe de gegevens van het onderzoek bewaard zullen worden en waarvoor ze gebruikt zullen worden. Ik stem in met deelname aan het onderzoek, zoals beschreven in het informatiedocument.

Daarnaast geef ik toestemming voor (s.v.p. aankruisen wat van toepassing is):

Ja	**Nee**	
☐	☐	Maken van video-opnamen voor de uitvoering van het onderzoek.
☐	☐	Gebruik van identificeerbare foto's (zonder naam) uit de video-opname in (wetenschappelijke) artikelen
☐	☐	Gebruik van deze identificeerbare opnamen (zonder naam) voor wetenschappelijke presentaties (bijvoorbeeld op een conferentie)
☐	☐	Gebruik van identificeerbare foto's (zonder naam) uit de video-opname in Auris cursussen.
☐	☐	Gebruik van deze identificeerbare video-opnames (zonder naam) voor onderwijsdoeleinden (bijvoorbeeld in een hoorcollege en/of Auris cursus)
☐	☐	Uitschrijven van de NGT-uitingen in de video-opnamen (transcriptie) – anoniem.
☐	☐	Gebruik van de anoniem gemaakte geschreven transcripten voor wetenschappelijk onderzoek

Naam : .....

Handtekening: ..... Datum:.....

Verklaring uitvoerend onderzoeker

Ik verklaar dat ik de hierboven genoemde persoon juist heb geïnformeerd over het onderzoek en dat ik mij houd aan de richtlijnen voor onderzoekers zoals verwoord in het protocol van de Ethische Toetsingscommissie Geesteswetenschappen.

Naam: .....

Handtekening: ..... Datum:.....

Appendix 5d. Permission document – school.

Radboud Universiteit

INFORMATIEDOCUMENT EN TOESTEMMINGSVERKLARING SCHOOL

Uitleg onderzoek
Aan de Radboud Universiteit is men bezig met het ontwikkelen van een zinsherhalingstaak NGT (SRT-NGT) waarmee een inschatting gemaakt kan worden van de NGT-vaardigheid van volwassen tweede taalleerders van NGT.
Als uitbreiding op deze SRT-NGT willen we In het huidige onderzoek een 1e versie van een zinsherhalingstaak voor kinderen maken en uittesten, met als werktitel: 'SRT-NGT-kids'. De SRT-NGT-kids is een uitbreiding op de huidige mogelijkheden om de gebarentaalontwikkeling van DSH-kinderen te monitoren. Deze eerste versie van de zinsherhalingstaak NGT voor kinderen ('SRT-NGT-kids') is voor kinderen tussen de 6-10 jaar oud.

De kinderen moeten een aantal NGT-zinnen herhalen die verschillen in lengte en grammaticale complexiteit. De NGT-zinnen zijn speciaal gemaakt voor het testen van kinderen. De zinnen worden aangeboden via een laptop waarop een moedertaalgebruiker van NGT de zinnen voordoet. De kinderen kunnen in eigen tempo de zinnen herhalen. De kinderen zullen gefilmd worden tijdens de test zodat we na afloop van de test kunnen scoren hoeveel zinnen de kinderen goed hebben herhaald.
De zinsherhalingstaak-NGT zal in totaal maximaal 15 minuten duren.

De kinderen zijn al gewend om taaltesten te doen voor zowel het gesproken Nederlands als voor NGT tijdens de vaste testperiode op school in april. Deze extra zinsherhalingstaak zal voor de kinderen dus geen grote verandering en/of belasting zijn.

Informatievoorziening
De ouders van de kinderen van de groepen 3 t/m 7 zullen geïnformeerd worden over dit onderzoek door middel van een informatiebrief. Alle ouders wordt gevraagd toestemming te geven voor deelname van hun kind aan dit onderzoek door middel van een toestemmingsverklaring.

Wat gebeurt er met de gegevens die we in dit onderzoek verzamelen?
De onderzoeksgegevens die we in dit onderzoek verzamelen, zullen door ons gebruikt worden voor datasets, artikelen en presentaties. De anoniem gemaakte onderzoeksgegevens zijn tenminste 10 jaar beschikbaar voor andere wetenschappers. Persoonsgegevens die verzameld worden, blijven vertrouwelijk. Als we gegevens met andere onderzoekers delen, kunnen deze dus niet tot de deelnemers herleid worden.

In dit onderzoek worden video-opnames gemaakt. Deze opnames worden gebruikt voor het scoren van de test (hoeveel zinnen worden goed of fout herhaald). Ook zal gekeken worden naar specifieke NGT-onderdelen die goed of fout worden herhaald door de kinderen. Deze gegevens worden gebruikt om de 1e versie van de nieuwe test te verbeteren.
Mimiek in het gezicht een belangrijk onderdeel van gebarentaal. Daarom is het noodzakelijk dat de kinderen herkenbaar in beeld is. Bij het verwerken van de video-opnames zal verder geen naam o.i.d. gebruikt worden.
De video-opnames worden opgeslagen op een beveiligde omgeving van de Radboud Universiteit. Alleen de onderzoekers verbonden aan dit onderzoek hebben toegang tot de videobeelden. De videobeelden zullen niet gedeeld worden met andere onderzoekers.

Voor de uitvoering van het onderzoek en registratie van deelname is het nodig dat wij persoonsgegevens verzamelen, gebruiken en bewaren. In het toestemmingsformulier voor de ouders/verzorgers is aangegeven om welke (bijzondere) persoonsgegevens het gaat.

We bewaren alle onderzoeks- en persoonsgegevens op beveiligde wijze volgens de richtlijnen van de Radboud Universiteit.

Ethische toetsing
Dit onderzoek is goedgekeurd door de Ethische Toetsingscommissie Geesteswetenschappen van de Radboud Universiteit (ETC-GW nummer 2021-2033).

Heeft u vragen over het onderzoek?
Als u vragen heeft of meer informatie over het onderzoek wilt hebben, kunt u contact opnemen met de onderzoekers:
Belinda van der Aa, 06-22558164, b.vd.aa@auris.nl
Dr. Ellen Ormel, e.ormel@ru.nl

Toestemming
Ik geef de onderzoeker(s) van de Radboud Universiteit toestemming het onderzoek uit te voeren op mijn school

Naam school/instelling .....

Naam en functie.....

Handtekening:.....

Datum: .....

Appendix 6. Background questionnaire children.

AURIS
KONINKLIJKE AURIS GROEP

Radboud Universiteit

Vragenlijst bij onderzoek zinsherhalingstaak NGT voor kinderen.

Naam kind: _____

Leeftijd (in jaar; maanden): _____

Welke taal/talen worden er thuis gebruikt (meerdere antwoorden mogelijk):

- o gesproken Nederlands (eventueel in de vorm van NmG)
- o NGT
- o Andere gesproken taal: _____
- o Andere gebarentaal: _____

Vanaf welke leeftijd heeft uw kind NGT aangeboden gekregen: _____

Welk soort onderwijs heeft uw kind tot nu toe gehad?

- o Eerst regulier onderwijs, daarna overgestapt naar speciaal onderwijs
- o Een combinatie van regulier onderwijs en speciaal onderwijs
- o Alleen speciaal onderwijs

Hoe groot is het gehoorverlies van uw kind gemiddeld per oor:

Linkeroor: _____dB

Rechteroor: _____dB

Welk soort hoorapparatuur draagt uw kind (meerdere antwoorden mogelijk):

- o Hoortoestel
- o CI
- o BCD
- o Anders: _____

Wat is de oorzaak van het gehoorverlies van uw kind?

_____

_____

Dank u wel voor het invullen!