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Leena Mäkinen

NARRATIVE LANGUAGE IN TYPICALLY DEVELOPING CHILDREN, CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENT AND CHILDREN WITH AUTISM SPECTRUM DISORDER

UNIVERSITY OF OULU GRADUATE SCHOOL;
UNIVERSITY OF OULU,
FACULTY OF HUMANITIES, LOGOPEDICS;
CHILD LANGUAGE RESEARCH CENTER

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Abstract

This study examined Finnish children's narrative skills using a picture-based story generation task. 4- to 8-year-old children with typical development (n = 172), 5- to 7-year-old children with specific language impairment (SLI) (n = 19) and 5- to 10-year-old children with autism spectrum disorder (ASD) (n = 16) participated in the study. Linguistic (productivity, syntactic complexity, grammatical accuracy) and pragmatic (referential accuracy, event content, mental state expressions, discourse features, and story comprehension) measures were used so as to gain a comprehensive picture of narrative skills. The choice of measures was based on the narrative abilities of the participants, and not all measures were used with all participants.

In typically developing children, a subtle development trend was seen in all the measures used, but significant differences between consecutive age-groups were mostly seen in younger participants. The relationship between narrative productivity measures and event content was found to be important. The number of different word tokens was, in particular, useful in explaining the event content.

For children with SLI, the linguistic and pragmatic aspects of narration were demanding. Their stories were short and contained less information than those of their control. Their referential and grammatical accuracy was also poorer than among typically developing children, and they showed difficulties in expressing the mental states of the story characters and in story comprehension.

Children with ASD produced narratives with an almost similar linguistic structure to those of their control children. However, children with ASD showed difficulties in the pragmatic aspect of narration, in establishing informative story content and in story comprehension. They also tended to include irrelevant information in their stories, which was not seen to that extent in cases of typical development.

This dissertation shows a development in 4- to 8-year-olds' narratives that seems to occur around the ages of 4 and 5. Narrative difficulties seem to be related to both SLI and ASD, but are more wide-ranging in SLI, whereas in ASD difficulties focus on the pragmatic aspects of narration.

Keywords: autism spectrum disorder, narrative, narrative development, narrative structure, pragmatics, specific language impairment, typical language development

Mäkinen, Leena, Kertova kieli tyypillisesti kehittyneillä lapsilla sekä lapsilla, joilla on kielellinen erityisvaikeus tai autismikirjon häiriö.
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Tiivistelmä

Tutkimuksessa selvitettiin, millaiset ovat suomalaislasten kuvasarjakerronnan avulla arvioidut kerrontataidot. Tutkimukseen osallistui 4–8-vuotiaita tyypillisesti kehittyneitä lapsia (n = 172), 5–7-vuotiaita lapsia, joilla on kielellinen erityisvaikeus (SLI) (n = 19) ja 5–10-vuotiaita lapsia, joilla on autismikirjon häiriö (ASD) (n = 16). Tutkimuksessa käytettiin lingvistisiä (produktiivisuus, syntaksin monipuolisuus, kieliopillinen tarkkuus) ja pragmaattisia (viittaussuhteiden tarkkuus, tapahtumasisältö, mielentilailmaukset, diskurssipiirteet, kertomuksen ymmärtäminen) muuttujia, jotta kerrontataidoista saadaan kokonaisvaltainen kuva. Kaikkia muuttujia ei käytetty kaikkien tutkittavien kesken, vaan tutkimusmenetelmien valinta perustui tutkittavien kerronnan piirteisiin.

Tyypillisesti kehittyvien lasten kerrontataidot kehittyivät kaikkien käytettyjen muuttujien osalta, mutta peräkkäisissä ikäryhmissä merkitsevä muutos havaittiin vain nuorempien ikäryhmien välillä. Kerronnan produktiivisuuden ja tapahtumasisällön välillä havaittiin yhteys, ja erityisesti eri saneiden määrä oli merkitsevä tapahtumasisällön selittäjä.

Kerronnan lingvistinen ja pragmaattinen hallinta oli haastavaa lapsille, joilla on SLI. Heidän kertomuksensa olivat pituudeltaan, tapahtumasisällöltään ja mielentilailmauksiltaan niukempia sekä viittaussuhteiltaan epätarkempia kuin tyypillisesti kehittyvien lasten kertomukset. Lapset, joilla on SLI, tuottivat enemmän kieliopillisia virheitä kuin kontrollilapset, ja myös tarinan ymmärtäminen oli heille haastavaa.

Kertomuksen lingvistinen rakenne oli likimain samankaltainen tyypillisesti kehittyneillä lapsilla ja lapsilla, joilla on ASD. Lapset, joilla on ASD, tuottivat tapahtumasisällöltään niukempia kertomuksia kuin kontrollilapset, ja lisäksi heidän tarinansa sisälsivät irrelevanttia tietoa. Kertomuksen ymmärtäminen oli myös vaikeaa lapsille, joilla on ASD.

Tutkimus osoittaa, että 4–8-vuotiaiden kerrontataidoissa on kehitystä, mikä vaikuttaa olevan aktiivista erityisesti 4–5 ikävuoden aikana. Kerronnan vaikeudet ovat kielellisessä erityisvaikeudessa laaja-alaisia, kun taas autismikirjossa vaikeudet näkyvät ennemmin kerronnan pragmaattisessa hallinnassa.

Asiasanat: autismikirjon häiriö, kerronnan kehitys, kerronnan rakenne, kerronta, kielellinen erityisvaikeus, pragmatiikka, tyypillinen kielenkehitys

To my family

”Where shall I begin?” asked the White Rabbit.

“Begin at the beginning,” the King said gravely,

“and go on till you come to the end, then stop.“

- Lewis Carroll, 1865-

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A total of 207 children participated in this study, and the data collection took a great deal of time. All the children participating and their families are especially thanked, since without them this work would not have been possible. I am so grateful that I have such an amazing profession as a speech language therapist that I am allowed to work with wonderful children.

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Abbreviations

ADI-R	The Autism Diagnostic Interview-Revised
ADOS	The Autism Diagnostic Observation Schedule
ASD	Autism spectrum disorder
CD	Clausal density
CU	Communication unit (C-unit)
DSM-5	Diagnostic and Statistical Manual of Mental Disorders 5
ICD-10	International Classification of Diseases 10
MLU	Mean length of utterance
MLCU	Mean length of communication unit
NDW	Number of different word tokens
PIQ	Performance intelligence quotient
SLI	Specific language impairment
TNW	Total number of word tokens
ToM	Theory of mind
TTFC-2	Token Test for Children, Second Edition
TWF-2	Test of Word Finding, Second Edition
VIQ	Verbal intelligence quotient
WCC	Weak central coherence

List of original publications

This dissertation is based on three articles which are referred to in the text in Roman numerals as follows:

I Mäkinen L, Loukusa S, Nieminen L, Leinonen E & Kunnari S (2014) The development of narrative productivity, syntactic complexity, referential cohesion, and event content in four- to eight-year-old Finnish children. First Language 34(1): 24–42.

II Mäkinen L, Loukusa S, Laukkanen P, Leinonen E & Kunnari S (2014) Linguistic and pragmatic aspects of narration in Finnish typically developing children and children with specific language impairment. Clinical Linguistics and Phonetics 28(6): 413–427.

III Mäkinen L, Loukusa S, Leinonen E, Moilanen I, Ebeling H & Kunnari S (2014) Characteristics of narrative language in autism spectrum disorder: evidence from the Finnish. Research in Autism Spectrum Disorders 8(8):987–996.

Contents

1 Introduction

The developed use of discourse abilities makes it possible efficiently to participate in conversations, to explain things and events and to tell stories and personal experiences to others. Narratives, as well as other discourse genres, are commonly used in everyday social and communication situations. Especially narrative language has been of interest to researchers from different theoretical backgrounds for decades. Because narratives cover cognitive, pragmatic and linguistic as well as socio-cultural aspects of language use, they can be examined from various viewpoints.

Narration is a demanding task, since it requires the simultaneous interplay of multiple language domains. Linguistic, cognitive and pragmatic skills are needed in order to build a mental model of the story and to express the story with a precise structure and vocabulary and with accurate linguistic devices (Hudson & Shapiro 1991, Johnston 2008). In addition, utilization of a given context by means of observing the listener's needs is an essential part of efficient narration. As Cummings (2009: 23) mentions "*a narrative that fails to take account of listener knowledge by leaving certain information implicit and by presupposing other information will be inefficient*". Thus interaction of world knowledge and language and cognitive skills with pragmatics is needed in narration (Cummings 2009, Leinonen *et al.* 2000).

The basis of narration lies in early joint conversations and play situations with caregivers (Kavanaugh & Engel 1998, Nelson 1996). However, the first primitive narratives start to appear in a child's communication no earlier than at the age of three (Leadholm & Miller 1992). As a multifaceted skill, the ability to narrate develops from childhood all the way to adolescence (Leinonen *et al.* 2000). Narrative development is well-studied, especially in English, but the information from Finnish, a language that is structurally very different compared to English, is not available. Some language- (Hickmann 2003) and culture-specific (e.g. Jokinen & Wilcock 2006) variation are likely to be detected in discourse use, and therefore the data from Finnish is needed. Moreover, understanding typical development is a prerequisite for exploring the nature of impairments.

Specific language impairment (SLI) is a developmental disorder in which a child's language skills for no apparent reason fall below those expected from their age, but the development in other areas fall broadly within normal limits (Finnish Medical Association Duodecim 2010, World Health Organization, WHO 1993).

However, in addition to difficulties in structural aspects of language, research has increasingly shown that problems in social cognition are also observed in SLI (e.g. Ford & Milosky 2003, Gillot *et al.* 2004, Loukusa *et al*. 2014, Taylor *et al.* 2012). Autism spectrum disorder (ASD) is also a developmental disorder in which persistent difficulties in social communication and interaction are seen together with restricted patterns of behaviour (American Psychiatric Association, APA 2014, WHO 1993). Individuals with ASD are widely heterogeneous and their language abilities vary a great deal, since some have a persistent lack of speech and many have language disorders but some even show intact linguistic skills (Loucas *et al.* 2008, Rapin & Dunn 2003). However, problems in pragmatic aspects of language use and in social cognition seem to be universally impaired in ASD (APA 2014, Rapin & Dunn 2003).

An ability to communicate efficiently with others in social situations is an essential skill needed through one's lifetime. As Conti-Ramsden and Botting (2004:158) have said "*children who cannot effectively communicate are at risk of further social and behavioural problems, perhaps through frustration or negative experiences with interaction*". Individuals with SLI and ASD show problems in social and/or behavioural skills in childhood and also in adolescence (e.g. Conti-Ramsden & Botting 2004, Fujiki *et al.* 1996, Hurtig *et al.* 2009, White & Roberson-Nay 2009), and these problems may still be seen in adulthood (Whitehouse *et al*. 2009). Since narrative abilities are needed in many daily activities, as well as in academic settings, difficulties in this area of language use may cause secondary, social problems. In addition, there is evidence that narrative skills can predict later language and literacy achievement (Botting *et al.* 2001, Reese *et al.* 2010, Stothard *et al.* 1998). Therefore, assessment of children's early narrative abilities should be included in clinical evaluations in order to start intervention as early as possible.

This doctoral dissertation was motivated by the fact that Finnish typically developing children's narrative skills have not been systematically studied before, even though some unpublished master's level theses have been written. Instead, for example, studies concerning narratives by adults and aphasic speakers do exist (Korpijaakko-Huuhka 1995, 2003). In addition, to date in Finland, no well-studied children's narrative assessment methods exist, and the information concerning the narrative abilities of clinical groups is also restricted. Therefore, there is a need to better understand the narrative language development and its possible disorders when assessing children's narrative skills in clinical settings. The information concerning the narrative abilities of clinical groups is essential

when planning assessment methods that could target the core problems of these children‘s communication skills, and, on the other hand, also give information about the strengths children may have while narrating. Effective assessment is the basis for efficient intervention. Since problems in language use are found in both children with SLI and ASD, and as these children often receive speech and language intervention, these clinical groups were selected in order to study their narrations in detail. The problems seen in narrative skills may have long-standing effects on individuals’ lives and therefore early identification of these problems is important.

2 Literature review

2.1 Narratives

Narratives are spoken (or written) fictive- or real life-based depictions of temporally and causally related events that focus on a particular theme and together form a complete wholeness (Boudreau 2007, Kavanaugh & Engel 1998, Nelson 1996). While narrating it is necessary to operate not only "here and now" but to use decontextualized language in order to express events that already happened or that are fictional (Johnston 2008). Narratives are typically classified into scripts, personal narratives and fictive narratives, which differ in their demands and the function that they serve (e.g. Hudson & Shapiro 1991). Fictive narratives are stories, either retold or self-generated. Because they have a schema (a mental model of a story), people can intuitively differentiate stories from other discourse genres (Kintsch & van Dijk 1978, Stein & Policastro 1984). According to Stein and Policastro (1984) story must include at least an animate protagonist and a causal relationship among story events in order to be recognized as a story. However, the ranking of a story's quality is based on the presence of some other story elements also (i.e. setting, initial event, internal response, outcome, reaction), which are described in detail in so-called story grammars (see, for example Mandler 1978, Stein & Glenn 1979).

Story grammars have been extensively used in narrative studies for decades, also when examining children's narrative production, even though they were originally used in the studies of narrative comprehension or recall and as a model of a good or a well-formed story (Stein & Glenn 1979). According to Hickmann (2003) story grammars are one kind of narrative macrostructures, cognitive schemas, which guide the interpretation and understanding of the discourse. Kintch and van Dijk (1978) used the terms macro- and microstructures. In their model of text comprehension, the semantic structure of a discourse is formed through semantic units – propositions. Microstructure is the local structure of individual propositions and their relations, whereas macrostructure is a more global level that characterises the discourse as a whole. The overall meaning at the macro level is created through the microstructure. In this process, inferencing is essential, since it is possible to infer macrostructure from incomplete microstructure because language users can utilize their general or contextual knowledge of the situation and facts.

In addition, coherence and cohesion are commonly used terms in narrative settings. At a macro level, coherence refers to the global organisation of the story in an interrelated and meaningful way, so that the story hangs together (van Dijk 1997, Hickmann 2003, Hudson & Shapiro 1991). At the micro level, local coherence is commonly referred to as cohesion. According to Halliday and Hasan (1976: 4), "*cohesion occurs where the interpretation of some element in the discourse is dependent on that of another*". Cohesive ties are used to create the connectiveness and clarity within and between the sentences via reference use, substitutions, ellipsis, conjunctions, and through lexical cohesion (Halliday & Hasan 1976). Perkins (2007: 132) has written that "*cohesion may be considered part of the language system, since it is realized through the use of explicit linguistic devices, whereas coherence relies in addition on cognitive systems such as memory and executive functions such as planning, sequencing and self-monitoring in conjunction with linguistic and sensorimotor systems*". However, coherence and cohesion are related. Cohesion also occurs beyond adjacent clauses and it is therefore a constitutive of coherence (see Hickmann 2003, 2004).

As described above, narrative study covers a variety of aspects of language and language use. According to Perkins (2007), narrative analysis can be seen as a part of discourse studies as well as belonging to pragmatics, since, for example, inferencing and referencing, which are traditionally seen as belonging to pragmatic research tradition, are needed when narrating. In this study, a distinction is made between narrative linguistic and pragmatic aspects, which are now discussed in detail. I recognize that this division is somewhat arbitrary, since a well-formed narrative can only be created in a simultaneous interplay of these both elements.

2.1.1 Linguistic aspect of narration

The terminology used in narrative studies has been variable, but microstructure is commonly used to refer to narrative local structure – in particular to linguistic sentence-level analysis such as the use of syntactic structures (Justice *et al*. 2006), frequency of grammatical utterances or within-sentence productivity (see Liles *et al.* 1995). Originally, the concept of microstructure was used to indicate the semantics and relations of the propositions in the model of text comprehension and recall by Kintsch and van Dijk (1978). For clarity, following the terminology of Liles *et al.* (1995), I have chosen to use the term linguistic structure instead of microstructure. This is further divided into narrative productivity and complexity,

which Justice *et al*. (2006) found to be moderately related factors of narrative linguistic (micro)structure.

Broadly speaking, narrative productivity reflects the amount of linguistic material produced in the narrative. This can be measured by tallying the total number of words (TNW) used in the narrative or by calculating clausal-level elements, such as Communication units (C-unit)[1] or conjunctions (Justice *et al*. 2006). In addition, the number of different words (NDW) is a measure used in narrative linguistic analysis. However, there has been inconsistency as to whether this measure is seen as reflecting the lexical diversity of stories (Leadholm & Miller 1992, Westerveld *et al*. 2004) or productivity (Justice *et al.* 2006, Muñoz *et al.* 2003, Schneider 1996). If NDW is counted from a fixed number of words, it can be seen as a measure of lexical diversity; if not it should probably be seen as a measure of productivity, or reflecting them both as did Fey *et al*. (2004).

As a connected discourse, narratives allow for the analysis of sentence level structure. In order to do that, syntactical complexity can be assessed by calculating the mean length of C-units (MLCU). Even though MLCU is widely used (e.g. Fey *et al*. 2004, Hughes *et al.* 1997, Schneider *et al.* 2005), it is only a gross measure of syntactical complexity based on an idea that the more complex sentence structures are seen as an increase of words at a C-unit level. For this reason, MLCU has been seen also to reflect productivity (Fey *et al*. 2004, Muñoz *et al.* 2003, Schneider 1996). MLCU may not capture the structural complexity after acquiring the developed syntactic skills, because complex syntax is not only produced with longer utterance or C-unit length (Miller 1991). However, the mean length of C-units, in particular, is based on the segmenting of utterances on a syntactical basis, not only by intonation or pause patterns, which differs from the traditional MLU (mean length of utterance).

Analysis of sentence structures is a more specific method of assessing syntactical complexity. This can be done by tallying the numbers of subordinate or complex clauses (Bishop & Donlan 2005, O'Neill *et al.* 2004) or by calculating the average proportions of clauses in C-units (Fey *et al*. 2004, Justice *et al*. 2006, Reilly *et al.* 2004).

[1] The basic rule for defining C-units is to treat a main clause and its subordination clause/s as one C-unit (Loban 1976, cited in Hughes *et al.* 1997).

2.1.2 Pragmatic aspect of narration

A coherent and meaningful story is based on a variety of pragmatic- and cognitive-based skills, i.e. the ability to establish logical and informative story content, the ability to make inferences between story events, the ability to understand and express ideas and motives underlying the events, and the ability to understand speaker-hearer presuppositions. Therefore, I adopted the term 'pragmatic aspect of narration' to refer to these elements.

Referential cohesion is needed in narration in order to introduce the characters, places and events, and to maintain the reference throughout the story. In some previous studies, referential cohesion has been seen as belonging to the narrative microstructure (e.g. Coelho 2007, Hudson & Shapiro 1991, Liles *et al*. 1995). Even though referencing is created and maintained through linguistic devices, it covers pragmatic elements, as utilizing previous verbal context and understanding the listener's perspective, by means of distinguishing between new and already given information, is necessary (Hickmann 2004). It is observed that contextual factors are essential in reference use, because referential accuracy increases in situations where the interlocutors do not have mutual knowledge of the story (Kail & Hickmann 1992, Schneider & Dubé 1997, see also Hickmann 1998). In addition, Liles *et al*. (1995) observed that the ability to link sentences using different linguistic devices, including referencing, was associated with both narrative linguistic structure and more pragmatic-based event content organisation.

Along with story grammars, story content and its informativeness can be analysed using so-called main ideas or information units (Bishop & Donlan 2005, Kit-Sum To *et al*. 2010, Norbury *et al*. 2013, Renfrew 1997, Soodla & Kikas 2011). Information unit is a generic term meaning the accurate and relevant use of words depicting the stimuli (Christensen *et al.* 2009). This analysis is based on predefined elements that are seen to be essential to the story. Usually these a priori elements are described by researchers (Bishop & Donlan 2005, Norbury *et al*. 2013), or they can be verified in a control study (O'Neill *et al*. 2004). These measures do not give an insight into the hierarchical or episodic structure of the narrative construction as a genre as do story grammars, but they do measure the semantic- and pragmatic-based amount of relevant information included to the story.

A logical and coherent story is not only based on informative enough story content and precise use of references. Importantly, the narrator must understand

and follow contextual factors. According to Sperber and Wilson's relevance theory (1995), people can intuitively distinguish relevant from irrelevant information in a given context, and communication is driven by the search for relevance. Information is relevant to an individual "*when it connects with background information he has available to yield conclusions that matter to him*" (Wilson & Sperber 2004: 608). In narrative contexts, this can be seen as an understanding of the listener's needs (i.e. world and mutual knowledge) and the avoidance of contextually unrelated, uninformative or irrelevant expressions. According to Grice (1975), participants are expected to observe the cooperative principle, which consists of four maxims: maxims of quality, quantity, relation and manner. In narrative settings, these maxims can be reflected in a narrative that is not based on a lie, that adequately covers information (neither too much nor too little), and where the narrative is relevant and told without ambiguity. Problems of utilizing these maxims while narrating will hinder the speaker's communicative competence and may even be distracting for the listener.

Bruner (1986) separates narratives into two modes. The first, the landscape of action, consists of a sequence of actions with minimal focus on the mental states of the characters of the story, whereas the second, the landscape of consciousness, encompasses the mental world of the story: "*what those involved in the action know, think, or feel, or do not know, think, or feel*" (p. 14). In order to interpret these cognitive states, theory of mind (ToM) is needed, which is an ability to understand and reflect mental states (e.g. desires, intentions, emotions and beliefs) as well as the ability to use this awareness for interpreting, explaining and predicting the behaviour of oneself and others (Astington & Pelletier 2005, Baron-Cohen 2000). As fictive narratives are typically goal-based and social, mindreading is needed to interpret the characters' mental states that underlie and cause the actions in the narratives (Barnes *et al.* 2009).

Finally, efficient narrative skills are not only based on expressive skills, but the understanding of narratives is also essential. In order to understand the story's meaning and the relations between actions, inferencing skills are required. Inferencing is a process that integrates information from several sources and results in a logical outcome, a conclusion (Letts & Leinonen 2001, Sperber & Wilson 1995).

2.1.3 Interplay of linguistic and pragmatic aspects

As described above, in order to narrate a meaningful and coherent story, many different language skills are needed. In addition, a narrative in itself comprises of many interrelated factors, such as an ability to use accurate and meaningful words describing characters, actions and mental state terms, an ability to master the morphosyntax of the given language and an ability to connect utterances in a coherent manner for a comprehensible completeness. However, the number of studies concerning the interplay of different narrative aspects are surprisingly few, and this connection in typical development is, in particular, still under-explored (see however Fernández 2013, Hakala 2013, Kit-Sum To *et al.* 2010, Lepola 2009). The pioneering study by Liles *et al*. (1995) concerning children with language impairments showed that narrative measures can be divided into two factors that reflect the content organization (macrostructure) and the sentence (micro)structure. Later, Wellman *et al.* (2011) showed that a three-factor model could be found. A macrostructure factor included measures of story content, a comprehension factor contained measures of story comprehension and the use of irrelevant utterances, and the third, microstructure factor included measures of vocabulary and syntactic complexity.

Since narratives are spontaneous language that goes beyond a sentence level, the variability in narrative production is wide, which has also been evidenced in adult narrations (e.g. Berman & Slobin, 1994, Korpijaakko-Huuhka 1995), and may reflect the communicative strategies of the speakers. One narrator may be very verbose, whereas the other may be less talkative, but they can still both produce a narrative that is easy to follow and comprehend. Therefore, the story length itself, for example, may not be a critical factor for producing a good story (Berman & Slobin 1994, Stein & Policastro 1984). Moreover, Shiro (2003: 192) evidenced that the "*presence of evaluative expressions is a necessary but not a sufficient condition for the overall coherence of the story. Furthermore, a good story is not necessarily one that contains a very high number of evaluative expressions. It is the skillful combination of evaluative expressions within the story that enhances its coherence.*" Thus, it seems that narratives should not be valued with single measures, but instead looking at completeness.

In this study, a detailed look is taken at the relationship between narrative productivity and story content in order to understand the rationale for using narrative productivity measures, since the number of produced words or word tokens may not guarantee an informative story content. Even though different

productivity measures are extensively used for research purposes, surprisingly little is known about their usability. Considering children with language disorders, it is observed that they may be rather verbose, but produce stories with poor content, because their stories contain some irrelevant information (Reuterskiöld Wagner *et al*. 1999). Correspondingly, Merritt & Liles (1987) observed that stories generated by those with language impairment were not significantly shorter than those of their typically developing peers, but, children with language impairments still produced fewer story components. This may suggest that the stories were quantitatively alike but qualitatively less was said. Moreover, high-functioning children with ASD may not produce shorter stories than their controls, but their narratives may still lack story components (Losh & Capps 2003). Considering adults with ASD, it is observed that narrative length and content are not related (Barnes & Baron-Cohen 2012).

On the other hand, a connection between story length and content has been detected in children with language impairments, since longer stories seem also to contain more story elements (Colozzo *et al.* 2011, Reuterskiöld Wagner *et al.* 1999). A similar trend is also observed in typically developing children. Stein and Albro (1997) discovered that the longest stories, measured by the number of clauses, were also structurally the best developed goal-based stories. A Finnish study by Hakala (2013) supports the relationship between content and productivity, since she found that stories which were sparse in content contained significantly fewer words and different words than stories with more story grammar elements. Soodla and Kikas (2011) obtained a significant correlation between story content and total number of words among Estonian children, and Fernandez (2013) detected that the number of utterances produced and the composite measure of narrative pragmatic language were significantly correlated. Importantly, it should be noted that even a strong correlation does not imply causality.

2.2 Narrative development

Children encounter personal and fictive narratives in many forms in their everyday lives. Conversations with parents include personal narratives and stories are not only read to children, but they hear and see them on TV and the movies as well. In addition, narratives are involved in play situations with caregivers and peers. Children also construct stories by themselves. However, narrative

development starts long before children start to actively tell stories, watch films or play.

According to Bruner's (1990) theory of narrative thinking, a baby's innate ability to direct towards action and, in particular, human interaction is the starting point for narrative development. Moreover, from very early on children have an ability to sequence events and differentiate usual from unusual ones. These non-canonical events, which are unfamiliar in a child's world, are those that the child is more likely to linguistically express when later acquiring expressive language and early narrative skills. Nelson (1996) claims that narrative development includes an ability to verbally formulate connected discourse, an ability to represent events and their temporal and causal relations, as well as an ability to understand connected discourse. Moreover, understanding of the perspectives of actors and spatio-temporal locations is needed. Since a great deal of language competence is required for extended discourse production, storytelling is also enabled only after the complex language is learned.

Two-year-olds and even younger children can participate in social, interactive narratives and produce them in a collaboration with their parents, who guide narrative production and elaborate children's expressions (Engel 1995). Two and a half-year-olds can already produce script-like accounts of daily occasions (Nelson 1996) and 3-year-olds have a knowledge of familiar routine scripts (Nelson & Gruendel 1986). 4-year-olds produce personal narratives about single experiences, which are still lacking logical order, and around the age of 6, children's personal stories are coherent (Peterson & McCabe 1983). However, the narrative development is long-lasting as it may continue even among teenagers or young adults (Berman & Slobin 1994, Westerveld & Moran 2013).

2.2.1 Development of linguistic structure

The linguistic structure of children's pictorial narratives develops along with the child's age. Considering narrative productivity, older children, in general, tend to produce longer narratives with more different words than those of younger ones (Justice *et al*. 2006, Leadholm & Miller 1992, Schneider *et al*. 2005). According to Westerveld *et al.* (2004) and Muñoz *et al.* (2003), 4- and 5-year-olds seem to produce narratives with similar productivity, since these age-groups did not differ in the number of different words (NDW) or the total number of words (TNW). However, significant differences between 5- and 6-year-olds and 6- and 7-year-olds have been observed in these measures (Westerveld *et al*. 2004). Productivity

may even develop in adolescence, since Westerveld and Moran (2013) showed that number of clausal units and NDW increased with age between 7-, 11- and 18-year-olds.

Syntactic complexity also shows development, since in general it becomes more complex with age, measured by MLCU (Leadholm & Miller 1992) or by calculating sentences structures (Justice *et al.* 2006, Reilly *et al*. 2004, Schneider *et al.* 2005). Muñoz *et al.* (2003) observed that MLCU in words differentiated 4- from 5-year-olds but, on the contrary, Westerveld *et al*. (2004) did not find differences between these age-groups. However, Westerveld *et al*. showed that MLU in morphemes was significantly higher in 6-year-olds in comparison to 4-year-olds. The development of narrative complexity (MLU) may continue even up to the early teens (Bishop 2004a, Kit-Sum To *et al*. 2010), but this finding is not uniform, since Westerveld and Moran (2013) did not observe group differences in MLCU or clausal density between 7-, 11- and 18-year-olds. Justice *et al*. (2006) suggest that the development of narrative linguistic structure seems evident during preschool and early school years, but it may start to reach a plateau in performance at around the age of 10. However, Miller (1991) discovered that, in narrative samples of standard length, MLU as well as NDW and TNW were all significantly correlated with age among children from 3 up to 13 years of age.

2.2.2 Development of pragmatic structure

As the linguistic structure of narrative develops with age, so does the pragmatic structure. An ability to use accurate references in narratives increases with age across languages (Gutierrez-Clellen & Heinrichs-Ramos 1993, Kit-Sum To *et al*. 2010, Whitely & Colozzo 2013, see also Hickmann 2004). Even though 4-year-olds can understand reference assignments in a given context (Loukusa, Leinonen & Ryder 2007, Ryder & Leinonen 2003), use of accurate referencing is still demanding for young children in storytelling situations. For example, 4-year-olds favour deictic pronoun use, which makes their performance at referencing poor (Wigglesworth 1990). Schneider & Dubé (1997) found that in 5-year-olds' narratives referential adequacy was poorer than in 7-year-olds'. Interestingly, differences were especially detected in picture-based tasks, but not in oral only conditions, in which there were no pictures available while retelling a story. In this task, 5-year-olds' performance was similar to 7-year-olds', and for both groups the use of referencing was quite accurate. These results imply that younger children may find a story generation task more difficult, since the referential

adequacy was poor while they had to construct the story without a given schema. The inaccuracy seen in reference use may reflect the developmental characteristics of understanding a listener's needs and the communicative context. Kail and Hickmann (1992) observed that 6-year-olds have not yet developed the ability to use accurate first mentions (indefinite articles) and only at the age of 11 years, children start to use an established pattern of referent use despite the background knowledge of the listener. Also, Wigglesworth (1990) found that 8-year-olds' stories lack adult competence in anaphoric relations.

Story content and its' informativeness increases as children grow older (Bishop 2004a, Hudson & Shapiro 1991, Kit-Sum To *et al*. 2010, Schneider *et al.* 2006). For young children, narrative tasks are still difficult. Lepola *et al.* (2009) found that 4-year-olds could, on average, mention only two story elements out of six (based on story grammar). Muñoz *et al*. (2003) and Price *et al*. (2006) observed that there was more content in 5-year-olds' stories than those of 4-year-olds, which implies that this may be the period when development is taking place. Kit-Sum To *et al*. (2010) proved that the biggest growth period in story content and vocabulary (i.e. semantic score) was seen between the ages of 5 and 6 but the semantic score differentiated even 10- and 11-year-olds. Also, Schneider *et al.* (2006) observed that the greatest rate in development of story content was seen in younger age-groups (from 4 to 6), and the development started to reach a plateau at around the age of 7. However, Berman and Slobin (1994) have shown that the development of narrative structure and content develops up to adulthood, since there were both qualitative and quantitative differences between 9-year-olds' and adults' stories.

The use of evaluative language, including mental state expressions, seems to develop with age (Eaton *et al.* 1999, Shiro 2003). Ukrainetz *et al*. (2005) showed that the internal state words, which refer to thoughts, intentions and emotions, increased with age among 5- to 12-year-olds, but the frequencies were not high. 5- and 6-year-old typically developing children hardly used these expressions, whereas the older age-groups used at least three of these words while narrating a picture-based task. Bamberg and Damrad-Frye (1991) found that there were no differences in the use of mental state expressions between 5- and 9-year-olds, but adults produced these expressions significantly more often.

Also, the ability to make inferences from a given context develops along with age. In the study by Ryder and Leinonen (2003), 3-, 4- and 5-year-old children were asked questions, with differing contextual and processing demands, from a storybook. Results evidenced a clear development trend. Loukusa, Leinonen and

Ryder (2007) observed that the ability to utilize complex contextual information in comprehension process gradually increased up to the age of 8 years. The clearest development was seen in the youngest age-groups – between the 3- and 4-year-olds.

2.3 Narrative assessment and elicitation methods

Narrative language assessment can be approached from different perspectives, but in a study of linguistics or psycholinguistics, the most frequently used methods are based on some kind of stimulus material, usually pictorial, and therefore they are not purely spontaneous. In research and testing situations, the interaction with the interlocutor is usually purposely diminished in order to gain a picture of individual ability, which makes narratives monologist (Perkins 2007).

Fictive story generations and story retellings are probably the most used narrative elicitation methods. These methods differ from each other and also require somewhat differing underlying abilities. Duinmeijer *et al.* (2012) studied the cognitive and narrative skills of children with SLI and found that, in a story generation task, attention and story content were moderately correlated, whereas no correlation was found with memory skills. Instead, in a retelling task correlation was detected between story content and memory skills, but not with attention. In story retelling, memory skills may play a bigger role compared to story generation, since retelling is based on a verbally given schema with a precise linguistic model (Leinonen *et al*. 2000). Instead, story generation tasks may give a more reliable picture of a child's own ability to construct a story, since the production is not guided by an exact model, even though the story model may be given pictorially (Schneider 1996).

Considering the underlying differences in narrative elicitation techniques, it is not surprising that the elicitation method may have an effect on narratives. Schneider (1996) found that children with language impairments produced more story elements in a story retelling (without pictures) situation in comparison to a picture-based story generation task (see also Merritt & Liles 1989). Similar results were also obtained with typically developing children (Schneider & Dubé 2005). Thus, it seems that story retelling tasks are easier for children than story generation tasks. One reason might be the processing load, which is likely to be more demanding in a story generation task, since no verbal schema is given (Schneider & Dubé 2005). Considering the linguistic structure of narratives, research suggest that (at least in children with SLI), story retellings produce

syntactically more complex narratives than story generations (Duinmeijer *et al.* 2012).

In addition to fictive stories, narrative can be elicited using personal narratives. In these tasks, children are asked to spontaneously recount something that has happened to them (see further McCabe & Bliss 2003). There is some evidence that children with SLI may perform better in personal than in storybook narratives (Epstein & Phillips 2009) whereas children with ASD may find storybook narratives easier than personal ones (Losh & Capps 2003).

2.4 Specific language impairment

2.4.1 Definition of specific language impairment

Specific language impairment (SLI) is a developmental disorder with unknown aetiology. It is usually defined by exclusionary criteria, ruling out conditions like hearing impairment, neurological dysfunctions or intellectual disability (Finnish Medical Association Duodecim 2010, Rice 2013, Schwartz 2009). Hannus *et al.* (2009) found that the prevalence of SLI was less than 1%, but Tomblin *et al.* (1997) estimated it to be around 7%. According to Tomblin *et al.* (1997), SLI is somewhat more common in boys than in girls (male-to-female ratio 1.33:1) and twin studies has evidenced that there is a genetic influence in SLI (Bishop 2006, Rice 2013). For research purposes, a child with SLI is commonly expected to have a nonverbal IQ of at least 85 and thus a discrepancy between nonverbal and verbal skills (Leonard 1998). This criterion is used to diminish the heterogeneity of children with SLI. However, children with low nonverbal IQ may show similar language impairments to children whose nonverbal IQ is in the normal range (e.g. Pearce *et al.* 2010).

Children with SLI have problems with many aspects of language such as semantics, morphology and syntax (Leonard 1998) as well as pragmatics (Bishop 1997, Ryder *et al.* 2008). Difficulties in social cognition and behaviour are also documented in children with SLI (Leyfer *et al*. 2008, Taylor *et al*. 2012). Interestingly, in a recent Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA 2014) a new diagnostic category, a social (pragmatic) communication disorder is presented. This disorder can be diagnosed if a child shows persistent difficulties in social aspects of language use, such as in narrative

and in other discourse skills, and in nonverbal communication, without the restrictive patterns of behaviour or interests which are seen in ASD.

There is research implying that SLI may not be just language-specific after all, since these children may also show problems in the areas of cognitive functions, i.e. attention, information processing and working memory, and also in visual domains (see reviews Ebert & Kohnert 2011, Schwartz 2009, see also Leonard *et al*. 2007). For this reason, the term *primary language impairment* (PLI)[2] has also been suggested. PLI implies that the impairment is probably primarily in the area of language but also other developmental deficits may exist (e.g. Ebert & Kohnert 2011, Thordardottir *et al*. 2011).

2.4.2 Narrative abilities in SLI

Children with SLI comprise a heterogeneous group with a variety of problems in language abilities. Therefore, assessment of narrative language among this diagnostic group is valuable since narratives tag many language domains. There is a large body of research evidencing that narratives differentiate children with SLI from typically developing peers (e.g. Fey *et al.* 2004, Liles *et al.* 1995, Norbury *et al.* 2013) and the discrepancy can be seen even up to adolescence (Wetherell *et al.* 2007). Narrative skills have been associated with later language development, as Botting *et al*. (2001) discovered that narrative retelling at the age of 7 predicted the outcome of children with SLI 4 years later (see also Bishop & Edmundson 1987, Stothard *et al.* 1998).

Considering the narrative linguistic structure, children with SLI tend to produce stories with limited productivity. Their stories contain fewer C-units, words or different words compared to their controls (Fey *et al*. 2004, Norbury *et al*. 2013). However, some studies have found that the length of stories do not differentiate children with language impairments and typical development (Norbury & Bishop 2003, Soodla & Kikas 2011). Differences may be task-specific, since for example, Merritt and Liles (1987) detected that children with language impairments produced fewer clauses in story retelling but not in story generation. In addition, not all productivity measures are equally sensitive, as, according to Fey *et al*. (2004), the number of C-units proved to be relatively

[2] Note that the abbreviation PLI is also used to refer to *pragmatic language impairment* (see further e.g. Bishop 2001, 2004b).

insensitive for differentiating children with language impairments from their controls.

Difficulties in morphosyntax are widely recognized characteristics of SLI (Leonard 1998) and these difficulties are also seen in their connected speech. Children with SLI tell stories that are syntactically less complex or accurate and grammatically incorrect, since they produce more morphological errors in comparison to their peers (Duinmeijer *et al.* 2012, Norbury & Bishop 2003, Reilly *et al.* 2004). Syntactical skills are in particular needed to conjoin clauses and in order to express causality and temporality between the events. As Liles *et al.* (1995) mention, grammatical errors and ambiguous intersentential coherence reduces the narrative quality.

When pragmatic structure is considered, narrative coherence is, at least partly, created through cohesive devices. Referential cohesion in particular is an aspect of cohesion that is studied among children with SLI. There is some evidence that children with SLI can introduce the story characters and maintain the reference in quite a similar way to language-matched children (van der Lely 1997). On the other hand, inaccurate reference use is also observed in SLI children (Kit-Sum To *et al*. 2010, Pearce *et al*. 2010). Norbury and Bishop (2003) discovered that children with SLI used more ambiguous pronouns in their narrations than their peers did. In addition, typically developing children tended to choose a more mature strategy in reference use, since children with SLI used more definite nominal phrases when introducing characters and fewer pronominal references when maintaining the reference to story characters. Finestack *et al.* (2006) also observed ambiguous referencing in SLI children's narrations. Referential accuracy was also found to be impaired in a study by Suvanto (2012), who discovered that Finnish children with language impairments had a tendency of dropping out overt subjects, which consequently made referential ties unclear.

Considering the expression of the mental model of the story in terms of story grammars, children with SLI do not necessarily differ from typically developing children (Liles *et al.* 1995, Norbury & Bishop 2003, Reuterskiöld Wagner *et al.* 2011). However, contradictory results are also observed (Colozzo *et al*. 2011, Merritt & Liles 1987, Pearce *et al*. 2010). If expression of story content is analysed using measures that cover the relevant information included into the story, such as information scores or main idea units, it seems that the stories of children with SLI contain less information than those of their peers (Bishop & Donlan 2005, Colozzo *et al*. 2011, Dodwell & Bavin 2008, Duinmeijer *et al*. 2012, Kit-Sum To *et al*. 2010, Norbury *et al*. 2013, Pearce *et al*. 2010). However,

some studies have found opposite results. Norbury and Bishop (2003) did not observe differences in school-age children with SLI and their controls in the amount of information included in their stories. Authors criticize the idea that this measure may be too simple, since only picture descriptions are needed. On the other hand, this measure may be best suited for young children. For example, Reilly *et al*. (2004) detected that younger children with SLI (from 4- to 9-year-olds) differed from their peers, but differences were not evident among children from 10 to 12 years. Also, elicitation methods may have an effect, as Dodwell and Bavin (2008) found that children with SLI produced significantly less information than their controls in a retelling situation but similar pattern was not evident in a story generation task.

Theory of mind skills is needed in narration in order to interpret and express mental states. Even though it was traditionally thought that ToM difficulties do not belong to SLI (see e.g. Zietas *et al.* 1998), research has shown that children with SLI show problems in mind-reading (Loukusa *et al.* 2014, Miller 2001, Taylor *et al*. 2012). However, Colle *et al.* (2007) documented that ToM difficulties were not seen among children with SLI in non-linguistic ToM tasks, which suggest that the deficit may be related to language. Not many studies have analysed the use of mental state language in storybook narratives among children with SLI and the results have varied. Some have detected that children with SLI produce mental states similar to those of their counterparts (Norbury & Bishop 2003, Reilly *et al*. 2004), whereas others have found opposite results (Norbury *et al.* 2013). In narratives, mental states are typically expressed with particular sentence structure that requires complex sentences, as in a following example '*Boy thinks that the balloon seller can help him'*. As mentioned above, the ability to use complex syntax seems to be restricted in SLI, along with difficulties in grammar, and these restrictions may consequently lead to limitations in expressing mental states, at least if complex syntax is needed. For example, Miller (2001) observed that, in SLI, understanding of false beliefs was affected by the sentence structure, and Farrar *et al*. (2009) found a connection between ToM and grammatical and vocabulary skills. Bishop and Donlan (2005) observed that children who included mental state expressions in their narratives tended also to use more complex syntactic structures. These authors bring an important topic into the question: "*Do syntactical limitations lead to conceptual limitations or do conceptual limitations result in simpler syntax*?" (p. 39). The relation of linguistic and cognitive skills is complicated in general and, in particular, it is difficult to distinguish in narrative settings when story characters' mental states are supposed

to be verbally expressed using various syntactic constructions. However, Bishop and Donlan (2005) discovered that children whose language impairment was expressive (with poor grammar) did not differ from their counterparts in cognitive state expressions in a storytelling situation, but children also with receptive problems did, which implies that conceptual rather than syntactic restrictions are in play. Furthermore, the story recall of children with receptive impairment was accounted for by the use of complex syntax and cognitive state expressions, which was not the case in children with expressive problems.

In order to understand narratives, inferencing from story events is needed, and this may be challenging for children with SLI. Merritt and Liles (1987) observed that children with SLI scored similarly to control children when answering factual questions. Instead, questions that targeted the story grammar elements were more difficult for those with language impairment than for control children. A number of studies has found that questions demanding inferencing are difficult for children with SLI (Botting & Adams 2005, Dodwell & Bavin 2008, Norbury & Bishop 2002). Leinonen *et al*. (2003) and Ryder *et al.* (2008) found that implicature questions that require the integration of multiple sources of information (e.g. given context, world knowledge and experiences) via deduction were especially difficult for children with SLI. Ryder *et al*. (2008) showed that the contextual support may have an effect, as children with SLI performed similarly to their peers if inferencing was strongly based on pictorial support. Similar results were not obtained with weaker pictorial support, since 7- to 11-year-old children with SLI scored even poorer than their younger 5- to 6-year-old counterparts. The role of working memory for narrative comprehension is taken into account in some studies. Dodwell and Bavin (2008) found a connection between memory (recalling sentences) and story comprehension skills among children with SLI and those with typical development. Norbury and Bishop (2002) did not find a similar connection among children with communication impairments (combined a sample of children with high-functioning autism, SLI or pragmatic language impairment). Instead, Norbury and Bishop showed that it is not the memory abilities but the ability to build a mental model of the story that facilitates story comprehension.

Narration is a demanding process, since linguistic and pragmatic aspects of storytelling must be processed simultaneously. Therefore, there are many aspects in which children with SLI may be vulnerable. Liles and her colleagues (1995) observed that especially the linguistic structure, not the more global episodic structure of story content, differentiated children with language impairments from

typically developing children. Linguistic skills may be the key determinant in supporting narrative skills, since non-verbal cognitive skills (Pearce *et al*. 2010) or pragmatic skills, measured by Children's Communication Checklist (Norbury & Bishop 2003) have not been shown such a contribution to narration among children with SLI. On the other hand, Norbury *et al*. (2013) discovered that pragmatic errors produced while narrating significantly contributed to narrative coherence (i.e. macrostructure). Recently, Colozzo *et al.* (2011) reported interesting results since they found a subgroup of children with SLI who produced stories that were grammatically weak but high in content, whereas another subgroup showed the opposite pattern with high grammaticality and weak content. The authors discuss the idea that this dissociation may reflect limitations in processing capacity. Some children may concentrate more on content which, in consequence, leads to grammatical errors because of the limited resources available, whereas a subgroup of children may concentrate more on grammar because of the difficulties in managing the story content. Nowadays, processing limitations in working memory or/and in processing speed are considered to be one of the core mechanisms underlying language impairments (see Leonard *et al.* 2007).

2.5 Autism spectrum disorder

2.5.1 Definition of autism spectrum disorder

Autism spectrum disorder (ASD) is a neurobiological condition that is characterised by persistent deficits in social communication and interaction, and by stereotyped and restricted patterns of behaviour, interests or activities. In the current Diagnostic and Statistical Manual of Mental Disorders (DSM-5), autism and Asperger syndrome are no longer separated, but incorporated into one diagnosis of ASD (APA 2013). In the forthcoming Internal Classification of Diseases (ICD-11), a similar policy seems to be implemented (WHO 2014). According to an epidemiological study by Mattila *et al.* (2011), the prevalence of ASD was 8.4 per 1,000 individuals (using DSM-IV criteria), of which 65% were high-functioning with a full scale IQ of at least 70. ASD is more common in boys than in girls (male-to-female ratio 1.8:1) (Mattila *et al.* 2011) and it has a genetic base (Losh *et al.* 2008, Rutter 2005), even though a recent study by Sandin *et al.*

(2014) evidenced that even 50% of the risk of developing ASD could be explained by environmental or non-heritable factors.

Difficulties in social perception are widely recognized characteristics of ASD. Individuals with ASD show problems in theory of mind (e.g. Baron-Cohen 2000) and emotion recognition (e.g. Kuusikko *et al*. 2009). Communication difficulties, such as deficiencies in conversational skills (Loveland & Tunalo-Kotoski 2005) and in pragmatic understanding of contextually demanding language (Loukusa & Moilanen 2009, Rapin & Dunn 2003) are core features of ASD. However, ASD is a very heterogeneous condition, since the communication and cognitive skills in ASD vary a lot. Some individuals do not have spoken language whereas some even show intact linguistic skills (Rapin & Dunn 2003, Tager-Flusberg *et al*. 2005). In addition, profiles resembling children with language disorders are seen in ASD as also the high-functioning children with ASD may show problems in structural language skills such as in morphosyntax (Eigsti & Bennetto 2009, Eigsti *et al.* 2011, Lindgren *et al*. 2009) and linguistic comprehension (e.g. Saalasti *et al*. 2008).

2.5.2 Narrative abilities in ASD

The research concerning narrative abilities in ASD is not as extensive as it is in SLI. However, as Loveland and Tunali-Kotoski (2005) remark, narrative assessment is particularly interesting among individuals with ASD, since they are expected to show difficulties in cultural expectations and interpersonal awareness, which are characteristics needed in storytelling. Previous research has shown that children with ASD show weaker narrative skills than their controls, at least in some aspects of narration (Norbury *et al*. 2013, Rumpf *et al*. 2012), and differences can even be seen in adulthood between individuals with and without ASD (Barnes & Baron-Cohen 2012, Colle *et al*. 2008). Narrative tasks can also reveal subtle language and communication difficulties in adolescents who have been diagnosed with ASD in childhood but have shown an optimal outcome later (Suh *et al.* 2014). However, research findings have not been uniform, since not all studies have detected difficulties in storybook-based narration (Young *et al*. 2005).

In many studies, it is observed that children with ASD perform similarly to their controls in narrative linguistic structure. They produce stories of similar length measured by the number of words (Novogrodsky 2013, Suh *et al*. 2014) or clausal units (Losh & Capps 2003, Norbury & Bishop 2003, Young *et al.* 2005).

In addition, the syntactic structure of their narratives seems to be comparable to their age- and language-matched peers (Losh & Capps 2003, Novogrodsky 2013, Rumpf *et al*. 2012, Young *et al*. 2005). However, opposite results are also detected. Some have found that narratives of those with ASD may be sparse, since they consist of short utterance length (Smith Gabig 2008) or contain a reduced number of words (Norbury *et al.* 2013, Rumpf *et al.* 2012). The use of simpler syntax is also observed (Norbury & Bishop 2003, Norbury *et al*. 2013).

When discussing the pragmatic structure of narratives, the ability to use accurate referencing may be restricted in ASD. Children with ASD may use more ambiguous pronouns in comparison to their peers (Norbury & Bishop 2003, Norbury *et al.* 2013, Suh *et al*. 2014). However, ambiguity is not the only exceptional character of referential cohesion seen in ASD. Arnold *et al.* (2009) showed that children with ASD used accurate references, but their reference use was pedantic. This was seen as a referencing which was carried through using explicit noun phrases instead of pronominal references. However, this character was only observed in younger participants, since adolescents used pronouns and zero anaphoras similarly to their controls. The use of noun phrases instead of more implicit pronouns is also reported in a study by Rumpf *et al*. (2012). The narrative elicitation method may have some influence on referencing. Novogrodsky (2013) observed that children with ASD used more ambiguous third-person subject pronouns only in a story generation but not in a retelling task. Children with ASD may benefit from the given model of the story and thus show problems only in a story generation task in which more linguistic and cognitive planning is needed.

There is some evidence that children with ASD can produce narratives with informative story content similar to those of typically developing children. Norbury *et al.* (2013) found that children with ASD did not differ statistically from their counterparts, even though there was a trend for children with ASD to produce stories with less relevant information. Similar results were also obtained by Norbury and Bishop (2003). Young *et al*. (2005) used the story grammar model and found no differences between children with ASD and typical development. However, this finding has not been unequivocal, since opposite results are also seen. Suh *et al.* (2014) discovered that narratives of children and adolescents with ASD contained fewer story elements than those of typically developing children and similar results are also observed elsewhere (Rumpf *et al*. 2012, Smith Gabig 2008). Losh & Capps (2003) observed that narratives of children with ASD contained fewer story components than those of their peers,

but children with ASD could still maintain the main story theme. However, with different analytical methods, Barnes and Baron-Cohen (2012) detected that narratives by adults with ASD concentrated more on specific details than the overall story gist.

An unusual or idiosyncratic way of using words and phrases is a characteristic often seen in ASD (see Tager-Flusberg *et al.* 2005). These features are also observed in narratives of those with ASD. Irrelevant details and misattributions of story (Norbury *et al.* 2013) as well as idiosyncratic speech, such as the use of scripted or overly formal language (Suh *et al*. 2014) is seen in the narratives of individuals with ASD. However, Norbury and Bishop (2003) did not find differences in the use of additional information. In addition, Losh and Capps (2003) report the use of irrelevant comments only in less structured personal narratives, but not in a picture-based story generation task, and Losh & Gordon (2014) found that the use of off-topic or irrelevant utterances was abundant in narrative retellings but not in story generations. It is likely that the serial order and the presence of pictures in a story generation task may help the focusing on what is relevant.

Understanding the mental states of others requires ToM skills, which is especially difficult for individuals with ASD (e.g. Baron-Cohen 2000). While narrating, children with ASD may produce fewer mental state expressions than typically developing children (Rumpf *et al.* 2012) or children with Down syndrome (Baron-Cohen *et al.* 1986). However, opposite results are also reported (Norbury & Bishop 2003, Norbury *et al*. 2013, Suh *et al*. 2014). Again, narrative elicitation method may influence this, since Baron-Cohen *et al.* (1986) found that mental state language was mostly used in intentional, in contrast to mechanical and behavioural, picture scenarios. Moreover, Losh & Capps (2003) report the use of fewer evaluative devices (including mental state expressions) in personal narratives but not in a story generation task.

Story comprehension and inferencing skills among individuals with ASD has, in most cases, been studied using short story passages with or without picture support that are read to children. In these settings, weak inferencing skills are observed (Norbury & Bishop 2002). However, as Loukusa, Leinonen, Kuusikko *et al.* (2007: 1056) mention, it is "*an inefficiency, but not an inability in context use in comprehension*". They also showed that there is development in pragmatic comprehension among children with ASD. In some studies, comprehension of event knowledge of familiar scripts is assessed. Loth *et al.* (2008) observed that individuals with ASD could not explain as efficiently as their controls why a

particular familiar event happened. Also Loukusa, Leinonen, Jussila *et al.* (2007) observed that children with ASD had difficulties in explaining their answers for the questions that needed inferencing. Nuske and Bavin (2011) found that children with ASD showed difficulties when inferencing from event scripts (i.e. short stories about birthday parties, going to the restaurant, etc.) was needed. Interestingly, if inferencing could be carried through without utilizing event knowledge, then children with ASD performed similarly to their younger, language-matched controls. This may imply that young children with ASD were particularly impaired in elaborating the information from event schemas in a narrative context. Loukusa, Leinonen, Kuusikko *et al.* (2007) showed that especially implicature questions that demand the use of multiple information are difficult for children with ASD. To date, the study by Young *et al.* (2005) might be the only one that has analysed narrative comprehension based on a child's own picture-based, fictive narration. In their study, children were asked to answer comprehension questions after a retelling task, and it was found, along with other studies with different methods, that it was particularly inferencing questions, instead of factual ones, that were difficult for children with ASD.

The problems seen in narration among high-functioning individuals with ASD may arise from different language or cognition-based deficits. Theoretically, the difficulties in ToM abilities may also pose problems in narrative settings, which require the awareness of listeners needs in many respects as well as the use of mental state language and inferencing skills. To my best knowledge, the relationship between narrative discourse and ToM skills is still underexplored. However, Loth *et al.* (2008) found a correlation between ToM skills and script narratives among individuals with ASD. Losh and Capps (2003) did not observe similar results either in personal or in picture-based narrations, but, instead, found a correlation between narrative measures and emotional understanding. In conversational settings, ToM skills has been evidenced to show unique variance in contingent discourse, even though language status was the best predictor of discourse skills (Hale & Tager-Flusberg 2005). These findings may imply that social cognition and social communication, including narratives, are related in ASD. The weak central coherence (WCC) may also be in play, considering the narrative difficulties seen in ASD. WCC suggests that the processing towards global may be biased in ASD (Happé & Frith 2006). Theoretically, this would mean that individuals with ASD might produce stories that would lack coherence and the global gist of the story. Loth *et al*. (2008) found some evidence, since weak coherence was associated with weak hierarchical organization of the story.

In addition, Jolliffe and Baron-Cohen (2000) found that adults with ASD had difficulties in arranging written narratives into a coherent whole. Moreover, focusing on what is relevant may be difficult generally for children with ASD (Loukusa, Leinonen, Jussila *et al.* 2007) and this is a feature needed in storytelling as well.

3 Aims of the study

The purpose of this study was to investigate narrative development in typically developing children and to examine the narrative abilities of children with specific language impairment and those with autism spectrum disorder using a picture-based story generation task with both linguistic and pragmatic-based narrative measures. The aims were:

1. To examine the development on narrative abilities in 4- to 8-year-old typically developing children (Study I).
2. To examine the associations between narrative productivity and event content in typical development (Study I).
3. To examine the narrative abilities of children with specific language impairment (Study II).
4. To examine the narrative abilities of children with autism spectrum disorder (Study III).

4 Method

4.1 Participants

4.1.1 Typically developing children

In Study I, the data of typically developing children is reported. These children (aged from 4;1 to 8;10) were recruited from 8 day nurseries and from 4 schools. All nurseries and 3 of the schools were in the area of Oulu, Finland and one school was located in Tampere. One day nursery was private and the others were municipal. Written information, a consent sheet and a questionnaire about their child's developmental history were delivered to the children's parents by teachers. Questions about parental profession, language spoken at home and familial risk of language delays were asked, in addition to questions concerning the child's early language development and possible attendance in speech language therapy. Information sheets were not given to children who were bilingual, had a known history of language delay, or were receiving speech therapy at that moment. Parents of 188 children gave their permission.

In order to receive some background information about the child's current language abilities the Token Test for Children, Second Edition (TTFC-2) (McGhee *et al*. 2007) and the Finnish version of the Test of Word Finding, Second Edition (TWF-2) (German 2000) were conducted. These tests were chosen to measure child's receptive and expressive language skills. In TTFC-2 understanding of concepts and instructions with increasing length and complexity is needed. TTFC-2 is not standardised into Finnish and therefore the raw scores instead of standard scores are reported. For the age-groups studied, there are no suitable language comprehension tests available in speech-language therapists' usage in Finnish. Therefore, TTFC-2 was chosen so as to give at least some information concerning child's linguistic comprehension skills. In TFW-2 accuracy of word finding is measured by naming pictures of nouns and verbs, and by completing sentences.

8 children, who could not pass the TWF-2 or the practise items of the TTFC-2, were excluded. Moreover, one child had to be ruled out since the main language spoken at home was not Finnish, and 2 children had some neurological disorders (TIC, ADHD). In addition, 4 children refused to collaborate, and, due to technical problems in data recording, the data of one child was not available for

later analysis. Finally, data from 172 children, 86 boys and 86 girls, were analysed. All the participating children spoke Finnish at homes as their main language; none had indications of language delay and none was receiving regular speech language therapy. Single speech sound disorders did not rule out their participation, since they can still be normal at the age of the children investigated in this study (see Kunnari *et al.* 2012). According to the parental questionnaire, 47.7% of the mothers and 46.5% of the fathers of the children were upper-level employees with administrative, managerial, professional or related occupations, 27.9% of the mothers and 22.1% of the fathers were lower-level employees with administrative or clerical occupations, and 12.8% of the mothers and 18.6% of the fathers were manual workers. 8.7% of the mothers and 2.9% of the fathers were studying, retired, or unemployed and 1.7% of the mothers and 5.2% of the fathers were self-employed. The information about occupation was not available for 2 mothers (1.2%) and for 8 fathers (4.7%). Children were divided into 5 groups according to their age. Description of the groups is given in Table 1.

Table 1. Characteristics of typically developing children by age-groups.

	4-year-olds	5-year-olds	6-year-olds	7-year-olds	8-year-olds
Number of participants	30	36	39	37	30
Boys/girls	16/14	18/18	22/17	15/22	15/15
Age					
M	4;6 years	5;5 years	6;6 years	7;8 years	8;4 years
SD	3 months	3 months	3 months	3 months	3 months
TTFC-2[a]					
M	23.8	30.9	35.9	37.7	38.8
SD	7.8	6.4	4.3	3.5	3.3
TFW-2[b]					
M	107.2	106.7	106.4	89.9	97.2
SD	13,5	13.4	13.0	12.0	12.9

[a] Scores: maximum 46. [b]Standard scores: 90–110 average; 80–89 low/below average; 70–79 deficient.

4.1.2 Children with SLI

Study II concerns the children with SLI and their typically developing control children. 20 Finnish children with SLI were recruited to this study from the area of the Northern Ostrobothnia Hospital District in Finland. However, data from 19 children is analysed, since one child's performance in IQ testing proved to be weak (verbal IQ 61, performance IQ 72). Children were diagnosed with SLI at the

audio-phoniatrics clinic at the University Hospital of Oulu, Finland by an experienced phoniatrician following investigations carried out by a multi-professional team. All children with SLI (aged from 5;0 to 7;7 years) were monolingual, had normal hearing and none had any evidence of neurological dysfunctions or other developmental disorders. 10.6% of the mothers and fathers of the children with SLI were upper-level employees with administrative, managerial, professional or related occupations, 42.1% of the mothers and 15.7% of the fathers were lower-level employees with administrative or clerical occupations, and 36.8% of the mothers and 57.9% of the fathers were manual workers. 10.2% of the fathers were self-employed and 5.3% were retired. The information about occupation was not available for 2 mothers (10.5%).

According to the age-appropriate Wechsler Intelligence Scale, children's non-verbal abilities were at least 85 (performance IQ: M = 101.1, SD = 11.6, n = 18), and their verbal abilities were below their non-verbal abilities (verbal IQ: M = 73.4, SD = 13.1, n = 18). For one child, exact test values were unavailable, but according to a psychologist's statement, this child's non-verbal abilities were within the normal range whereas their verbal abilities were below this. Many children had phonological difficulties, but these difficulties did not substantially impair speech intelligibility.

During the data collection, a larger battery of tests was conducted for some, randomly selected typically developing children, and 19 of these typically developing age- and sex-matched children were randomly selected to work as a control group in Study II. Participant characteristics for children with SLI and children with typical development are presented in Table 2. In addition to previously described TTFC-2 and TWF-2, a grammatical closure subtest of the Illinois Test of Psychological Abilities (ITPA) (Kirk *et* al. 1968) was conducted. Moreover, verbal working memory abilities were assessed by the age-appropriate task of NEPSY-II (the Developmental Neuropsychological Assessment, Second edition) (Korkman *et al.* 2008) using either the Sentence Repetition or Word List Interference subtest. These tests were carried out in order to gain background information on the language skills of the participating children. Typically developing children outperformed the children with SLI in all the language tests performed. However, age-related differences between the groups were not detected (see Table 2).

Table 2. Participant characteristics and group comparisons between children with SLI and typical development (TD) by measures.

	SLI	TD	Group comparisons	
			t	*p*
Number of participants	19	19		
Boys/girls	14/5	14/5		
Age				
M	6;1 years	6;2 years	-0.125	0.83
SD	8 months	9 months		
TTFC-2[a]				
M	18.9	35.3	-7.96	<.001
SD	7.2	5.3		
TWF-2[b]				
M	82.9	106.6	-5.544	<.001
SD	14.2	12.1		
Grammatical closure[c]				
M	24.5	37.9	-6.66	<.001
SD	6.0	6.4		
Verbal working memory[d]				
M	4.7	11.4	-8.54	<.001
SD	2.7	2.2		

[a] Scores: maximum 46. [b]Standard scores: 90–110 average; 80–89 low/below average; 70–79 deficient. [c]Scaled scores: mean 36, normal range 30–42 (1 standard deviation is 6). [d]Standard scores: 8–12 average; 6–7 low/below average; 4–5 deficient.

4.1.3 Children with ASD

In Study III children with ASD participated. As the research has shown, the diagnosis between Asperger syndrome and high-functioning autism is not clear (e.g. Howlin 2003, Mattila *et al*. 2007, Mattila *et al.* 2011) and as the current DSM-5 (APA 2013) suggests, autism and Asperger syndrome is no longer separated but included into one diagnosis of autism spectrum disorder (ASD). Thus, for clarity, in this study I use the term ASD to refer to high-functioning children who have been diagnosed either with autism or Asperger syndrome.

17 children with ASD were recruited to this study, but the data of one child was not analysed, since this child's cognitive skills proved to be weak (verbal IQ 77, performance IQ 64) according to a psychologist's assessment. All the children were diagnosed by a child neurologist or a child psychiatrist at the Department of Child Neurology or Child Psychiatry at the University Hospital of Oulu.

Diagnoses were based on investigations by a multi-professional team according to ICD-10 criteria (WHO 1993) utilizing information from ADOS (Lord *et al*. 2000) and ADI-R (Lord *et al.* 1995). None of the 16 participating children (aged from 5;1 to 10;7 years) had an intellectual disability (full scale IQ > 70) and all had normal hearing. IQ information was received from the children's psychologists. For 2 children, the exact test values were not available, but it was evident from the psychologists' statements that these children did not have an intellectual disability. For the rest of the children (n = 14), mean verbal IQ was 92.7 (SD = 19.9) and mean performance IQ was 97.3 (SD = 13.7). According to the age-appropriate Wechsler Intelligence Scale. 31.3% of the mothers and 18.8% of the fathers of the children with ASD were upper-level employees with administrative, managerial, professional or related occupations, 37.5% of the mothers and 43.8% of the fathers were lower-level employees with administrative or clerical occupations, and 18.8% of the mothers and fathers were manual workers. One father (6.2%) was self-employed. One mother (6.2%) and one father (6.2%) were studying and the information about occupation was not available for one (6.2%) mother and for one father (6.2%).

As in Study II, the control group in Study III consisted of age- and sex-matched typically developing children, who were randomly selected from the larger data set of typically developing children. 2 typically developing children (9;5- and 10;0-year-olds) were additionally recruited for the control group using the same criteria as in Study I, because there were 2 children with ASD who were older than 8;11 years. TTFC-2, TWF-2, grammatical closure subtest of ITPA, and sentence repetition or word list interference subtests of NEPSY-II were carried out to acquire information on the language skills of the groups. The children with ASD showed poorer skills in all measures compared to typically developing children. It should be noted that the grammatical closure subtest of ITPA was possible to score only for 14 participants from both groups, since the scaled scores were available only for children up to 9;2 years. Participant characteristics and group comparisons by measures are presented in Table 3.

Table 3. Participant characteristics and group comparisons between children with ASD and typical development (TD) by measures.

	ASD	TD	Group comparisons	
			t	*p*
Number of participants	16	16		
Boys/girls	15/1	15/1		
Age (years)				
M	7;7	7;5	0.256	0.793
SD	1;7	1;5		
TTFC-2[a]				
M	30.6	38.1	-3.54	0.001
SD	7.5	3.9		
TWF-2[b]				
M	84.1	101.1	-2.89	0.007
SD	18.6	14.5		
Grammatical closure[c]				
M	31.8	37.4	-2.236	0.034
SD	7.4	5.7		
Verbal working memory[d]				
M	7.8	10.9	-3.45	0.002
SD	2.3	2.8		

[a] Scores: maximum 46. [b]Standard scores: 90–110 average; 80–89 low/below average; 70–79 deficient.

[c]Scaled scores: mean 36, normal range 30–42 (1 standard deviation is 6), n = 14 in both groups.

[d]Standard scores: 8–12 average; 6–7 low/below average; 4–5 deficient.

4.1.4 Ethical consideration

This study was carried out as part of a research project *Assessing of pragmatic language abilities in children with typical language development, autism spectrum disorder, attention-deficit/hyperactivity disorder and specific language impairmen*t in collaboration with the principal investigator, Dr Soile Loukusa. The Ethical Committee of the Northern Ostrobothnia Hospital District approved the study.

For typically developing children the permission to carry out the research design was received from the Head of the Day-Care and Family Work Unit of the City of Oulu. In addition, permission for the study was asked from the principals of the schools and nurseries before delivering the information sheets for the participants' families via teachers. Those families that wanted to participate

returned signed consent sheets to the child's nursery or school. These consents were then delivered to researchers via the children's teachers.

Considering the recruiting of children with SLI or ASD, there was collaboration with the clinics of audio-phoniatrics, child neurology and child psychiatry in University Hospital of Oulu. Doctors, speech language therapists or nurses from those clinics asked permission from the parents of the children who fulfilled the recruiting criteria to contact either the researcher or Dr Soile Loukusa. If permission was given, researchers phoned the family, described the research design in detail, and mailed the information sheets. For all children, participation was voluntary and signed consent from the children's parents was required before the assessments.

4.2 Data collection and material

4.2.1 General procedure

The data was collected during the years 2009–2013. The battery of tests consisted of three narrative tasks: The Cat Story, The Bus Story (Renfrew 1997) and the Edmonton Narrative Norms Instrument, ENNI (Schneider *et al.* 2005), of which only the Cat Story is reported in this dissertation. Since this dissertation was motivated by the fact that a well-studied narrative test in Finnish does not exist yet, the Cat Story was chosen for the elicitation task to be used in this study in order to gain information concerning its usability as a narrative elicitation method. This information will be important in future work when studying its validity as an assessment tool more precisely. In the Bus Story test as well as in the ENNI test some culturally inappropriate elements may exist and therefore the Cat Story was designed. The presentation order for the three narrative tasks was always randomized.

TTFC-2 and TWF-2 were also performed to all participating children. In addition, a task of pragmatic understanding by Dr Soile Loukusa, which is under development at the moment, was conducted with all children as assessment of pragmatic understanding was part of a larger research project. For children with SLI and ASD and for their control children, subtests of NEPSY-II and one subtest of ITPA were carried out. Narrative tasks were never administered first in order to avoid shyness; otherwise the order of the tasks was random.

Assessments were administered in a private room in child's day nursery or school, at the child's home or at the Department of Logopedics at the University of Oulu. Children were investigated separately from 2 to 4 times depending on the child's age, attention skills and group status. If a child took part only in Study I (the development of narratives in typical development) and did not participate as a control child in Studies II and III, only the smaller test battery was conducted and therefore 2 assessment sessions were needed. Each assessment was videoed and the duration of the sessions varied from 30 minutes to one hour, lasting an average 45 minutes. Children with SLI or ASD were assessed by myself or Dr Soile Loukusa. In addition, master students of logopedics (Ilona Haataja, Meeri Nurmimäki, Anniina Ruohomäki, Katja Saarinen and Kaisa Tervahauta) helped with the data collection of typically developing children and investigated a total of 69 5- to 8-year-old typically developing children.

4.2.2 Narrative elicitation method

The Cat Story is a goal-based wordless picture booklet developed for the purposes of this study. The storyline was written by myself and it partly follows the traditional story grammar model by Stein and Glenn (1979). The story was planned to reflect fictive but culturally appropriate events for Finns in a familiar storybook condition. Buying a balloon was considered to be a familiar experience for Finnish children. Before actual data collection, a pilot test with 9 5- to 11-year-old children was conducted. After the pilot test, some pictures from the Cat Story were modified because there were some disruptive details and elements that confused the storytelling.

The Cat Story consists of 12 coloured pictures, illustrated by a speech-language therapist, MA Soile Ukkola. The story is about a kitten that accidentally falls over a rock and, as a consequence, loses his recently bought balloon. Unfortunately the balloon gets stuck in a tree and finally, after several attempts to get it back, the balloon pops. At the end of the story, the kitten, however, gets a new and even a better balloon.

Before narrating, children were briefed that the story is about a kitten and were instructed to look silently and carefully through the booklet. After that, children were introduced to a puppet, Herra Hakkarainen, who is a familiar story character for Finnish children. Children were told that Herra Hakkarainen is wearing a nightdress and wants to hear a bedtime story as he is about to fall asleep. It is impressed on the children that Herra Hakkarainen cannot see the

pictures as his eyes are closed and therefore they should tell the story very carefully. This 'naïve listener' was used to encourage accurate reference use. It is observed that the use of references may be more accurate in situations where the context is not shared with an interlocutor (Kail & Hickmann 1992, Schneider & Dubé 1997).

If necessary, children were helped to get started, by saying "What happens in the story?" If the child did not respond and did not start to narrate, a specific question was asked while pointing to the picture (What are these characters doing here?). This response was not analysed later, since it was not a child's spontaneous utterance, and the question might have directed the child to answer with a specific clausal structure. If children skipped some pictures, they were directed back to the right picture. These were the only times when children were helped. While narrating, children were encouraged by repeating their utterances or giving neutral prompts (good, go on, umh, and then?).

After finishing the storytelling, the story booklet was taken from the child and he/she was praised for their good performance. Children were told that Herra Hakkarainen did not quite hear everything. Therefore 11 questions were to be asked, without the presence of the pictures, in order to assess the story comprehension. Finally, only 6 of those questions were, however, used in the analysis.

4.3 Data analysis

4.3.1 Transcribing

The data was transcribed orthographically by the researcher using the CHAT-format of the Child Language Data Exchange System (CHILDES) (MacWhinney 2000). Rules for transcribing were applied by the general transcribing conventions suggested by MacWhinney (2000), Bishop (2004a), and Schneider *et al*. (2005). False starts (*the mom no* the boy went to the market), retracings (*he wanted* he wanted to buy a balloon), reformulations (he ran and didn't see *the tree uh* the rock), fillers (*uhm, so, that*) and answers to the direct questions erroneously made by the examiner (Examiner: *What was he doing*? Child: *Playing*) were not analysed. Also, the comments and questions made by the examinee (I am tired/What time is it?/I have a balloon at home) were excluded from the analyses, but, importantly, included in the analysis of discourse features in Study III.

Unintelligible C-units were excluded if the whole meaning was unclear, mostly due to background noise or overlaps, but these occurrences were rare. If the meaning of the C-unit and words could be still recognized, the C-unit was included to the analysis. Some words inside the C-unit had to be excluded due to unintelligible speech, but the rest of the C-unit was still analysed. These excluded words were marked and they were marginal in the data. Onomatopoeic words and interjections were analysed if they were commonly used and word-like (Poika sanoi *oho*! 'Boy said *oops*!' *Poks*, pallo hajosi. '*Pop* the balloon fell into pieces.'). Contracted words, such as combinations of conjunction and negation word which are typical in Finnish (*muttei* mutta ei), were treated as two words.

4.3.2 Data segmenting

Narratives were segmented into C-units according to Loban's rules (cited in Hughes *et al*. 1997). C-units are defined solely on a syntactical basis and they are extensively used in narrative studies (e.g. Colozzo *et al*. 2011, Fey *et al*. 2004, Heilmann *et al*. 2008, Muñoz *et al*. 2003, Schneider *et al*. 2005). Traditional definition of utterance, based on, for example, intonation contour, is not, without fail, suitable in narrative studies, since reliability of utterance segmentation is somewhat arguable (Berman 2009, Hughes *et al*. 1997). Utterance analysis also tends to produce long utterances, which is problematic in syntactical analysis when a clear division of different sentence structures is needed.

Basically, each main clause and its possible subordination clause/s was considered as one C-unit: *Poika itki koska hän kompastui.* 'The boy cried because he stumbled'. Coordinated main clauses were treated as separate C-units: *Poika kaatui/ ja äiti lohdutti häntä* 'The boy fell down/and mom comforted him'. If the subject was elliptical, main clauses were treated as one C-unit: *Poika kaatui ja ø alkoi itkeä* 'The boy fell down and ø started to cry'. Moreover, direct quotes formed one C-unit: *Poika sanoi minä satutin polveni* 'The boy said I hurt my knee'. However, if a direct quote was followed by another direct quote, they were treated as two C-units: *Poika sanoi äiti ei saa palloa* / *Voitko auttaa?* 'The boy said mom can't get the balloon/Can you help?' If the quote was indirect, it was treated as a subordinate clause in one C-unit: *Poika sanoi että äiti ei saa palloa puusta.* 'The boy said that mom can't get the balloon from the tree'.

In addition, C-units without a predicate which do not fulfil the criteria of a clause (e.g. *Kiitos/ Okei/ Selvä se* 'Thanks, OK'), can be included in C-unit analyses (Hughes *et al*. 1997). In this study, story endings (*Sen pituinen se/ Loppu*

'The end') were, however, excluded, because they are very short, typically learnt by heart and therefore not used by all children. This use of story endings will unavoidably affect the measures of syntactical complexity (see Schneider *et al*. 2005).

4.3.3 Narrative measures and coding

The measures were chosen from the previous literature and are commonly used in narrative studies with participants of different ages and language abilities. Not all measures were used in all 3 studies (see Table 4), since the choice of measures was based on the characteristics of narrative abilities of the targeted participants. Sample narratives and coding examples are presented Appendix 1.

Table 4. Narrative measures analysed in studies I, II and III.

Measure	Study I	Study II	Study III
Linguistic measures			
CU	yes	yes	yes
NDW	yes	yes	yes
TNW	yes	no	no
CD	yes	yes	yes
MLCU	yes	yes	yes
Grammatical accuracy	no	yes	no
Pragmatic measures			
Referential accuracy	yes	yes	yes
Event content	yes	yes	yes
Discourse features	no	no	yes
Mental state expressions	no	yes	yes
Comprehension questions	no	yes	yes

CU = Number of C-units, NDW = Number of different word tokens, TNW = total number of word tokens, CD = clausal density, MLCU = mean length of C-units, Yes = analysed, No = not analysed

Productivity

Three measures of productivity were used: the number of C-units (CU), the number of different word tokens (NDW), and the total number of word tokens (TNW). Because inflection of words is characteristic of the Finnish language, word tokens, instead of types, were used. Since the data length was not controlled for, the NDW was not seen as a measure of vocabulary, as it is likely that the sample length influences lexical measures (see further Miller 1996).

Syntactical complexity

Clausal density (CD) is a measure that reflects the complexity of syntactical constructions. It is calculated by tallying all the main and subordinate clauses and dividing the total by the number of C-units. Thus, the CD value reflects the average number of clauses in one C-unit. For example, a CD value of 1.00 suggests that there were only main clauses in a child's narrative.

Mean length of C-unit in words (MLCU) is another measure of syntactical complexity that is commonly used in narrative settings. It is important to differentiate the MLCU from the mean length of utterance (MLU), which was originally developed for the analysis of young children's grammatical development by means of measuring the average number of morphemes from 100 utterances (Brown 1973). Instead, MLCU is calculated by dividing the total number of word types by the total number of C-units. Thus, the MLCU value reflects the average number of words in one C-unit. MLCU is based on the segmentation of C-units, which is defined by syntactical properties. MLCU is only a gross measure, suggesting that the longer the C-unit is in words, the more likely the C-unit consists of more than one clause.

Since narratives are spoken discourse, they do not follow the rules of literal Finnish, and some clausal structures are therefore difficult to analyse. Use of coordination conjunctions or connectives (e.g. and, but) is very common in narrative language (Chafe 1988, Kalliokoski 1989). All the main clauses that start with *and*, *and then*, or *but* could not be treated as coordinated clauses, because these same conjunctions can also function as discourse particles (Hakulinen *et al*. 2004, Kalliokoski 1989). For example, *and* at the beginning of a clause is a typical character of spoken language, which, as a discourse particle (or as a connective) does not connect coordinated clauses but larger parts and meanings of a text (Kalliokoski 1989). It can also have pragmatic meanings by means of linking narrative phrases together into a coherent narrative unit or expressing the continuity of a speaker's turn (Chafe 1988, Hakulinen *et al*. 2004). In Finnish, coordinated clauses are often elliptical, in that the latter part of the complex sentence is dependent on the first part and, for example, the subject can easily be omitted in order to avoid repetition (Hakulinen *et al*. 2004). Since the distinction between discourse particles and conjunctions is hard to reliably make; in this study only the main clauses with elliptical subjects were treated as coordinated main clauses and as one C-unit.

In addition, some other elliptical verb forms are problematical. For example, in this study some children used sentences consisting of two C-units, but the last part of the sentence did not completely fulfil the criteria of a clause, because of the elliptical part of the predicate: *Poika ei ylety palloon/ ja ei äitikään (ylety).*'The boy can't reach the balloon/and neither (can) the mother'. This latter clause was, however, credited as a clause, because the use of elliptical structures is typical in spoken Finnish; it is pragmatically acceptable and these structures show advanced language competence when used in a proper way.

Basically, the criterion for a clause is to have a finite verb as a predicate, which can form a minimal clause even on its own (Hakulinen *et al*. 2004), as, for example, in a clause with an experiencer (*Minua väsyttää* 'I am tired'). In Finnish, the syntactic position of subject-verb agreement features varies across persons and syntactic constructions (Vainikka & Levy 1999). In some syntactical sentence types (e.g. intransitive, transitive and copula clauses), an overt subject is required (Hakulinen *et al*. 2004), but it can also be omitted in the first and second persons, as person can be seen from the inflected verb. Instead, the third person overt subject is normally required. Some children used clauses without third person subjects while narrating. These clauses were considered to be independent C-units and separate main clauses, because the subject was not elliptical. Rather, it was incorrectly missing: *Sitten kaatui/ ja koitti ottaa palloa/ ja ei saanut.* 'Then fell down/ and tried to take the balloon/ and didn't get it'.

There were also some children who used coordination of the same verb as a tool for emphasising or expressing continuity (Hakulinen *et al*. 2004): *Ja taas poika itki ja itki* 'Again the boy cried and cried. These constructions were treated as one C-unit and one main clause. Non-finite clauses (*Saatuaan ilmapallon poika oli iloinen* 'Having got a balloon boy was happy') were extremely marginal in the data and these were not analysed separately.

Grammatical accuracy

Grammatical accuracy was analysed as a percentage of grammatically correct C-units out of all C-units. Narratives were marked for ungrammatical elements, which were C-units with syntactical or morphological errors. Word order is relatively free in Finnish but in general subjects precede finite verbs (Hakulinen *et al.* 2005, Vainikka & Levy 1999). Thus, sentence structure with a reverse word order (*Kaatui poika kiveen* 'Fell a boy over a rock') was considered ungrammatical in this study. Moreover, omissions of obligatory clausal elements

were treated as a syntactical error. These were incorrect omissions of third person subjects in those syntactical sentence types (e.g. copula or transitive clause) in which a subject is necessary (*on surullinen* 'is sad'/ *haluaa pallon* 'wants a balloon'). In addition, morphological errors in inflections of cases or tenses were analysed.

Referential accuracy

The reference use was analysed by assessing the accuracy of introducing and maintaining reference, and the use of ambiguous pronouns (procedure adapted from Norbury & Bishop 2003, van der Lely 1997). Referential accuracy was analysed from three story characters (boy, mother, seller) and from the balloon, which appears in many story events. Each reference was marked as being clear or ambiguous. If the reference was not explicit and understandable in the previous context, it was coded as ambiguous (*Äiti ja lapsi yrittivät saada ilmapallon mutta se ei saanut ilmapalloa*, 'The mum and child reached for the balloon but it did not get the balloon'). The referential accuracy is a percentage of clear references used out of all references.

The reference use was analysed from noun phrases (*Poika halusi ilmapallon*, 'Boy wanted a balloon'), personal and demonstrative pronouns (*Hän sai sen puusta*, 'He got it from the tree'), as well as deictic speech act pronouns (*Poika sanoi minä haluan pallon*, 'The boy said I want a balloon'), and zero anaphora (*Poika juoksi ja ø kaatui kiveen*, 'The boy ran and ø tripped over a rock'). In addition, the possessive suffixes, which mark literal language and can be used with or without the preceding pronoun (*Hänen pallonsa poksahti*, 'His balloon went pop') were coded. Since Finnish verbs have a subject-verb agreement system and the person is marked in the verb stem (*sano+n*, first person singular, 'I say'), subjects are not always required. On these occasions the reference use was analysed from the inflected verb (*En ylety palloon sanoi poika,* 'I can't reach the balloon the boy said').

Event content

The scoring system was created for the Cat Story in order to assess the amount of relevant information included in children's narrations. The Cat Story was first divided into 29 information units by the author. The concept of an information unit, a denotation or a meaning of a clause, was theoretically adapted from the

model of text comprehension by Kintsch and van Dijk (1978) reflecting the micro-propositions of that model. Following the procedure from O'Neill *et al*. (2004), an adult control study was set up in order to confirm that these propositions were essential for the story content. 29 Cat Story narratives by adults were scored according to the predefined scoring system. This scoring had to be modified, since some information units were not mentioned by adults, while they also mentioned some that had not been taken into account. Information units mentioned by at least 50% of the adults were included in the final scoring system. In previous research, an 80% cut off has been used (Christensen *et al*. 2009, Korpijaakko-Huuhka 1995). However, in this study the cut off was set at 50%, because there were some unexpected results from the adult control study. For example, 69% of the adults explicitly mentioned that *the boy tries to reach for the balloon*. The rest of the adults did not mention this, but instead they described some details concerning the birds with a nest in a tree near to where the balloon that had got stuck in a tree. This disruptive element was deleted from the picture after the adult control study.

It is possible that adults and children do create somewhat differing mental models of the stories (see Cohn 2013, Nicolopoulou 2008), and children's' narrations should perhaps not be compared with those of adults. In this study, the adults' narrations were only used as a reference base to be sure that the predefined elements are indeed worthy of telling and relevant for the story. For example, an information unit reflecting the internal plan of a character (see Stein & Glenn 1979) was rarely mentioned by adults, and it was, therefore, not included in the scoring system, even though it was thought to be relevant for the story. Results from the adult control study by information units are described in Table 5.

In the final scoring, each information unit mentioned was awarded one point, leading to a maximum score of 29. Information units were only scored if they were told temporally and causally in the right order, since these features are essential for narration. Children's expressions did not need to be precisely comparable with the expressions mentioned in the scoring sheet (Appendix 2). For example, the expression *falls down* was scored one point instead of the more precise *The boy tripped*. The reference did not need to be stated clearly, because referential cohesion was analysed elsewhere, and also synonymous and dialectical expressions were accepted if they still captured the main idea.

Table 5. Results from the adult control study (n = 29).

Information unit	Percentage of adults who mentioned the unit
Mother cat	100%
Balloon seller	82.9%
Park	75.9%
Boy wants or gets a balloon	100%
Boy runs or plays with a balloon	100%
Boy is happy	96.6%
Boy trips up	100%
Stone (in relation to tripping)	96.6%
Balloon flies away	100%
Balloon gets stuck in the tree	100%
Boys is sad or cries/ or mention of hurting a knee	96.6%
Mum comforts	89.7%
Boy tries to reach the balloon	69.0%
Boy can't get the balloon	72.4%
Mum tries to reach the balloon	96.6%
Mum stands on a bag	96.6%
Mum can't get the balloon	72.4%
Boy goes to seller	96.6%
Boy asks for help/ or says what happened	96.6%
Seller helps/ or comes with a boy	82.8%
Seller has a ladder	100%
Seller climbs the tree	93.1%
Seller tries to reach the balloon	75.9%
Balloon pops	100%
Boy is sad or cries	100%
Mum is sad	58.6%
Seller is sad or sorry	65.5%
Seller gives a new balloon	93.1%
Boy is happy	51.7%

Discourse features

Additional information that children may have included in their narratives was assessed according to the models presented by Norbury and Bishop (2003) and Norbury *et al*. (2013). To do that, children's stories were compared with the event content coding sheet. All appropriately produced details that were not mentioned in the original coding were tallied. For example, a point was scored for mentioning additionally that *mom paid for the balloon with a ten euro note* in

addition to mentioning that *mom bought the balloon for the boy*. In addition, extraneous utterances that were irrelevant or odd concerning the original event content coding and storyline were assessed. These were irrelevant descriptions or details (*The balloon seller walks forward)* or mentions of off-topic occurrences (*The whole bunch of balloons flies away*) as well as comments and questions made (*Is mom wearing a hat?)* or irrelevant repetitions of a previously mentioned event. For the scoring, two categories were created. Firstly, additional information was calculated and, secondly, the rest of the categories were combined for one measure reflecting extraneous information.

Mental state expressions

The model for analysing mental state expressions was adopted from Bamberg and Damrad-Frye (1991) which was also later used in Norbury and Bishop (2003). In this study, only the category called 'frames of mind' of that model was included. All explicitly mentioned emotion words and cognitive states were accepted (Table 6). Cognitive state words refer to the story characters' beliefs and thoughts or desires and intentions. Communication expressions (e.g. say, whisper), perceptual states (e.g. see, hurt), or behavioural emotional expressions (e.g. cry, laugh) were not accepted. These actions are visible from the picture and may thus not give insight into mental processes or the understanding of emotional states. Each accepted mental state expression was scored as one point.

Table 6. List of mental state expressions used in children's narratives.

Emotion words	Beliefs and thoughts	Desires	Intentions
annoy, comfort, excited, happy, pleased, sad, sorry	discover, have an idea, notice, wonder	want	ask for help, (somebody) can help, decide, in order to get

Note. Expressions containing modal verb *can* or verb chain including the verb *help* were analysed as intentions, since these were considered to reflect intentionality (*The boy asks if the man can help*) when compared to phrases where no intentionality was shown (*The boy says the balloon is in the tree*).

Comprehension questions

Originally 11 comprehension questions were developed in order to assess how children understood the story. 6 of these questions where why-questions, one was a feeling-question, and the other 4 were explicit questions that did not require

inferencing. After the data analysis, only the 6 why-questions that required inferencing were accepted in this study, since the rest of the questions proved to be too easy.

Comprehension questions were asked after the child had finished their storytelling without the help of the pictures. Pictures were not available, because of a presupposition that, if children were able to understand the story and make inferences, they could also remember it (Norbury & Bishop 2002). It was not possible to convey correct answers just by describing the pictures, but inferencing skills, such as utilization of story context and world knowledge (i.e. usually someone is comforted when he/she is feeling sad), were needed for the correct answer. For example, in the question *Why did mom comfort the boy?* the correct answer was *The boy is sad.* Answers such as *The boy hurt his knee* or *The boy tripped* were not sufficient for awarding the point, because these reflect the premises of the inferencing process (see Sperber & Wilson, 1995), but the conclusion is not carried through in that context (boy tripped over a rock + he hurt his knee = he is sad). Each correct answer was scored as one point, leading to a maximum score of 6. Appendix 3 presents the questions and examples of answers.

4.3.4 Interrater reliability

In order to verify the reliability of scoring, an intraclass correlation coefficient was calculated between the researcher and a speech language therapist, researcher, Anna-Kaisa Tolonen. In Studies II and III she was blind to the group status of the children. Scoring was based on the instructions made by myself and practise items that were scored together. Reliability was not calculated for NDW, TNW and MLCU, since these values were automatically calculated by the CLAN program of the CHILDES. Instead, classification of the C-unit was checked, since values of MLCU and CD were based on calculating the C-units. Interrater reliability was high for all of the measures apart from the mental state expressions in Study III, in which the reliability was moderate (Table 7).

Table 7. Interrater reliabilities between the raters.

	Study I random sample = 15	Study II random sample = 6	Study III random sample = 8
Variable	ICC value	ICC value	ICC value
Number of C-units	0.99	0.93	1.00
Clausal density	1.00	0.89	1.00
Grammatical accuracy	not analysed	0.97	not analysed
Referential accuracy	0.98	0.95	0.98
Event content	0.95	0.98	0.96
Discourse features	not analysed	not analysed	
additional information			0.90
extraneous information			0.94
Mental state expressions	not analysed	1.00	0.66
Narrative comprehension	not analysed	1.00	0.91

ICC = intraclass correlation coefficient

4.3.5 Statistical analyses

In Study I, the differences between age-groups were modelled by the one-way analysis of variance (ANOVA) with detailed comparisons by Tukey's HSD post hoc tests. Even though the data was not normally distributed for some variables, the distributions of the variables were considerd to be similar enough for parametric methods. However, the non-parametric methods (Kruskal-Wallis one-way analysis of variance and Mann-Whitney *U*-test with Bonferroni corrections) were also applied and corresponding results were obtained. Partial eta squared (η_p^2) was calculated to represent the effect sizes. Simple linear correlations were analysed using Pearson product-moment correlation coefficients (*r*). In order to further examine the associations between narrative variables, linear regression analyses, adjusted for age and gender, were conducted. Two different models were entered, because of the collinearity between some explanatory variables. Akaike's information criterion (AIC) was used to evaluate the models' goodness-of-fit. The model with a lower AIC value is considered to be a better model (Tabachnick & Fidell 2007).

In Studies II and III, group differences were analysed by a two-tailed two-sample *t*-test with Cohen's *d* as a measure of effect size. If *d* is around 0.8, it is considered as a large effect; *d* around 0.5 reflects a medium effect, whereas *d* around 0.2 can be interpreted as a small effect (Cohen 1988). For highly skewed

data (Study III extraneous information), the Mann-Whitney *U*-test was used to compare group differences.

In Study II, the use of mental state expressions was rare both in children with typical development and in children with SLI. In addition, for children with SLI, the distribution of mental state expressions was strongly positively skewed. Therefore, proportions of mental state expressions were compared, instead of raw scores, using the two-proportion *z*-test.

5 Results

5.1 Narratives in typical development (Study I)

5.1.1 Age-group comparisons

Descriptive statistics by age-groups for narrative variables are presented in Table 8. Age-group differences were analysed by one-way analysis of variance (ANOVA) which revealed a main effect for age-group for every narrative variable (number of C-units (CU): $F(4,167) = 4.43$, $p = 0.002$, $\eta_p^2 = .10$; total number of word tokens (TNW): $F(4,167) = 8.11$, $p < 0.001$, $\eta_p^2 = .16$; number of different word tokens (NDW): $F(4,167) = 9.96$, $p < 0.001$, $\eta_p^2 = .19$; mean length of C-units (MLCU): $F(4,167) = 8.66$, $p < 0.001$, $\eta_p^2 = .17$; clausal density (CD): $F(4,167) = 4.92$, $p < 0.001$, $\eta_p^2 = .11$; referential accuracy: $F(4,167) = 19.66$, $p < 0.001$, $\eta_p^2 = .32$; event content: $F(4,167) = 25.51$, $p < 0.001$, $\eta_p^2 = .38$.

Tukey's honest significant difference (HSD) test was used for multiple post-hoc comparisons, which showed a significant difference ($p < .05$) between 4- and 5-year-olds in CU, NDW and event content. 5- and 6-year-olds differed significantly in referential accuracy. No other statistically significant differences were detected between consecutive age-groups. However, 4-year-olds differed from older age groups in many variables, and 5-year-olds differed from 7- and 8-year-olds in some variables. In addition, 6-year-olds differed from 8-year-olds in event content. Pairwise comparisons are presented in detail in Table 9.

Table 8. Narrative measures by age-groups.

Variable	4-year-olds (n = 30)	5-year-olds (n = 36)	6-year-olds (n = 39)	7-year-olds (n = 37)	8-year-olds (n = 30)
CU					
M	13.7	17.1	16.6	18.4	17.3
SD	5.3	4.9	3.4	3.4	4.5
TNW					
M	66.4	91.4	91.5	113.3	109.8
SD	29.8	30.2	31.8	44.9	45.9
NDW					
M	39.9	53.4	54.7	66.4	65.6
SD	15.5	17.6	15.9	24.0	21.4
MLCU					
M	4.7	5.3	5.4	6.1	6.2
SD	1.1	1.2	1.2	1.2	1.3
CD					
M	1.1	1.2	1.2	1.3	1.3
SD	0.2	0.2	0.2	0.2	0.2
Referential accuracy (%)					
M	45.3	52.8	71.0	78.9	84.7
SD	25.4	26.1	20.3	19.0	14.3
Event content					
M	12.0	16.1	17.5	19.2	19.9
SD	4.2	3.5	3.6	2.7	3.1

CU = number of C-units, TNW = total number of word tokens, number of different word tokens, MLCU = mean length of C-units, CD = clausal density

Table 9. *P* values of Tukey's HSD post-hoc multiple comparisons.

Age-group comparisons	CU	TNW	NDW	MLCU	CD	References	Event content
4 and 5 years	.043*	.053	.020*	.172	.701	.626	<.001*
4 and 6 years	.125	.046*	.008*	.080	.499	<.001*	<.001*
4 and 7 years	.001*	<.001*	<.001*	<.001*	.004*	<.001*	<.001*
4 and 8 years	.040*	<.001*	<.001*	<.001*	.004*	<.001*	<.001*
5 and 6 years	.987	1.000	.999	.998	.998	.003*	.420
5 and 7 years	.675	.090	.063	.051	.129	<.001*	.002*
5 and 8 years	1.000	.268	.135	.030*	.108	<.001*	<.001*
6 and 7 years	.343	.080	.100	.098	.222	.547	.218
6 and 8 years	.968	.252	.199	.059	.186	.072	.036*
7 and 8 years	.804	.995	1.000	.997	1.000	.773	.907

CU = number of C-units, TNW = total number of word tokens, number of different word tokens, MLCU = mean length of C-units, CD = clausal density, *significant difference $p < .05$

Effect of age on the narrative variables is illustrated by measures in Figures 1–7. As can be seen, all measures show some increases with age. Even though statistical significance was not found between 5-, 6-, 7- and 8-year-olds in the measures of productivity and complexity (regardless of the difference between 5- and 8-year-olds in MLCU), the descriptive statistics (Table 8) and Figures 2, 3, 4, and 5 indicate that the mean values of productivity (TNW, NDW) and syntactic complexity (MLCU, CD) measures showed a similar developmental trend. This suggest that, as a group, the 5- and 6-year-olds performed similarly- and this was also true for the 7- and 8-year-olds, and the older age groups outperformed the 5- and 6-year-olds. The number of C-units did not show a similar trend; actually the median values of the number of C-units do not increase after the age of 5 (Figure 1). In measures of referential accuracy (Figure 6) and event content (Figure 7), the developmental trend is also seen between the 5- and 6-year-olds as well as between 7- and 8-year-olds, even though the differences in event content are only marginal. It is of note, however, that the relatively large standard deviations indicate the heterogeneity of measurements in all variables

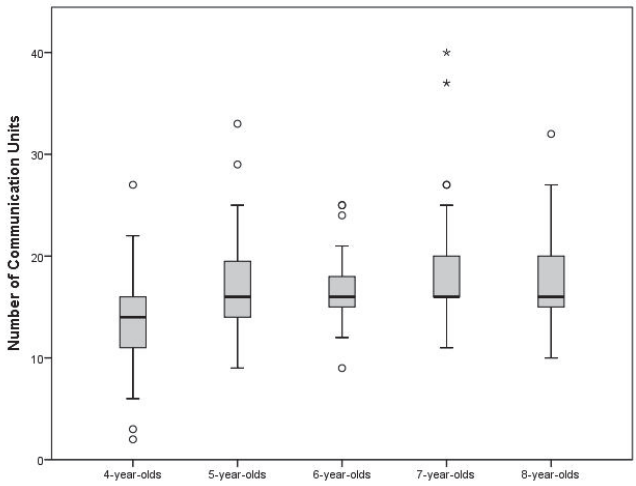

Fig. 1. Development of number of C-units by groups.

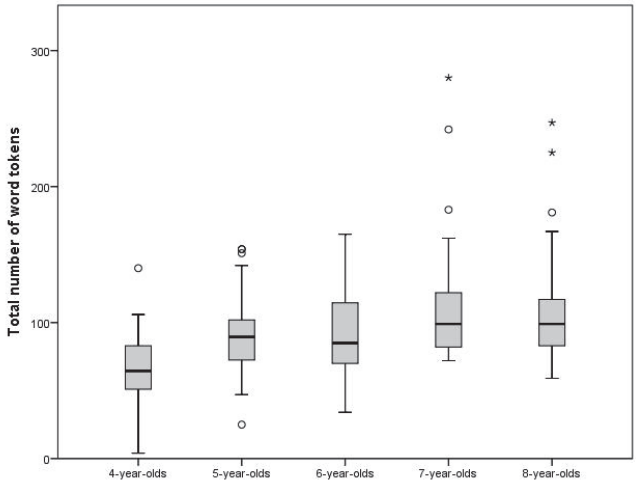

Fig. 2. Development of TNW by age groups.

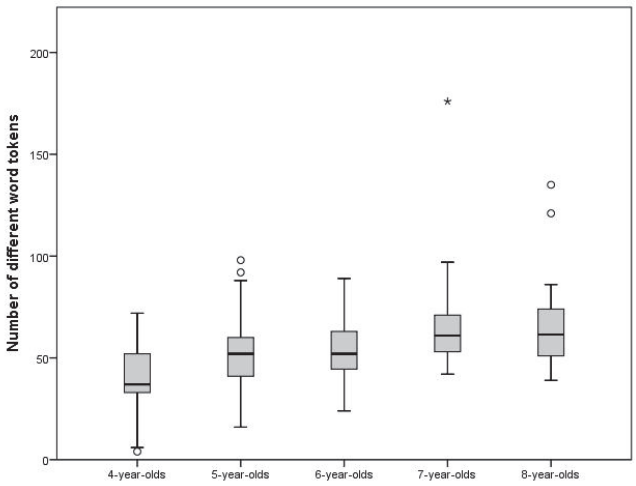

Fig. 3. Development of NDW by age groups.

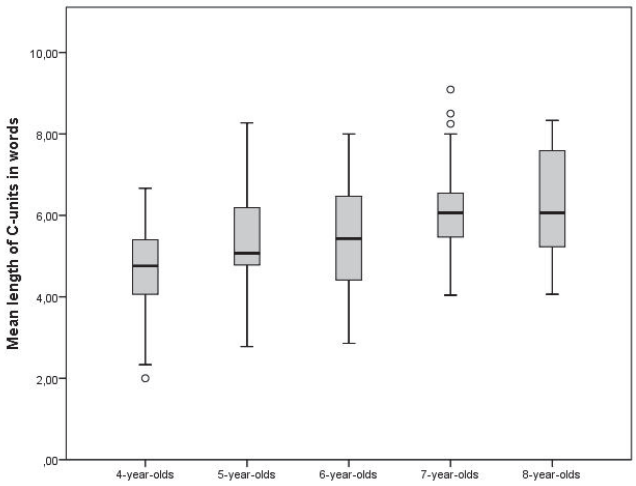

Fig. 4. Development of MLCU by age groups.

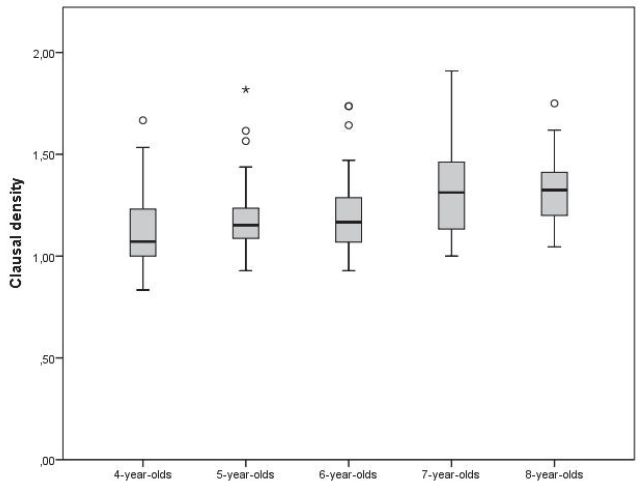

Fig. 5. Development of CD by age groups.

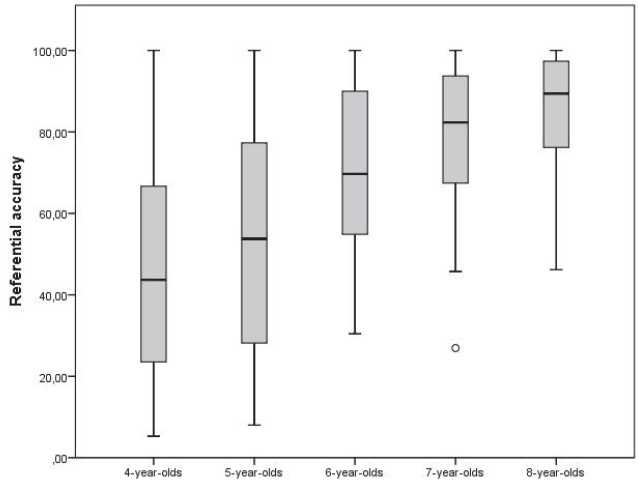

Fig. 6. Development of referential accuracy (%) by age groups.

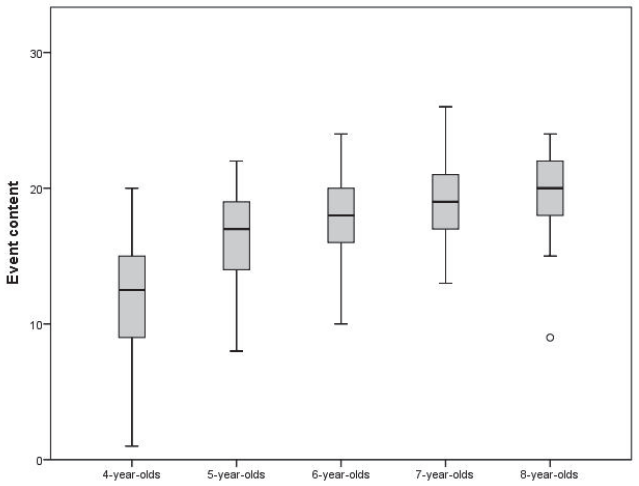

Fig. 7. Development of event content scores by age groups.

5.1.2 Associations between narrative variables

In Study I the associations between narrative productivity measures (CU, TNW, NDW) and event content were investigated. To do that, the Pearson product-moment correlation coefficients (*r*) were calculated. Intercorrelations among analysed narrative variables were all strong and statistically significant ($p < .001$) (Table 10).

Table 10. Correlation coefficients (*r*) between narrative measures.

	Event content	CU	TNW	NDW
Event content	1			
CU	.57	1		
TNW	.65	.86	1	
NDW	.70	.83	.94	1

CU = number of C-units, TNW = total number of word tokens, NDW = number of different word tokens

Multiple regression analysis was conducted with event content as a response variable and CU, TNW and NDW as explanatory variables to further study the associations between measures. Two different models (see Table 11) had to be entered, because TNW and NDW were highly correlated. Both models were

adjusted for gender and age. According to the Model 1, NDW increased ($p < .001$) the event content, but the CU did not. Model 1 explained for 60.0% of the variance in the event content (adjusted $R^2 = 0.600$, $F(4, 167) = 65.09$, $p < 0.001$). In Model 2, only TNW could be entered as an explanatory variable, because there was collinearity between TNW and CU. In this model, TNW increased ($p < .001$) the event content and the Model 2 accounted for 57.4% of the variance in the event content (adjusted $R^2 = 0.574$, $F(3,168) = 77.74$, $p < 0.001$). Akaike's information criterion (AIC) was calculated for evaluating the models' goodness-of-fit. The AIC value for the first model with TNW and CU as explanatory variables was 841.2, and for the second model with TNW 851.1. Thus, Model 1 with NDW was better than Model 2 with TNW.

Table 11. Multiple regression models with event content as a response variable.

Independent variables	B	SE	β	*t*	*p*	95% CI B	VIF
Model 1							
CU	0.08	0.07	0.10	1.07	0.29	[-0.07, 0.23]	3.39
NDW	0.09	0.02	0.43	4.55	< 0.001	[0.05, 0.13]	3.83
Model 2							
TNW	0.05	0.01	0.47	8.54	< 0.001	[0.04, 0.06]	1.21

CU = number of C-units, TNW = total number of word tokens, NDW = number of different word tokens

5.2 Narratives in SLI (Study II)

5.2.1 Linguistic measures in SLI

Descriptive statistics of narrative linguistic measures are presented in Table 12. Children with SLI performed significantly less well than typically developing children on NDW: ($t(36) = -4.26$, $p < 0.001$, $d = 1.38$); MLCU: ($t(36) = -4.25$, $p < .001$, $d = 1.38$); CD: ($t(36) = -2.77$, $p = .009$, $d = 0.90$) and on grammatical accuracy: ($t(36) = -4.75$, $p < .001$, $d = 1.58$). Children with SLI produced, on average, fewer C-units than typically developing children, but this difference was not statistically significant ($t(36) = -1.51$, $p = .14$, $d = 0.49$).

An examination of children's narratives revealed that there was a tendency for the children with SLI to omit third person subjects, and therefore grammatical accuracy was analysed more carefully. Grammatical errors were categorised further into word order errors, inflection errors and omissions of third person

subjects. Children with SLI made 9 word order errors, 71 omissions of third person subjects and 15 inflection errors, whereas children with typical development made 0, 9 and 2, respectively. According to descriptive data, the omission of third person subjects was clearly used more among children with SLI than those with typical development. For statistical analysis, a two-proportion z-test was used to compare the proportions of children who erroneously omitted the third person pronoun. This was done because errors analysed from C-units were not independent, and because children with typical development produced only a few errors. The omission of the third person subject was made by 84.2% of SLI children (16 children out of 19) and 26.3% of typically developing children (5 children out of 19). The difference between these proportions (95% CI for the difference of the proportions [0.321, 0.836]) indicates that children with SLI produced more errors of this kind ($z = 3.59$, $p < .001$).

Table 12. Descriptive statistics of linguistic measures among children with SLI and typical development (TD).

			Group difference	
Variable	SLI (n = 19)	TD (n = 19)	MD	[95% CI]
CU				
Mean	13.6	15.4	-1.5	[-3.5, 0.5]
SD	2.5	3.5		
NDW				
Mean	34.4	51.4	-17.0	[-25.1. -8.9]
SD	10.1	14.1		
MLCU				
Mean	3.8	5.6	-1.8	[-2.6, -0.9]
SD	1.2	1.3		
CD				
Mean	1.1	1.2	-0.2	[-0.3, -0.5]
SD	0.1	0.2		
Grammatical accuracy (%)				
Mean	63.2	96.3	-33.2	[-47.3, -19.0]
SD	29.8	6.2		

MD = Mean difference between the groups; CI = confidence interval, CU = number of C-units, NDW = number of different word tokens, MLCU = mean length of C-units, CD = clausal density

5.2.2 Pragmatic measures in SLI

Descriptive statistics of narrative pragmatic measures are presented in Table 13. Children with SLI performed significantly less well than typically developing children on referential accuracy ($t(36) = -3.06$, $p = .004$, $d = 0.99$), event content ($t(36) = -4.86$, $p < .001$, $d = 1.62$) and comprehension questions ($t(36) = -5.29$, $p < .001$, $d = 1.72$).

Children with SLI produced only a total of 13 mental state expressions and children with typical development produced 40. Since the use of these expressions was quite rare in both groups, and because the distribution of this variable in SLI group was strongly positively skewed, the proportions of used mental state expressions were calculated. 42.1% of children with SLI (8 children out of 19) used mental state expressions, whereas, respectively, 79.0% of children with typical development (15 children out of 19). The difference between these proportions (95% CI for the difference of the proportions [0.081, 0.656]) indicates that children with typical development produced significantly more mental state expressions ($z = 2.323$, $p = .020$).

Table 13. Descriptive statistics of pragmatic measures among children with SLI and typical development (TD).

			Group difference	
Variable	SLI (n = 19)	TD (n = 19)	MD	[95% CI]
Referential accuracy (%)				
Mean	37.5	61.5	-24.5	[-40.4. -8.6]
SD	22.3	26.3		
Event content				
Mean	11.3	16.6	-5.3	[-7.5, -3.1]
SD	3.3	3.4		
Mental state expressions				
Mean	0.7	2.1	-1.4	[-2.3, -0.5]
SD	0.9	1.6		
Comprehension questions				
Mean	2.3	4.6	-2.3	[-3.2, -1.4]
SD	1.6	1.0		

MD = Mean difference between the groups; CI = confidence interval

5.3 Narratives in ASD (Study III)

5.3.1 Linguistic measures in ASD

Descriptive statistics of performance of children with ASD and their control children are presented in Table 14. Only one measure of linguistic structure, MLCU, statistically differentiated the groups (*t(30)* = -2.05, *p* = .049, *d* = 0.73). The performance in NDW (*t(30)* = -1.16, *p* = .257, *d* = 0.41), C-units (*t(30)* = -1.09, *p* = .284, *d* = 0.39), and CD (*t(30)* = -0.45, *p* = .660, *d* = 0.16) was similar between the groups, even though there was a trend for children with ASD to score less well in these measures.

Table 14. Descriptive statistics of linguistic measures among children with ASD and typical development (TD).

			Group difference	
Variable	ASD (n = 16)	TD (n = 16)	MD	[95% CI]
CU				
Mean	14.5	15.9	-1.4	[-4.0, 1.2]
SD	4.4	2.5		
NDW				
Mean	47.2	53.9	-6.8	[-18,7, 5.2]
SD	19.5	12.8		
MLCU				
Mean	4.8	5.7	-1.0	[-1.9. 0.0]
SD	1.4	1.3		
CD				
Mean	1.2	1.3	0.0	[-0.2, 0.1]
SD	0.2	0.2		

MD = Mean difference between the groups; CI = confidence interval, CU = number of C-units, NDW = number of different word tokens, MLCU = mean length of C-units, CD = clausal density

5.3.2 Pragmatic measures in ASD

Descriptive statistics of narrative pragmatic measures in ASD are presented in Table 15. Children with ASD scored significantly lower than typically developing children in event content (*t(30)* = -2.59, *p* = .015, *d* = 0.91) and comprehension questions (*t(30)* = -3.03, *p* = .007, *d* = 1.07). In referential accuracy (*t(30)* = -1.05, *p* = .301, *d* = 0.37), mental state expressions (*t(30)* = -0.187, *p* = .953, *d* = 0,07),

and in the use of additional information ($t(30) = 0.331$, $p = .743$, $d = 0.12$) the performance of both groups was similar and no statistically significant differences were detected.

Because the use of repetitions, comments or questions, and irrelevant comments were not frequent among participants, these were combined for a composite measure of extraneous information. Since this composite score was highly skewed, a nonparametric Mann Whitney *U*-test was carried out. This test showed that children with ASD gave more extraneous information ($U = 58.5$, $p = .007$).

Table 15. Descriptive statistics of pragmatic measures among children with ASD and typical development (TD).

			Group difference	
Variable	ASD (n = 16)	TD (n = 16)	MD	[95% CI]
Referential accuracy (%)				
Mean	63.6	73.8	-10.2	[-30.1, 9.6]
SD	26.1	28.9		
Event content				
Mean	13.7	17.5	-3.8	[-6.8, -0.8]
SD	4.7	3.5		
Additional information				
Mean	1.3	1.1	-0.2	[-1.0, 1.3]
SD	1.8	1.4		
Extraneous information				
Mean	2.5	1.1	1.7	[0.2, 3.2]
SD	2.5	1.4		
Mental state expressions				
Mean	2.1	2.2	-0.1	[-1.5, 1.2]
SD	1.9	1.8		
Comprehension questions				
Mean	3.7	5.1	-1.4	[-2.3, -0.5]
SD	1.7	0.6		

MD = Mean difference between the groups; CI = confidence interval

6 Discussion

The aim of this study was to investigate how narrative abilities develop in 4- to 8-year-old typically developing children using a picture-based story generation task, and to discover the relationship between narrative productivity measures and event content in typical development. Secondly, the narrative abilities of children with SLI and ASD were assessed using a variety of linguistic- and pragmatic-based measures in order to gain a comprehensive picture of the strengths and weaknesses they might have in a picture-based narration.

6.1 Linguistic aspect to narration

This study shows that the linguistic structure of narratives reflects a subtle development trend in typical development. Moreover, performance of children with SLI was poor in every aspect of linguistic structure studied, whereas children with ASD showed quite intact linguistic structure.

Considering the productivity measures, both TNW and NDW increased with age in typically developing children, which supports previous English-language studies (Justice *et al.* 2006, Westerveld *et al*. 2008). However, statistical differences were only seen between 4-year-olds and the older age-groups. Children with SLI produced stories with fewer different word tokens than their controls, but no similar trend was seen among children with ASD. These findings are in line with previous studies, suggesting that narrative productivity, measured by NDW is scarce in SLI (Fey *et al*. 2004) but not necessarily in ASD (Suh *et al*. 2014), even though opposite results in ASD are also reported (Norbury *et al.* 2013). It should be noted, however, that direct comparisons between studies cannot be made, as different word types instead of tokens are frequently used in studies based on the English language. However, considering the characteristics of Finnish morphology, word tokens were chosen for use in this study.

Productivity measures have been extensively used in narrative studies, but not many researchers have questioned their validity. However, length is not unavoidably a guarantee of good story quality or informative story content, as discussed also, for example, by Berman and Slobin (1994). To study this phenomenon further in narratives of typically developing children, two regression models were conducted, with productivity measures (TNW, NDW, CU) as explanatory variables, and event content as a response variable. These models evidenced that productivity measures show varying associations to event content

and the NDW was found to be a best predictor. This finding is plausible, considering that the more different word forms there are, the more meaning there is also likely to be. In Finnish, semantics are not only expressed by words but also by the inflections of words. Therefore, NDW may capture more about semantics than does TNW, and for this reason NDW might be a measure that reflects both productivity and semantic skills. Also Leadholm and Miller (1992) have discussed the idea that TNW (counted from controlled story length) might reflect general language proficiency, whereas NDW (in word types) is a measure of semantic diversity. If narration is seen as a complex linguistic- and pragmatic-based whole, productivity should be seen in relation to story content. From that point of view, the use of NDW instead of TNW might be recommended. For these reasons, TNW was not used as a narrative variable in studies concerning children with SLI and ASD.

With regard to the number of C-units, its use as a narrative measure should be considered carefully, as it did not prove to be useful in explaining the event content in the regression model, nor did it capture the development after the age of 5 in typically developing children. In addition, there were no statistical differences in the number of C-units between children with SLI or ASD and their typically developing control children. The average similarity of number of C-units in children with SLI (Fey *et al.* 2004, Norbury *et al.* 2013) or ASD (Suh *et al.* 2014, Young *et al.* 2005) and control children is also observed elsewhere. These findings, as well as the lack of developmental trend after age of five, are reasonable if it is considered how C-units are defined as "*an independent clause with its modifiers*" (see Hughes *et al.* 1997: 53). One C-unit may thus consist of only one main clause or even several main clauses with elliptical subjects and subordinate clauses. Therefore, a bare total number of C-units does not probably reflect either productivity or syntactical skills, as it is probably an artefact of a data segmentation. As a child's linguistic skills develop, she/he can start to use more complex syntactical structures. Consequently, this increases the length of one C-unit, but reduces the total number of C-units. In future studies, it is thus recommended that C-units are only used as a tool for reliable data segmenting. The rules for data segmenting using C-units are clear and therefore high interrater reliability scores are gained. Since some narrative measures, such as CD and MLCU, are based on number of C-units, it is crucial that narratives are segmented reliably. For these purposes, the use of C-units is justified.

Narrative complexity as measured by MLCU and CD showed a subtle development trend, as 4-year-olds' narratives were significantly less complex than

those of 7- and 8-year-olds, and 5-year-olds differed significantly from 8-year-olds in MLCU. Differences between consecutive age-groups were not observed. Utterance length has been detected to increase with age in other studies too (Bishop 2004a, Miller 1991, Westerveld *et al.* 2004). Subtle development trends have also been observed in syntactical complexity using different analytical methods (e.g. Justice *et al.* 2006, Schneider *et al*. 2005), but not many studies have used CD as a complexity measure in typically developing preschool children. With older participants, CD has not been showed to be sensitive to development in narrative contexts (Westerveld & Moran 2013), but, however, does show development in conversational discourse (Nippold *et al*. 2005). Children with SLI performed less well than their control children both in CD and MLCU, which supports previous findings that their narratives consist of short utterance length (Duinmeijer *et al.* 2012, Norbury *et al.* 2013) and simple clauses (Colozzo *et al.* 2011, Fey *et al.* 2004). Children with ASD showed poorer skills in comparison to their peers in MLCU as in previous studies (Norbury *et al.* 2013), but not in CD. With control children, the ability to use complex syntax is correspondingly in line with Diehl *et al.* (2006).

In narrative settings, there are many task-related factors that might have affected children's performance on complexity measures that should be taken into account when interpreting the results. First, story generation narratives may not be sensitive enough for assessing syntactic skills. In narratives, coordination in particular is seen, whereas subordination is more commonly observed in written language (Chafé 1982, Kalliokoski 1989). Therefore, it is possible to construct a successful narrative with simple syntactic structures, and these tasks do not necessarily require the use of complex syntax (see also Hesketh 2004, Leinonen *et al*. 2000). Moreover, in narratives the use of *and* as a coordinating conjunctions is typical. Since the segmentation of C-units was based on main clauses, the coordination of main clauses was not actually credited at all unless the subject was not elliptical. This division may have resulted in quite small CD and MLCU values, since the most frequently used strategy was not actually credited at all. However, as mentioned above, the use of C-units is justified for reliable data segmentation. In addition, not all *and*-words can be treated as conjunctions in narrative discourse since *and* or *and then* have an important role also as connectives that do not connect clauses but rather larger discourse units (Hakulinen *et al.* 2005). In story retellings, it is possibly to create a narrative with complex syntactic structures and examine if a child is able to produce these. It is also documented that retellings elicit more complex syntax (Westerveld & Moran

2013). However, specific syntactical formulation tasks are probably more reliable if syntactical skills in particular are to be assessed. Understanding of narrative discourse and its nature is thus important when making conclusions about children's skills.

Grammatical accuracy was measured only in SLI, since difficulty in morphosyntax is a common characteristic of SLI across languages (e.g. Leonard 1998) but may not necessarily belong to ASD (e.g. Leyfer *et al*. 2008). Interestingly, the majority of the grammatical errors children with SLI made were due to the omissions of third person singular subjects. This characteristic was also seen in Finnish children with language impairments in a study by Suvanto (2012). In this study, inflection or syntactic errors were also seen, but surprisingly to a quite small extent. In previous studies that aimed to assess particular grammatical structures with probe tasks, Finnish children with SLI have shown difficulties in the verb (Kunnari *et al.* 2011, Kunnari *et al.* 2014) and noun inflections (Leonard *et al*. 2014). The differences observed between narrative and probe tasks may be task-specific. Children with SLI overall produced very short stories, and these scarce samples may not show all the difficulties they have in morphosyntax. It is also possible that children may have focused only on the action they saw in the picture. This action could be expressed using the third person singular in the present tense, which is the tense these children master best (Kunnari *et al.* 2011).

Considering these restrictions in linguistic measures and the nature of the narrative task in general, the results of linguistic structure are plausible. First, statistically significant differences with consecutive age-groups in typical development were hardly seen. This may be due to a large within group variability in relation to relatively small sample sizes and the multiple comparisons made. However, 4-year-olds were clearly still lacking those linguistic skills that 7- and 8-year-olds had. Moreover, it can be seen from the descriptive data that 5-year-olds and 6-year-olds resemble each other as a group in many respects as well as 7- and 8-year-olds, who outperform the 5- and 6-year-olds. Thus, it seems that there is some development at the time of school entry. Narratives are used as a source of language learning during the preschool and early school years in Finland, which may support the use of more sophisticated language as children encounter complex syntax and diverse vocabulary in various narrative contexts.

The performance of children with SLI was poor overall in linguistic structure. Even though complex syntax or long and diverse sentences are not necessary in order to produce a narrative, children with SLI still showed problems with these

measures. Conversely, children with ASD performed similarly to their peers, even though there was a trend for them to score somewhat lower. The only statistically significant difference was seen in MLCU, which is difficult to explain, as children with ASD did not clearly perform less well in NDW or CD, which measures syntax in a more precise manner. It should also be mentioned that both children with SLI and ASD showed poorer skills in the background assessments made (grammatical closure, linguistic comprehension, word finding, and verbal working memory) in comparison to their age-matched control children. Therefore, it may be justified to suggest that the narrative task can bring out notable linguistic difficulties as in SLI, but the more subtle ones as seen in ASD, may not be captured using a Cat Story narrative task.

6.2 Pragmatic aspect to narration

Referential accuracy increased with age in typically developing children, as documented in previous studies (Gutierez-Clellen & Heinrichs-Ramos 1993, Schneider & Dubé 1997). Significant differences were observed between 4-year-olds and the older age-groups as well as between 5-year-olds and those aged 6, 7, and 8. Children with SLI were clearly less accurate than their peers, as also documented elsewhere (Finestack *et al.* 2006, Pearce *et al.* 2010). Surprisingly, children with ASD showed similar referential accuracy to their control children, even though referential inaccuracy or ambiguity has been shown to be distinctive in other studies (Norbury & Bishop 2003, Norbury *et al.* 2013, Novogrodsky 2013, Suh *et al*. 2014).

Accurate referencing requires the ability to use linguistic devices as well as the ability to understand picture-based context and the listener's needs. Therefore, many simultaneous skills are in play, which makes the task demanding. According to this study, referential accuracy is about to be mastered at the age of seven or eight, which is the age when, on average, 80% accuracy was reached. This may explain why clear differences between children with ASD and typical development were not observed, as participants were aged between five and ten. Therefore, referential accuracy should probably be studied with children who are at least 7 years old, of whom we can already expect quite accurate referencing in a picture-based task. On the other hand, children with ASD may have performed quite well, because pictures may help them to focus on what is relevant. In less structured discourse settings, they might show inaccuracy in referencing (Baltaxe & D'Angiola 1996).

In SLI, referential accuracy was weak overall. One reason for the poor performance was the lack of third person subject pronouns (see also Suvanto 2012). Even though in this study this character was considered to be a grammatical error, it had to be taken into account also in reference use, as the subject pronoun also carries the meaning, which makes it pragmatically relevant. Omission of these pronouns inevitable confuses the listener and distorts referential accuracy.

Task-specific reasons may have affected all the children's performance in reference use. First, picture-based tasks are not comparable to real-life situations. Even though children were told that they had to tell the story very carefully to the naïve listener (the puppet Herra Hakkarainen with closed eyes), some children may not have understood the situation or it might have felt artificial. The use of an ambiguous pronoun *se* (it) is clear from the child's perspective, as she/he saw the pictures, but not from the listener's perspective. To understand this, ToM skills are needed. As Nelson (1996) has discussed, anaphoric pronoun use may be distorted in picture narratives, since children rely on pictures. Secondly, as many different domains must be simultaneously handled, a great deal of processing capacity is needed. It is possible that the cohesion cannot be maintained if a child focuses, for example, on the story content. When story content is mastered, there is more capacity to focus on cohesion as well, which may be secondary in relation to content (see discussion also in Hudson & Shapiro 1991, Johnston 2008). In typically developing children, this may be the case, since the more content there was, the more accurate was the reference use. Thus, referential accuracy and event content showed at least a somewhat parallel development trend.

Turning to the story content, the informativeness increased with age in typical development, which supports previous findings (Bishop 2004a, Kit-Sum To *et al*. 2010, Schneider *et al*. 2006). Significant age-related differences were observed between 4-year-olds and the older age-groups as well as between 5-year-olds and those aged 7 and 8, and between 6- and 8-year-olds as well. Mastering of event content was demanding for children with SLI, as documented elsewhere (Duinmeijer *et al.* 2012, Norbury *et al.* 2013). In this study, children with ASD also scored lower than their peers, which is in line with some previous studies (Rumpf *et al.* 2012, Suh *et al.* 2014), but in contrast to Norbury *et al*. (2013) and Losh and Gordon (2014).

Norbury and Bishop (2003) did not find any differences between children with SLI and their controls in event content, nor between children with ASD and their peers. Authors criticize this, saying that it is relatively easy to perform in the

event content measure (similar to the one used in this study), since scores can be gained by describing the pictures. Theoretically this may be true, since information units do not capture the hierarchical organization of the story as a genre as do story grammars. However, story grammars reflect the model of a well-formed story (Nicolopoulou 2008, Stein & Glenn 1979) and not all story grammar units are needed for the story to be recognized as a story (Stein & Policastro 1984). Moreover, not all stories reflect the goal-directedness and use a story grammar structure (see Cohn 2013). In this study, the purpose was not to assess how children with different ages and language abilities can express the story as a genre, but to assess the amount of information they produce while narrating a picture-based task. Even though it was possible to gain some information units just by describing the pictures, younger typically developing children could not do this as efficiently as did older children, nor could the children with SLI or ASD when compared to their controls. However, in typical development, the only difference between consecutive age-groups was seen between the ages of 4 and 5, which may be a time of rapid development. Differences were not observed between 7- and 8-year-olds, which may suggest that the event content analysis may be most suitable for younger children. Considering the children with SLI and ASD, the small number of information units may reflect the difficulty of creating the mental model of the story by themselves, since story-generation is not based on a given model. Interestingly, children with ASD did not, on average, produce shorter stories, but their stories still lack information. Thus, in ASD, a similar amount was narrated as their peers, but what was said seemed not to be fully relevant.

In this study, the use of additional or extraneous information was only assessed in ASD, since this feature has been observed in previous literature (see Tager-Flusberg *et al.* 2005). There were no differences in the use of relevant additional information between children with ASD and those with typical development. Instead, children with ASD included more extraneous information, such as irrelevant details, comments or questions, than did their peers. Similar findings are documented in other studies too (Norbury *et al.* 2013, Suh *et al.* 2014), even though opposite results also exist (Losh & Capps 2003, Norbury & Bishop 2003). Hale and Tager-Flusberg (2005) suggest that the analysis of discourse features in ASD would give diagnostic information, since the use of non-contingent speech in a spontaneous speech sample was associated with the diagnostic assessment of autism symptomology. In this study, distinctive discourse features were also seen in narrative settings. However, it should be

mentioned that not all children in the ASD group produced extraneous information, which suggests heterogeneity in terms of discourse skills.

The use of mental state expressions and narrative comprehension was analysed only in Studies II and III, since the detailed examination of pragmatic-based narrative abilities in SLI and ASD was one of the purposes of this study. Results show that children with SLI produced fewer mental state expressions than did their peers, but no similar trend was seen among children with ASD. Previous literature has shown that children with SLI may not necessarily produce fewer mental state expressions than control children (Norbury & Bishop 2003, Reilly *et al.* 2004), but results similar to this study have also been detected (Norbury *et al*. 2013). The relationship between syntactical skills and mind-reading has been observed (e.g. Miller 2001, Tager-Flusberg 2000), and in narratives mental state expressions are often expressed with a sentential complement. In this study, children with SLI produced syntactically simpler C-units, but not all mental state expressions require complex syntax. For example, expressions of desire as well as emotions can easily be expressed with simple and common clauses, such as with a transitive (*The boy wants a balloon*) or copula clauses (*Boy is sad*). Therefore it seems unlikely that syntactical limitations alone would have caused the difficulties seen in mental state expressions. It is true that language provides the tools for representing mental events (see Astington & Baird 2005, Johnston *et al*. 2001), and therefore a child needs to have language competence and vocabulary to do that. Since participating children have specific *language* impairment, it is possible that they might lack some lexical skills. They also had somewhat poorer word finding skills compared to their peers, which might have an effect on mental state expressions as well as for expressing the event content. Processing deficits may also be in play, as children might have focused on the pictorial action rather than inferring the mental states that cause or underlie the actions.

Considering the children with ASD, the results of mental state expressions are somewhat surprising, since difficulties in mind-reading is one of the most identifiable characteristics of ASD (see Baron-Cohen *et al.* 2005). However, other researchers have also observed that in narrative settings this area may not be problematic for children with ASD (Norbury & Bishop 2003, Norbury *et al.* 2013, Suh *et al*. 2014). On the other hand, for example, Rumpf *et al*. (2012) found differences in mental state language between children with and without ASD. On the basis of the findings of this study, it is not fully correct to claim that children with ASD would show intact mind-reading skills. It should be bore in mind that the task did not require advanced ToM skills, which are more problematical than

first order ToM tasks for high-functioning children with ASD (see Baron-Cohen 2000, Brent *et al*. 2004). It should also be noted that not even the typically developing control children (in both Studies II and III) expressed a variety of mental states, which supports the findings of Ukrainetz *et al.* (2003). Actually, studies from typically developing children have documented that it may not be until 7 (Eaton *et al.* 1999) or 9 years of age (Bamberg & Damrad-Frye 1991) that children increasingly express these terms in narrative tasks. Moreover, Eaton *et al.* (1999) found that even 5-year-old typically developing children were capable of producing more mental states with specific prompt questions when compared to spontaneous narration, suggesting some task-specific factors. Shiro (2003) found that, among typically developing children, the most frequently used type of evaluative language was perception that refers to things which are sensible, such as seeing. In this study these terms were not chosen for inclusion in the analysis, since these are easily visible from the picture and may thus not reflect the understanding of mental processes of the characters. It is also possible that the Cat Story may not sufficiently elicit mental state language. The study by Rumpf *et al*. (2012) that found differences in mental state expressions used a *Tuesday* storybook that has a very fictive storyline and lots of events in which mental state expression can easily be used. It is also observed that children with ASD understand mental states of goals and desires (Baron-Cohen 1995), which are typical of goal-based stories such as the Cat Story or the commonly utilized wordless picture book *Frog where are you*? used for example by Norbury and Bishop (2003).

Turning to the last narrative measure used in this study, the story comprehension, both children with SLI and ASD showed poorer inferencing skills than did their peers. Inferencing has been documented as being problematic for children with SLI (Dodwell & Bavin 2008, Leinonen *et al.* 2003) and ASD (Loukusa *et al.* 2007, Young *et al.* 2005) in other studies as well. However, in this study comprehension questions were asked after the child's own story generation, and no model of the story was given to the child as has been done in previous studies (e.g. Norbury & Bishop 2002, Ryder *et al.* 2008). Ryder *et al.* (2008) observed that having pictures available may facilitate inferencing and help with memory. In this study, pictures were not available while answering the questions, as they are not in real-life situations either, in which inferencing skills are needed. Thus, this story comprehension task may bring on several demands for both children with SLI and ASD. It should be acknowledged that both of the groups showed somewhat weaker linguistic comprehension and verbal working memory

skills in the background language testing compared to their typically developing peers. Linguistic comprehension and memory skills are needed in a story comprehension task like the one used in this study. Interestingly, Norbury and Bishop (2002) detected that, in story comprehension, it is not the memory abilities alone but the ability to build a mental model of the story that was likely to facilitate story comprehension. Lepola and colleagues (2009) studied typically developing 4-year-olds' narratives and found a strong correlation between the factors of story content and story comprehension. As both the children with SLI and ASD showed some difficulties in the event content, it is possible that they also struggled with constructing an informative enough story content which might consequently have led to difficulties in story comprehension and inferencing. However, having only 6 questions may not give a comprehensive picture of these children's narrative comprehension skills, which should be bore in mind when interpreting these results.

6.3 Limitations

6.3.1 Methodology

There are some limitations concerning the methodology that need to be brought into the discussion. The stories children told were quite short, also in typical development. Traditionally, it is recommended that language sample analysis should be based on a minimum of 50 utterances (Miller 1996). In this study, none of the children produced stories that long, as measured by C-units. The scarcity of C-units is also reported elsewhere (e.g. Heilmann *et al*. 2008, Justice *et al*. 2006) as it is not a unique finding in narrative studies. It is possible that short narratives do not sufficiently capture children's language abilities. However, Heilmann *et al*. (2010) found that language sample measures can be reliable despite the sample length.

There was a relatively large variability in all narrative measures and with all participants, which unavoidably weakens the reliability of this study. The quite small sample sizes in relation to a large within-group variability may not have been sufficient to reveal statistical significance. For example, children with ASD performed less well than their peers in all measures, but these subtle differences did not reach statistical significance. In real-life even subtle difficulties in communicative competence may hinder participation in social situations. A large

variability is, however, quite a common finding in narrative studies (e.g. Justice *et al*. 2006, Muñoz *et al*. 2003, Norbury & Bishop 2003, Pearce *et al*. 2010) since a more spontaneous discourse is inevitable challenging to measure.

Picture-based story-generation tasks are extensively used for research purposes, but this methodology has some restrictions since the context is shared, as both the child and the researcher sees the pictures. In this study, the shared context was necessary with young children, since they still needed help with turning the pages as well as encouragement to complete the task. If the context is shared with the interlocutor, the information status does not need to be stated clearly (Hickmann 2003). To avoid inaccurate storytelling, the naïve listener paradigm was created with the puppet with closed eyes and it was made clear to the children that the puppet cannot see the pictures. This condition may have been somewhat artificial. The use of another person as a naïve listener, perhaps even one familiar to a child, might have been more natural. Considering the data collection, it was not possible to put this into practice. Moreover, understanding that the puppet cannot see the pictures requires first order ToM skills, which should have been developed at the age of 4 or 5 (Wellman *et al.* 2001). For the youngest children participating, this skill may still have been developing, but for most of the children understanding of the task should have not been too difficult.

The Cat Story is a new story-generation task created for the purposes of this dissertation. More studies of its psychometric properties are clearly still needed. Thus, the results of this study are suggestive, since direct comparisons with other studies with similar method cannot be made and as narrative elicitation methods do inevitably have an effect on the results (see Shiro 2003). Well-studied narrative assessment methods from English-speaking cultures exist (see for example Bishop 2004a, Gillam & Pearson 2004, Schneider *et al*. 2005), but methods from different cultures were not chosen for use in this study, even though these assessment methods were carefully explored when creating the Cat Story. Instead, the purpose was to create a story-generation task suitable for Finnish culture and for young children, as it is important to detect early narrative difficulties in order that efficient language intervention can start as early as possible.

6.3.2 Participants

Some remarks on the participants and their recruitment need consideration. The typically developing children were recruited from day nurseries and schools, and teachers delivered the information letters to the parents of every child in a given

class or a day nursery group who fulfilled the recruiting criteria. Even though not studied in detail, the response rate was not very high. Because participation was on a voluntary basis, some selection might have occurred. Almost half of the parents of typically developing children were upper-level employees, and parents with higher education may be more willing to participate. The typically developing children's early language development was verified according to the parental questionnaire, and current language skills were assessed by TTFC-2 and TWF-2. It is true that using only two language tests does not give a comprehensive picture of children's language performance. In addition, in TTFC-2, normative data was not available. In Finland, there are only few standardized language tests available in speech language therapists' usage for the participating age-groups. TTFC-2 and TWF-2 were chosen to give at least some picture of the children's receptive and expressive language skills, and these tests could be performed with all participants ranging from 4 to 10 years of age. However, as none of the typically developing participants was receiving regular speech therapy, the children's parents did not find anything worrying about their child's development and nor did the teachers, and, according to the language tests performed, it is plausible to assume that the sample represents the normal variation of typically developing children.

The children with SLI and ASD comprise a clinical sample, since they were recruited to this study as they were visiting the university hospital. Therefore, only those children who attended the clinics at the time of the data collection could be reached. The population of Northern Finland is small and, consequently, a large number of children with diagnoses of SLI or ASD did not visit the university hospital at the time of data collection. For these reasons, the sample sizes remained rather small.

Even though psychologist's IQ testing was carried out for the children with SLI and ASD, this was not conducted for typically developing control children for practical reasons, as speech language pathologists are not allowed to perform IQ testing. The lack of IQ values from control children is one limitation of the study. IQ or language-matched control groups would have strengthened the conclusions and also allowed the investigations of possible causes that might underlie narrative difficulties. In addition, the educational background of the children's parents was not taken into account in the analyses, which might have had some effect on the results, especially concerning the comparison of children with SLI and typical development, since the parents of typically developing children clearly had a higher level of education. In future studies, the parents' educational

background should be controlled for, as it is shown that higher SES background (socio-economic status) may support language development (e.g. Harrison & McLeod 2010, Rowe & Goldin-Meadow 2009). However, the purpose of this study was not to investigate the possible reasons underlying the narrative difficulties of the clinical groups. Therefore, comparison with the typical developing children from various backgrounds is justified, as this is the peer group with whom these children with SLI or ASD participate in everyday social situations in day nurseries and schools.

Finally, the ASD group was somewhat older than the group of children with SLI. As a heterogeneous disorder, children with ASD had some language difficulties according to the assessments carried out in this study. Slightly younger children with ASD with more homogenous linguistic skills would have allowed the direct comparisons to be made between children with SLI and ASD.

6.4 Clinical implications

Story generation is an easy and convenient method for assessing children's language skills in a semi-structured situation that requires the use of connected speech going beyond the sentence level. Therefore, its use as a clinical tool for assessing children's communication skills should be included in language assessment batteries more often. To date in Finland, no well-studied narrative assessment methods exist.

This study evidenced development in narrative skills among 4- to 8-year-old Finnish children. Understanding of typical development is a prerequisite for detecting delayed or even deviant development. However, the large variability seen in narrative measures in the typical population will unavoidably challenge the use of normative values in narrative assessment using the Cat Story. However, it seems that the Cat Story can capture the early development well, and may, therefore, be suitable for children under school age (in Finland 7 years). The Cat Story seemed to be sensitive for detecting the difficulties showed by children with SLI and ASD while narrating, and the findings of this dissertation are in line with previous research (e.g. Duinmeijer *et al.* 2012, Norbury *et al.* 2013, Suh *et al.* 2014). An interesting characteristic was observed in SLI, since these children tended to erroneously drop out the overt subject. This was not seen to that extent in typically developing children, and may therefore work as an important diagnostic marker for SLI.

Analysis of narratives may reveal important starting points considering the language intervention and improving the communication skills. For example, it is a very favourable task to practice extended language use, such as complex sentence constructions. In addition, stories and narratives provide an excellent opportunity to talk about mental states of the characters and support child's comprehension of causal and temporal relations as well as the motives and intentions that lie behind the actions and provoke the reactions of characters. These are all important in everyday life, and children with SLI and ASD may find these skills problematical. Interestingly, Mar *et al.* (2006) found that the exposure to fictive narrative rather than non-fictive expository literature in particular seems to be connected with social ability. As Johnston (2008: 98) has summarized, narrative intervention includes multiple benefits, since "*we can explore processing limitations, create opportunities for using decontextualized language, facilitate social relationships, provide practice in constructive listening, improve reading comprehension, and identify language learning strengths and weaknesses*".

However, in general care should be taken when assessing children's narrative skills and when making conclusions from assessments. Clinicians should remember that narrative production is highly dependent on the stimulus material used (see further e.g. Westerveld & Moran 2013). Picture-based narratives are static, which may support the use of descriptive rather than narrative discourse (Hickmann 2003). If the pictures are presented in a clear temporal order, the child may not necessarily have any reason to use a variety of complex sentence structures. Moreover, for example the use of mental state language is elicited only in those stories, where there are the possibilities to use that kind of language sufficiently. In addition, a clear picture series may facilitate the ability to focus on what is relevant, and children with ASD, for example, may find less-structured discourse settings more difficult (see King *et al.* 2013, Losh & Capps 2003, Losh & Gordon 2014). Therefore, narrative analysis should take into account other discourse settings and situations as well. It is also important to bear in mind that the underlying demands in elicitation methods (i.e. story generations and retellings) differ. Therefore, it would be important also to assess retelling skills, since this method gives a picture of linguistically primed tasks (Schneider 1996) and can give important information about a child's skills, which can be useful considering the intervention. Analysis of narratives from natural situations would give us more reliable information, but in clinical settings this is often too time-consuming and complicated to perform. Clinicians should not forget to interview

the child's parents in order to find out whether similar patterns seen in picture-based narratives are also evident in a child's everyday life in natural settings. Importantly, the child's own motivation to tell a story should not be forgotten. In a testing situation a child may not find a story worth telling, at least if the context is shared with an investigator. A high motivation for telling may probably lead to a different kind of narration.

6.5 Future research

Despite the criticism expressed earlier, narratives deserve to be studied further. In the future, children's performance in a narrative retelling task will bring out important information about the possible benefit of the given story schema and how this might show up in children with different ages, language abilities and diagnoses. Also, the comparison between the Cat Story and other narrative tasks would strengthen the validity of the Cat Story. In addition, the development of mental state expressions and discourse traits in typical development should be studied, since to my best knowledge this area is still unexplored in Finnish. In addition, the discourse features in SLI and grammaticality in ASD would merit future research with larger participant groups, as there has been a debate for years concerning the overlap of these disorders (e.g. Bishop 2001).

One remarkably important research area would be the comparison of storytelling skills of Finnish-speaking and, for example, English-speaking children. Some cultural and language-specific variation is likely to occur, and this information would be crucial if some tests of narrative language are to be adapted to Finnish.

Narrative abilities have been associated with literacy and academic skills in many research projects (e.g. Botting *et al.* 2001, Reese *et al.* 2010, Stothard *et al.* 1998, Westerveld *et al*. 2008), but careful investigation into which narrative characters are associated with reading skills is still needed. In Finnish, the predictive value of narratives for later learning ability has not yet been investigated. Typically developing Finnish children acquire accurate reading skills quite easily during the first year at school (Holopainen *et al*. 2001), and it has been shown that reading acquisition, in general, is faster in languages with transparent orthographies, such as Finnish, than in English (see Aro 2006). Because of the differences in orthographies, the results from English-language studies cannot be straightforwardly generalized into Finnish. Therefore, research

is needed concerning the association of Finnish children's narrative language and later reading skills.

Especially the thorough investigation of narratives of children with SLI and ASD with carefully language- and IQ-matched control children would be of interest in order to explore what might be the basis of narrative difficulties seen in these children's communication. Previous research has suggested that linguistic skills are of importance, since non-verbal cognitive skills (Pearce *et al*. 2010) or pragmatic skills (Norbury & Bishop 2003) have not been shown to make such a contribution to narration. Colozzo *et al*. (2011) suggest that limitations in processing capacity may lead to difficulties seen in the narratives of English-speaking school-aged children with SLI. In their study, two subgroups were found. The first showed poor story content with few grammatical errors, whereas the second showed narrative profile of strong content with low grammaticality. In this dissertation, no similar profile was seen, since Finnish children with SLI showed difficulties both in story content and in grammaticality, even though the grammatical difficulties seen were mostly due to the erroneous use of third person subjects. Since Finnish and English are typologically very different, the replication of Colozzo and colleagues' study among Finnish children with SLI would be interesting.

The weak central coherence (WCC) theory suggests that the processing towards global may be biased in ASD (Happé & Frith 2006). There is some support that individuals with ASD provide more local than global information while narrating (e.g. Barnes & Baron-Cohen 2012), which might be due to WCC. However, there is not much research carried out on this topic, which would merit further study. In addition, an exploration of the associations between narratives and social cognition (i.e. ToM, emotion recognition) would be interesting, since, as a multidimensional task, narratives have been associated with these skills (Fernandez 2013, Losh & Capps 2003, Loth *et al*. 2008). The relationship of language and cognition is complicated overall, and the interface between pragmatic and linguistic skills in a narrative context should be investigated further.

6.6 Conclusions

This study presents new data concerning Finnish children's narratives, which can be summarised as follows:

Study I

- Narrative productivity, syntactic complexity, referential cohesion and event content show age-related differences in typically developing 4- to 8-year-old Finnish children's picture-elicited narratives.
- Significant differences in consecutive age-groups were observed between:
  - 4- and 5-year-olds in productivity measures (number of C-units, number of different word tokens) and in event content.
  - 5- and 6-year-olds in referential accuracy.
- The Cat Story narrative task may be best suited for children under school age (i.e. 7 years), which seems to be a time of rapid development.
- There was a strong correlation between narrative productivity measures and event content in typically developing children.
- According to multiple regression analysis, the number of C-units was not useful in explaining the event content, whereas the number of different word tokens, instead of total number of word tokens, had the best model of fit.

Study II

- Children with SLI showed problems in every aspect of narratives studied (i.e. productivity, syntactic complexity, grammatical accuracy, referential accuracy, event content, mental state expressions and story comprehension).
- The only measure that did not differentiate children with SLI from their typically developing peers was the number of C-units.
- Children with SLI tended to drop the explicit subject, which was not seen to that extent in typically developing children.
- Not only linguistic measures were fragile in SLI, but these children's narrative assessment, and intervention should also focus on pragmatic-based measures as well.

Study III

- Children with ASD showed difficulties in pragmatic-based aspects of narration (i.e. event content, comprehension and the use of extraneous information).

- The use of mental state language and referential accuracy did not differentiate children with ASD from those with typical development. However, there might be some task-specific factors that should be acknowledged.
- The linguistic structure of their narratives was quite intact, even though their stories had a somewhat lower mean length of C-units.
- Assessment of narratives can bring out difficulties in children with ASD exhibit as regards their discourse skills.

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Appendices

Appendix 1

Sample narratives and coding examples.

6;9-year-old boy with typical development

yhtenä päivänä kissaäiti osti pojalleen ilmapallon
one day a cat mom bought a balloon to her son
poika lähti juoksemaan ilmapallon kanssa
the boy started to run with a balloon
mutta sitten hän kaatui
but then he fell down
ja ilmapallo lähti karkuun
and the balloon flew away
ja ilmapallo oli lentänyt puuhun joten poika oli surullinen
and balloon had flown to the tree so the boy was sad
poika yritti ottaa ilmapalloa puusta
the boy tried to get the balloon from the tree
mutta hän ei saanut sitä
but he couldn't get it
ja sitten hänen äitinsä pani käsilaukun maahan ja meni sen päälle seisomaan
and then his mom put her bag on the ground and went standing on it
mutta hänkään ei saanut sitä
but she couldn't get it either
sitten poika meni sanomaan myyjälle että hänen ilmapallonsa lensi puuhun
then boy went and said to a balloon seller that his balloon flew into the tree
myyjä pani ilmapallot kiinni ja otti tikapuut
the balloon seller tied the balloons and took a ladder
sitten myyjä kiipesi tikapuita ylös
then the balloon seller climbed up the ladder
ja sitten hän otti ilmapallon
and then he took the balloon
mutta heti kun hän oli saanut sen käteensä ilmapallo poksahti
but as soon as he had got the balloon into his hands the balloon popped

sitten poika oli surullinen
then the boy was sad
mutta myyjä antoi pojalle toisen ilmapallon
but the balloon seller gave another balloon to the boy

Number of C-units = 16; number of different word tokens = 59; mean length of communication units in words = 6.38; clausal density = 1.31; referential accuracy (%) = 97.14; grammatical accuracy (%) = 100; event content score = 19; mental state expressions = 2.

6;5-year-old boy with SLI

inimapannoja
balloons
te juokkee
it runs
kaatuu
fells down
ikkee
cries
inimapanno on puutta
balloon is in a tree
te kentoo
it tells
te kävelee
it walks
te hakkee
it gets
te pokkatti
it popped
te anto uus
it gave a new

Number of C-units = 11; number of different word tokens = 14; mean length of communication units in words = 1.91; clausal density = 0.91; referential accuracy (%) = 11.11; grammatical accuracy (%) = 72.73; event content score = 7; mental state expressions = 0.

6;3-year-old boy with ASD

hänelle annettiin ilmapallo
a balloon was given to him
mää en jaksa ennää kertoa [excluded from the linguistic analyses]
I don't feel like telling any more
hän juotsee puuhun
he runs to the tree
ja sitten puun oksaan se ilmapallo lenti
and then to the branch of the tree the balloon flew
se lähti käestä ja puun oksalle lenti
it left from the hand and flew on the branch of the tree
kissalla tuli itku
a cat cried
yritti ottaa kissa ilmapallo
tried the cat take the balloon
mutta se ei saanu sitä
but he couldn't get it
ja kissaäiti hyppäsi laukun kans
and a cat mom jumped with a bag
mutta ei se saanu sitä
but she coulnd't get it
kissaiskälle tuli paha mieli
a cat dad was on a bad mood
se haki tikapuut ja sitte otti
it picked up a ladder and then took
mutta se kissan pallo poksahti
but the cat's balloon popped
se meni resuksi
it went ragged
ja sitte se sai uuven ilmapallon
and then it got a new balloon

Number of C-units = 14; number of different word tokens = 43; mean length of communication units in words = 4.71; clausal density = 1.14; referential accuracy (%) = 90.48; event content score = 12; mental state expressions = 1; additional information = 1; extraneous information = 3.

Appendix 2

Table 16. Scoring of event content.

Each mentioned event is scored for 1 point; maximum total score 29.
Mother cat
Balloon seller
Park
Boy wants or gets a balloon
Boy runs or plays with a balloon
Boy is happy
Boy trips up
Stone (in relation to tripping)
Balloon flies away
Balloon gets stuck in the tree
Boys is sad or cries/ or mention of hurting a knee
Mum comforts
Boy tries to reach the balloon
Boy can't get the balloon
Mum tries to reach the balloon
Mum stands on a bag
Mum can't get the balloon
Boy goes to seller
Boy asks for help/ or says what happened
Seller helps/ or comes with a boy
Seller has a ladder
Seller climbs the tree
Seller tries to reach the balloon
Balloon pops
Boy is sad or cries
Mum is sad
Seller is sad or sorry
Seller gives a new balloon
Boy is happy

Note. The boy is not credited because it is given to the child before narrating.

Appendix 3

Table 17. Comprehension questions and examples of correct and incorrect answers

Question	Correct answer	Incorrect answer	
		Example from SLI	Example from ASD
1. Why did the balloon get away?	The boy fell down.	The boy let the balloon go.	It floated in the air.
2. Why did the mum comfort the boy? (Understanding of emotion was required)	The boy was sad.	The boy cried.	Because the balloon was in the tree.
3. Why did the mum and the boy not get the balloon out of the tree?	They were too short.	The balloon was up.	The balloon went pop.
4. Why did the boy go to the balloon seller?	The boy asked for help.	The boy said that the balloon is in the tree.	So that he could tell him.
5. Why could the seller help mum and the boy?	The seller had a ladder.	The seller is big.	He had nothing else to do.
6. Why was the boy happy at the end of the story?	The boy got a new balloon.	Because this was the end.	He got the big.

Original publications

I Mäkinen L, Loukusa S, Nieminen L, Leinonen E & Kunnari S (2014) The development of narrative productivity, syntactic complexity, referential cohesion, and event content in four- to eight-year-old Finnish children. First Language 34(1): 24–42.

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