The verbalization of emotions in children

with a language impairment

- an exploratory study -

Master thesis

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Abstract

The present study discusses the difficulties that children with a language impairment can have with the verbal expression of their emotions as this is often observed but has never been examined. A literature review will give important background on the characteristics of children with Specific Language Impairment (SLI) and on research within the field of emotions, in particular concerning the verbalization of emotions. The exploratory research that follows will bring these two topics together. Two groups of children with a language disorder were studied, differing with respect to whether they could verbalize their emotions. The two groups were compared on many variables, including, most importantly, language profile, social contact and the suspicion of an Autism Spectrum Disorder (ASD). The results showed that the group with children that had difficulties with the verbalization of emotions was more pragmatically impaired and had poorer social contact compared to the group with children that did not have difficulties with the verbalization of emotions. Moreover, many children that had problems with the verbal expression of their emotions showed features that led professionals working with the children to suspect ASD. These results led to the prediction that children with SLI that have difficulties with the verbalization of their emotions will have a broad range of problems, including social-emotional and behavioural difficulties. Implications for the relation between SLI and ASD are discussed as well as suggestions for future research.

1. Introduction

Robert was a quiet but healthy and sweet child in the first years of his life. He could sit in his playpen for hours in silence. When taken for a walk, Robert would walk along without giving a single reaction to the environment around him. He seemed very solitary-minded and would shut himself off from the outside world. At the age of 3 years and 5 months, he could only say 'daddy' and 'mommy'.

Marjolein was often sick as a child. She had a bad cough and eating was difficult. Despite health problems, her motor and cognitive development seemed normal. However, when Marjolein was 2 years old, her mother started to notice difficulties with language, both in production and comprehension. Instead of using language, Marjolein often tried to express herself by screaming loudly. Not knowing what she meant, this would leave her parents helpless. It was only in primary school that her second grade teacher acknowledged the trouble that the child was having with understanding others around her and being understood.

Aniek showed a normal development as a baby and was easy to handle. As she did not talk much, her parents thought that she was just a 'late-talker'. However, her vocabulary grew very slowly and her speech was unintelligible to everyone but her mother. It appeared that her locomotion was also delayed. Although Aniek could manage everything very well on her own, it became clear in primary school that more research was necessary.

(Paraphrased and translated from Welle Donker-Gimbrère et al., 2001)

Robert, Marjolein and Aniek have a language disorder and are just three examples of the large and heterogeneous population of children whose language is impaired in one way or another. As is apparent in the short descriptions above, it can be hard to recognize a language impairment and it is even harder to diagnose it. Questions such as 'Is the child just late with speaking?' and 'Is the child just quiet in character?' surface and make it complicated to act upon the doubts that parents might have concerning the language development of their child. It is, however, essential that diagnosing and treating children with language problems is done at a young age. A so-called Critical Period for learning a language is often posited. This

hypothesis suggests that acquiring a language is a natural achievement but becomes more difficult as a person gets older (originally: Lenneberg, 1967; Guasti, 2004). An explanation for this lies in the cognitive neurosciences: the neuroplasticity of the brain declines with age and, although the process of brain change and adaptation goes on a lifetime, 'the earliest phases of maturation – during fetal development and childhood – are perhaps the most dramatic and important' (Toga, Thompson & Sowell, 2006, p. 148). Children as Robert, Aniek and Marjolein are, therefore, best treated at a relatively young age. With help from professionals, such children with a language impairment can 'recover' to some extent. Without this help, functioning in daily life would have been much more difficult because communication is such a vital part of life.

Another vital part of human life, and an important aspect of communication, is emotional expression. It is intrinsically human to have the need to share and express emotions. When someone witnesses an emotional event such as an accident or a sports victory, that person will have the urge to share that emotional experience. Language is a major medium for doing this, together with facial expressions, gestures, pitch and intonation (Fussell, 2002). Children start to express their emotions at a very young age, initially sharing it with their parents and later with peers in school (Niemeier & Dirven, 1997). An interesting, but under-researched, question is how children with a language disorder develop this human trait of emotional expression and what effect a language impairment has on this trait. This issue lies at the basis of the present research.

This thesis will focus on children such as Robert, Marjolein and Aniek. Specifically, it will evolve around children with a language disorder and the problems these children often have with openly talking about their emotions. The mother of Marjolein explained this problem with verbalizing emotions clearly: "By talking in telegraphese, you can tell far less than when you can just express yourself freely. When she [Marjolein] said: 'I think scared', it was obvious what she meant. Nevertheless, I would have been able to shelter her so much better if she could also explain what she was afraid of" (translated from Welle Donker-Gimbrère et al., 2001; 36). This quote illustrates the importance of being able to express emotions to others in the near environment. As emotional expression plays such a critical function in social life, this thesis will look into this particular side of a language disorder. Through an exploratory study, two groups of children with a language impairment will be studied. In addition to their language impairment, one group is known to have problems with expressing their emotions

through language and the other group is not known to have issues with this. It will be assessed whether patterns in, e.g., language, behaviour and cognition, can be found that distinguish these two groups. For example, the children who have difficulties with the verbalization of emotions might specifically have problems with the social use of language. Moreover, it could be hypothesized that children who have difficulties with emotional expression will have more issues with social relations, including, for instance, playing with peers. These hypotheses can be made based on earlier research that has looked at, e.g., social and emotional outcomes of children with a language disorder. Without yet making a subdivision between children with a language impairment who do have issues with emotional expression and children who do not, such researches indicate that many children with a language disorder also have social-emotional problems, next to their language difficulties (McCabe & Meller, 2004; Conti-Ramsden & Botting, 2004).

The results of this study can be of value for professionals who treat children for their language disorder. The results may make it easier to recognize children that have difficulties with expressing their emotions verbally. Consequently, treatment specifically targeted at emotion expression difficulties could start earlier in their life. This would mean that the children are better able to absorb the treatment given to them. Besides such practical advantages, this study is also meaningful on a theoretical level because it provides insight in the relation between language acquisition, language impairment and emotional expression on both behavioural and neurological level. For example, literature will be reviewed to see whether there are similarities between involved brain regions for language (impairment) and the verbalization of emotions. Moreover, various characteristics of children with a language disorder will be discussed which suggest that a language impairment is not specific to language and needs to be explained through a broader perspective.

1.1 Structure of the study

There is a long way ahead to fully understand why many children with a language disorder often have problems with emotional expression through language. This study starts to explore this ground. However, before diving into the actual explorative research, some background will be given on what is known about the two aspects that form this study. First, the discussion will touch upon the field of language impairment. The most common characteristics of SLI will be addressed and several models that try to account for these characteristics are discussed. Moreover, neurological data on SLI as well as issues of

comorbidity will be covered. Secondly, research in the field of emotions will be reviewed. After a general introduction to the broad field of emotions, this section will focus on the verbalization of emotions. The neural substrates and the development of emotional expression through language will be discussed, as well as a personality trait, called alexithymia, which can be described as 'no words for feelings'.

2. Language disorders

Language disorders can be distinguished in different ways. The International Classification of Functioning, Disabilities and Handicaps (ICF), describes seven types of language disorders (Goorhuis & Schaerlaekens, 2000). The first, and for this study the most important, is the developmental language disorder which is a disorder that surfaces in early childhood and can affect all domains of language. Other language disorders that are distinguished are: aphasia (language impairment through brain damage), reading and writing disorders, articulation disorders, nasality and disorders in the fluency and rhythm of speech, such as stuttering. For this study, the focus is on primary developmental language disorders, of which Specific Language Impairment (SLI) is the most extensively studied.

2.1 SLI and ESM

Children diagnosed with SLI generally show significant limitations in their language skills despite generally normal non-verbal intelligence. Factors that normally accompany language learning problems, such as a hearing impairment or neurological damage, are absent in these children (Leonard, 2000). The SLI population is heterogeneous. In practice, this makes the criteria used for identifying children with SLI complex. Usually, a low score on several language tests needs to be obtained, for example, 1.25-1.5 standard deviations below the mean, and children with a nonverbal IQ below 80-85 are excluded, as are children with autism. Thus, diagnosing a child with SLI often entails the task of excluding other possible disorders (Hulme & Snowling, 2009).

The Dutch term 'ernstige spraak- en/of taaloeilijkheden' (ESM, translated as severe speech and/or language difficulties) can be seen as the Dutch equivalent of SLI. Many children that would have been diagnosed with SLI in Great Britain or the United States of America, are diagnosed with ESM in the Netherlands. Although SLI and ESM are both definitions for a similar language disorder, they are not the same and, as some say, they are not interchangeable (e.g. Kouwenberg, van Weerdenburg & Slofstra-Bremer, 2007).

Kouwenberg et al. (2007) state that children with ESM, just like children with SLI, have a severe communicative disorder as a primary impairment. However, the difference between the two is that SLI should be seen as a primary *language* disorder, whereas ESM is a primary *speech and/or language* disorder. Still, the boundary between speech and language remains vague due to both the great variety of symptoms that children with SLI or ESM show as well as the observation that children with SLI also cope with speech difficulties (Shriberg, Tomblin & McSweeny, 1999). Therefore, in the next section, literature about SLI will be reviewed, assuming that this review also accounts for children with ESM.

2.1.1 SLI: a language deficit?

Many theoretical models have tried to explain SLI. Two main classes of hypotheses can be distinguished. The first one argues that SLI is an impairment that is specific to the domain of language, in particular to the domain of grammar, whilst the second class views SLI as a limitation in processing capacity. According to the first view, children with SLI have a deficit in 'the mental capacity that underlies the rule-governed combination of words into complex structures' (Ullman & Pierpont, 2005, p. 399). Within this broad perspective, several hypotheses have been posited that have tried to explain the linguistic characteristics of children with SLI (examples are: Rice, Wexler & Cleave, 1995; Clahsen, 1989; Rice & Oetting, 1993; Ullman & Gopnik, 1994). The focus of such hypotheses has especially been on the atypical morphosyntactic development of children with SLI.

The problem with the class of hypotheses that view SLI as a purely grammatical deficit is that none of those hypotheses can account for all linguistic problems of children with SLI. The language difficulties are not restricted to morphosyntax. For example, looking at lexical development, it is clear that children with SLI perform below age peers (Rice, Warren & Betz, 2005). Such a limited lexical system can cause word finding difficulties and substitutions of semantically related words (Lahey & Edwards, 1999; Kail & Leonard, 1986). Besides lexical problems, children with SLI have been observed to have difficulties in the realm of phonology (Leonard, 2000). Generally, children with SLI show phonological characteristics that can be seen in younger children. For example, segments are acquired rather late, final consonants are often deleted and consonant cluster reduction occurs with a relatively high frequency (Leonard, 2000). These are all problems that are difficult to be explained by models that seek the cause of the disorder in grammar.

To account for the broader difficulties with which children with SLI cope, a second class of models has come into existence. This class views SLI as a limitation in processing capacity, either general in nature (Kail, 1994) or specific to particular mechanisms (Gathercole & Baddeley, 1990; Tallal & Piercy, 1973a; Ullman & Pierpont, 2005). Assuming that children with SLI process all information at a reduced rate or have a general limited processing capacity clarifies the difficulties that children with SLI have on cognitive tasks, as phonological discrimination and word retrieval (Leonard, 2000). Nevertheless, due to the generality of such hypotheses, a general limitation in processing would predict to cause several other, non-linguistic, problems to surface in children with SLI, which, in reality, have not been observed. This is illustrated by the example that, in contrast to the predictions of a generalized slowing hypothesis, children with SLI do not seem to differ from typically developing children in the speed of visuospatial attentional orienting (Schul, Stiles, Wulfeck & Townsend, 2004).

The second class of the processing-deficit hypotheses argues that SLI is a limitation in processing in specific mechanisms, which makes this perspective more specific than the general limited processing models and broader than the grammar-deficit views. The Procedural Deficit Hypothesis (further on PDH; Ullman & Pierpont, 2005) is an example of a hypothesis that combines key elements from this processing-deficit perspective with key elements from the grammar-specific accounts. This hypothesis bases it arguments on the results of research on the cognitive neurological findings of children with SLI and is thereby one of the few that connects the cognitive impairments to the subtle neural abnormalities that are observed in children with SLI. A strong model should favourably be compatible with all the known neurological, cognitive and behavioural data available about a phenomenon, such as SLI. The PDH is a model that tries to incorporate all these three levels and will therefore be covered more elaborately. As the PDH is grounded in neurological data of SLI, these data will be shortly reviewed before discussing the model.

2.1.2 SLI: neurological data and the PDH
Part of the research on the biological origin of SLI has looked at brain structures. Any abnormality in brain development in a child with SLI should be of that impact that it can produce the specific pattern of characteristics of that child. Currently, there is no neurobiological model that can completely account for such complex characteristics of SLI. Progress in this field of research has been slowed down due to disagreement on diagnostic and

inclusion criteria. Moreover, research with more comprehensive analyses is needed to accomplish such a model; most neuroscientific research has focused on particular areas in the frontal and temporal regions of the brain as these have been found to be important for language (cited in Snowling & Hayiou-Thomas, 2009). Nowadays, therapy is often empirical whereas it would ideally be more theoretically motivated. A better understanding of the origin of the disorder might allow for more "specifically targeted therapy, avoidance of therapy that is ineffective, an ability to predict associated comorbidity, and a better ability to prognosticate regarding outcome." (Webster & Shevell, 2004, p. 478).

Looking at it superficially, the brain of a child with SLI appears normal. Close inspection with fMRI and EEG, however, has shown abnormalities around the frontal and perisylvian language regions in the cortex, mostly measured at rest. Moreover, the basal ganglia, particularly the caudate nucleus, and cerebellum have been seen to be reduced in size or under- or overactivated in children with SLI (for an overview see Ullman & Pierpont, 2005; Webster & Shevell, 2004). Based on the results of many experimental studies that have looked at neurological aspects of SLI, Ullman & Pierpont (2005) posit the Procedural Deficit Hypothesis (PDH) to attempt to explain the characteristics of SLI. That is, the PDH claims that the problems which children with SLI face are largely a result of abnormalities in the brain structures that are involved in the procedural memory system. The declarative memory system "has been implicated in the learning, representation and use of the knowledge of facts ('semantic knowledge) and events ('episodic knowledge)." (Ullman, 2004, p. 235). The procedural memory system "subserves the learning of new, and the control of established sensori-motor and cognitive 'habits', 'skills' and 'procedures'." (Ullman, 2004, p. 237). Relating these two systems to language, the declarative/procedural model states that brain structures underlying the declarative memory system also subserve the mental lexicon, and thus, lexical knowledge. Brain structures involved in the procedural memory system underlie the mental grammar, and thus, the learning and use of rule-governed computations. The PHD argues that many children with SLI have abnormalities in the brain structures that constitute this procedural memory system. This defect system in children with SLI would explain their limited mental grammar. Although the two memory systems seem to be dissociated, some brain structures underlying the procedural memory system, including the ventro-lateral prefrontal cortex as well as portions of the basal ganglia and the cerebellum, are also important for declarative memory and, thus, for lexical memory. This explains the lexical deficits observed in children with SLI. Furthermore, as evidenced by a review of studies by

Ullman & Pierpont (2005), it appears that several other functions are subserved by the procedural memory system, including motor skills, working memory, mental imagery and temporal processing. The PDH would predict tasks involving these non-linguistic functions to be impaired in children with SLI.

Indeed, behavioural studies support this prediction of the PDH. First, Hill (2001) reviewed 28 studies that looked at motor skills of children with a speech or language impairment. These studies showed that 40 to 90 per cent of the children with SLI had concomitant motor difficulties. More recently, Rechetnikov & Maitra (2009) supported Hill's study with a meta-analysis of 16 studies which included in total 621 children with a language disorder and 446 controls, all aged between two and 21 years. Comparing the two groups, the children with a speech-language impairment performed worse on motor measures than the controls. Secondly, tasks involving working memory, such as non-word repetition and remembering serial orders, are found to be difficult for children with SLI (Montgomery, 2003; Gathercole & Baddeley, 1993). Thirdly, many children with SLI have difficulty processing rapid sequence succession (Leonard, 2000) as is observed in discrimination tasks including language and non-language stimuli. The deficit is not restricted to the auditory domain but has been found in vision and in the somatosensory modality as well (cited in Ullman & Pierpont, 2005). Last, mental imagery seems to be another non-linguistic ability that is impaired in children with SLI (Leonard, 2000). Children with a language disorder have problems with imaginary tasks such as mental rotation (Johnston & Weismer, 1983) and anticipatory representation (Inhelder, 1976). Thus, the fact that the procedural memory system is an important underlying structure for both grammar as well as non-linguistic deficits observed in children with SLI, makes the PDH a promising framework. Nevertheless, this does not mean that the PDH is necessarily the correct explanation for SLI. Work from Kidd & Kirjavainen (2011) is an example of a research that has raised doubts about the PDH as the results of their study about the acquisition of past tense morphology did not match the predictions made by the PDH. Furthermore, the following section will illustrate that children with SLI show other features which have not received much attention in any of the models that have been discussed. The presence of these features might indicate that SLI is even more than a language and/or processing deficit. Possibly, a broader look at the language impairment is required.

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2.1.3. SLI: more than grammar and processing

The non-linguistic difficulties of children with SLI, as discussed above, question how specific to language SLI actually is (Hulme & Snowling, 2009). Although the PDH captures both linguistic and non-linguistic symptoms of children with SLI, no developmental theory about SLI yet sufficiently accounts for a feature that is common in all atypical development: comorbidity. Comorbidity means that "the developmental trajectories for different disorders intersect" (Pennington, Willcutt & Rhee, 2005; 264). Thus, different disorders can co-occur in one individual. Comorbidity is a complicated concept, as it is often difficult to determine whether symptoms co-occur, and are thus comorbid, or whether one symptom is a direct result of another, and thus secondary. Yet, it is important that a developmental theory about a disorder accounts for comorbidity as it can inform about the underlying mechanisms of the disorder. Moreover, ignoring comorbidity can result in incorrectly concluding that a particular symptom belongs to a disorder whereas, in fact, it is part of a second impairment (Pennington et al., 2005). Below, some comorbidity rates of SLI are covered. Furthermore, pragmatic, social-emotional and behavioural problems of children with SLI are discussed. It is still questionable whether these problems are secondary to the limited language of the children or whether they are concurrent.

SLI has high comorbidity rates with several other disorders. First, there is the high comorbidity rate between SLI and reading disorders such as dyslexia (Snowling & Hulme, 2005). Furthermore, the most common psychiatric diagnosis given to children with a language impairment is Attention Deficit Hyperactivity Disorder (ADHD), a disorder characterised by prominent symptoms of inattention and/or hyperactivity (American Psychiatric Association, 1994), of which the comorbidity rate goes up to 46% (Cohen et al., 2000). Longitudinal studies from Beitchman and colleagues (1996; 2001; 2004) followed children with SLI from the ages five to nineteen to look for psychiatric comorbidity rates. This work resulted in high comorbidity rates between SLI and ADHD (Beitchman et al., 1996), anxiety disorders (Beitchman et al., 2001), drug abuse (Beitchman, et al., 2001) and aggressive behaviour (Brownlie et al. 2004). Conti-Ramsden & Botting (2008) found similar results in that higher rates of depression and anxiety symptoms were observed in adolescents with a language impairment. Further, there are indications that SLI and Autism Spectrum Disorders (ASD), pervasive developmental disorders characterised by impairment in communication and social interaction as well as stereotyped behaviour and/or cognitive delay (American Psychiatric Association, 1994), are not totally distinct disorders. Children with SLI show problems that

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are associated with ASD and children with ASD very often have limited language skills (Bishop, 2010; Conti-Ramsden, Simkin & Botting, 2006). Conti-Ramsden et al. (2006) found a prevalence of ASD in youngsters with a history of SLI of 3.9%, which is ten times higher than expected if compared to the general population. Furthermore, a quarter of the youngsters were found to present several behaviours associated with ASD, although they were not diagnosed with full ASD. Given the discussion so far on theoretical models that intend to explain SLI, such high comorbidity rates might come as a surprise. Indeed, some characteristics of children with SLI, which could clarify these high rates, have not received much attention. Below, these characteristics are addressed.

A linguistically related difficulty that children with SLI have concerns language use. Some children with SLI do not use language appropriately in the social environment. This means that these children have difficulties in the field of pragmatics which includes, for example, turn taking, narrative abilities and the use of speech acts (Rice et al., 2005). Some professionals believe pragmatic difficulties to be secondary to grammatical language difficulties. Their view is that, because language is crucial for social interaction, children with SLI are bound to have problems with the social use of language (Brinton & Fujiki, 1993). An opposite view holds that children with pragmatic difficulties should be categorised as having a pervasive developmental disorder. The reason for this argument lies in the fact that a pragmatic deficit is one of the core problems of a person with ASD and is therefore often associated with ASD (Lord & Paul, 1997). Bishop (2000), arguing for an intermediate perspective, states that clinical categories, such as SLI and ASD, can overlap due to the many particular and personal profiles of children with a developmental disorder. This results in a possible group of children that cannot be diagnosed with ASD but does have difficulties extending beyond the area of language structure. This group of children may especially be interesting for the present study as the group at interest consists of children with a language disorder who have difficulties expressing emotions; a difficulty which also extends beyond the area of language structure.

A second non-language specific problem that many children with SLI often have is related to their social-emotional and behavioural development. McCabe & Meller (2004), who investigated the relation between language and social competence, state that "previous research has reported a 50-70% co-morbidity rate between speech, language and communication disorders with emotional and behavioural disorders in children and adolescents across diverse sampling populations" (McCabe & Meller, 2004, p. 313). Their

own study compared typically developing children with children with SLI on measures of social competence, which includes "knowledge of social standards of behavior, social problem-solving, emotion recognition and emotion understanding, and communication and language efficacy" (McCabe & Meller, 2004, p. 313). Seventy-one children participated in the study, aged between 3;10 and 5;7 years. The SLI group showed delayed social competence on many of their measures. Thus, this study supports previous research in that many children with SLI also have social problems besides their language difficulties. Such difficulties can be linked to characteristics of children with ASD, of which core features are limitations in social interaction, communication and emotional competence (cited in Begeer, Koot, Rieffe, Terwogt & Stegge, 2008; Howlin, 2006).

Van Daal (2008) examined the behavioural development of five year old children with ESM in the Netherlands. Results suggested that 40% of these children had severe behavioural problems such as aggressive or unsociable conduct. Conti-Ramsden & Botting (2004) also studied social and behavioural development of children with SLI. A group of 242 children were followed and tested at the age of seven and eleven. Up to 64% of the children scored at or above clinical threshold on Rutter's behavioural questionnaire (Rutter, 1967). Moreover, 36% of the SLI group were at risk for being a target of victimization, compared to 12% of typically developing children. Problems observed were often internalizing by nature, which includes withdrawn behaviour, lack of friendship and minimal social initiation. Externalizing behaviour, such as hyperactivity and aggression, was present to a lesser extent and seemed to decrease with age. A last interesting observation of this study is that pragmatic skills were strongly related to social outcome whereas no association was found between social outcome and overall linguistic skill or nonverbal intelligence. Moreover, children identified as having pragmatic difficulties from early childhood scored most poorly on social and behavioural outcome. According to Conti-Ramsden & Botting (2004), "this may indicate that social and communication difficulties are concurrent, rather than a progression of poor social competence leading to less pragmatic skill with age, due to factors such as limited social interaction" (pp. 158). A study by Ketelaars, Cuperus, Jansonius & Verhoeven (2010) with 1364 typically developing four year old Dutch children also found that pragmatic competence was a good predictor of behavioural problems. Such findings indicate that children with a language disorder that also have pragmatic difficulties are likely to develop social and behavioural problems.

A study that also tackles the question of what the relationship between language and social cognition/competence was conducted by Marton, Abramoff & Rosenzweig (2005). In the literature, there is not one main view about this relationship (Farmer, 2000). For example, Locke (1997) believes that socio-cognitive abilities are the basis for language acquisition and that acquiring language is thus determined by social cognition. Others argue (e.g. Bishop, 1997) that language and social cognition are supported by more basic shared cognitive abilities, such as working memory and processing capacity. Although there is no agreement on what the relationship exactly is, empirical evidence points to a strong relationship between language and social competence (Farmer, 2000). Consequently, limited language abilities must have some effect on social skills. This, in fact, appears to be the case for children with a language impairment, as has been illustrated above.

As social competence and emotional competence are heavily intertwined, it may be concluded that linguistic skills are in some way related to emotional competence as well. That is, "emotions are dynamic processes that create and are created by the relationships with others" (cited in Begeer et al., 2008). Emotions give direction to social interaction whilst, at the same time, the social context gives meaning to the emotion (Brinton, Spackman, Fujiki & Ricks, 2007). Given this two-way relationship between emotional and social competence, the discussed social-emotional problems in children with a language impairment are not surprising. Indeed, a research that has looked at emotional competence in children with SLI is conducted by Spackman, Fujiki & Brinton (2006) and these authors suggest that a group of 43 American children with a language impairment, aged 5-12 years, are less emotionally competent than typically developing peers. Moreover, Fujiki, Brinton & Clarke (2002) showed that children with SLI, aged 6-13 years, have difficulties with emotion regulation, and suggest that these difficulties might be related to the social outcomes of these children. Such studies support the strong relation between social and emotional competence and language. Below, the discussion will continue to address research about emotions, and, in particular, research about the verbalization of emotions as this is of core interest to the present study.

3. Emotions
William James, Charles Darwin and Sigmund Freud, have laid the essential foundations for the understanding of human emotions (Oatley, Keltner & Jenkins, 2006). From quite different backgrounds, these three men have approached the study of emotions in three different ways. As emotions motivate human behaviour, they are now still of interest to various disciplines

and have been studied from diverse angles. Psychologists, philosophers, sociologists, neurologists, paediatricians and even historians have been examining the concept of emotion, looking at it through their own specialization.

The term 'emotion' is one of the fuzziest concepts in almost all sciences which can be partly explained by the fact that it has been a topic of interest to so many disciplines (Sander & Scherer, 2009). A solid and uncontroversial definition is still far from having been formulated. Treating emotion as a multifaceted phenomenon, consisting of different components, is the best solution to define the complicated concept. Four components can be identified: 'behaviour reactions (e.g. approaching), expressive reactions (e.g. smiling), physiological reactions (e.g. heart pounding) and subjective feelings (e.g. feeling amused)' (Desmet, 2003). An instrument that intends to measure emotions, thus usually measures one of these four components. As can be imagined, many instruments measuring such components can be distinguished. There are simple questionnaires with rating scales which measure a person's feeling as well as complicated high-tech devices that measure physiological reactions of the brain. Depending on the research question and the component of emotion at interest, an appropriate instrument can be chosen to measure this component and answer the research question.

For this study, the component of interest is the (verbal) expressive reactions. The following sections in this chapter will give insight into the literature about verbal emotion expression as far as it is is relevant to language and children with a language disorder. By way of introduction, emotional competence and background on the affective system in the brain will be discussed. Thereafter, the chapter will zoom in the verbal expression of emotions.

3.1 Emotional competence

Emotional competence is an umbrella term that refers to three specific components, including emotion knowledge, expression of emotions and regulation of emotions (Denham et al., 2003). First, emotion knowledge refers to the identification of emotional states of the self and of others, as well as the development of a lexicon with words that express such emotional states. Secondly, the expression of emotions is the ability to verbally and nonverbally express these emotional states. And last, emotion regulation manages emotional states in an effective and organized way (Way, Yelsma, van Meter & Black-Pond, 2007). This last mentioned component heavily relies on the first two components of emotional competence as emotion knowledge and emotional expression are resources for regulating emotions. Reading the

definition of emotion knowledge and emotion expression, it is evident that language plays an essential role in emotional competence. Furthermore, the interrelation of emotional and social competence has to be kept in mind: the three components of emotional competence each contribute to success in social life (Denham et al., 2003).

3.2 The affective system in the brain

Affective neuroscience is a field of research that is concerned with how emotions are processed in the human brain. Darwin and James can be seen as the founding fathers of this field, which has grown immensely since the 1970s. The most important findings within the affective neurosciences will be briefly addressed below as this is important to understand the nature of emotions and to better grasp the discussion that will continue in a later section about studies that have explored the neural bases of verbal emotional expressions, which is the core interest of this study.

Emotions are regulated by the affective system in the brain. Humans often rely on this system to make important decisions, such as choosing a life partner. The brain can detect certain emotional stimuli, e.g. someone making a joke (a reward) or a mysterious shadow in the dark (a punisher). In reaction to such stimuli, the affective system produces an emotional state of respectively approach or withdrawal. These emotional states can be further divided in the basic emotions such as happiness (approach) or fear (withdrawal) which can thus be seen as emotional responses (Kropotov, 2009).

Anatomically, the affective system used to be linked to the limbic system (Papez, 1937; MacLean, 1949). The neural structures within this system, located on the inner border of the neocortex, were believed to be involved in the experience, expression and regulation of emotions (Patterson & Schmidt, 2003). Although the limbic system is indeed crucial for human emotions, the structures are by no means sufficient for emotional processing. Nowadays, the idea of one neural circuit that captures emotion is abandoned. Emotion is understood as a multifaceted behaviour including a great diversity of elements that are subserved by many brain structures (Gazzaniga, Ivry & Mangun, 2002). Anatomically, the affective system can better be described as an interconnected composite of cortical and subcortical structures together forming a functional system (Kropotov, 2009). Some of the structures within this functional system might be more or less specialized for emotional processing while other structures serve many different functions. Cortical structures belonging to this system are the orbitofrontal cortex, the cingulate cortex and somato-sensory cortical

areas. Subcortical structures include the amygdala, the hypothalamus and the basal ganglia (Patterson & Schmidt, 2003; Kropotov, 2009; Dalgleish, 2004). Below, the role of the orbitofrontal cortex and the amygdala in the affective system are discussed as these two structures have emerged as brain regions whose primary function is related to emotion (Gazzaniga et al., 2002; LeDoux & Phelps, 2000).

The orbitofrontal cortex is part of the prefrontal cortex and believed to be the regulator of the ability to evaluate and act upon emotional stimuli (Gazzaniga et al., 2002). Rolls has extensively examined the orbitofrontal cortex and found that neurons in this area respond to the affective value of a stimulus. For example, taste neurons in the orbitofrontal cortex are only activated by tasting something sweet if this sweet taste is rewarding at that time. Such neurons are different from the neurons that react upon the identity and intensity of the sweetness in the mouth. Thus, according to Rolls, the ability to rapidly evaluate the rewarding properties of a stimulus and thereafter assess the utility of a subsequent action relies on the orbitofrontal cortex (Rolls & Grabenhorst, 2008).

A subcortical structure which is believed to interact with orbitofrontal cortex is the amygdala, located in the medial temporal lobe next to the hippocampus. The amygdala is believed to be involved in several emotional tasks such as the processing of social signals of emotion (e.g. facial expression) (Dalgleish, 2004). Research has shown that many neurons in the amygdala respond to unpleasant stimuli whereas few respond to pleasant ones (Kropotov, 2009). In light of these findings, many studies have focused on the significant role of the amygdala in fear processing, and in particular fear conditioning (LeDoux, 2007). Although fear is the emotion that is most well-studied, the amygdala plays an important, though slightly more limited, role in the processing of other (positive) emotions as well (Gazzaniga et al., 2002).

3.3 The verbalization of emotional expression

Humans use a wide range of nonverbal and paralinguistic means to express and share their emotions. Examples are facial expressions, gestures and tone of voice. These means, however, are not sufficient to fully and precisely communicate emotional experiences. Fussell (2002) gives an example of the limitation of nonverbal expressions:

"By seeing that someone is crying, for instance, we might assume that they are sad; by the extent of sobbing, we might even be able to infer the intensity of sadness. But the tears in and of themselves provide no information about the particular experience of sadness (e.g. 'I have no money' vs. 'I'm lonely') or the circumstances that lead up to feeling sad (e.g. 'I lost my job' vs. 'My dog just died')." (p. 2)

It is exactly this precision of providing information that verbal communication of emotions can see to. Moreover, verbal communication can enable a person of talking about emotions that are not experienced at the time of discourse.

The importance of language in sharing and expressing emotions is reflected in research that has been conducted on emotional expression and mental or physical health. Through a variety of methods, Rimé (2009) provides evidence for the argument that both positive and negative emotional experiences elicit a process of social sharing of these experiences through verbalization, and thus language. The question remains why this social sharing would be beneficial for a person and why the urge to socially share emotional experiences exists. Rimé, Herbette & Corsini (2002) tackle this question and have examined the illusory and real benefits of talking about, mostly negative, emotional experiences, both in daily life and in therapy. First, the common assumption that verbalizing an emotional experience can bring emotional relief is not supported by these authors. Many studies have examined this in several ways and have not found concluding evidence that this is the case (for a review, see Rimé, 2009; Rime et al., 2002). Nevertheless, talking about emotions has not been found to be useless. Several beneficial effects have been uncovered (Rimé, 2009; Rimé et al., 2002). To begin, research subjects reported more benefits when talking about an emotional event in a research session compared to a non-emotional event. Such benefits included feeling better after the session, understanding themselves better and finding the session more meaningful. Secondly, sharing an emotional experience decreases physical distance between the speaker and listener and can contribute to maintaining and improving interpersonal relations. Thirdly, recollecting an emotional memory can contribute to processing and constructing this memory. It puts in place what has happened which can enhance a person's sense of control. Fourthly, the sharing of an emotion has an effect on the collective memory as well. 'Secondary' and 'tertiary' sharing make the community surrounding the person that has experienced the emotional event aware of what has happened. Last, verbalizing an emotional experience has been found to improve a person's physical

health. Putting stress-related events into words reduces physiological work and can therefore be beneficial to health.

The points that have been discussed above indicate the importance of the verbalization of emotional experiences and explains the urge of humans to socially share this information. Without language, this sharing would have been much more complex. Misunderstanding would be more common. Now, it is easier to comprehend the reasoning of Marjolein's mother when she said the following: "When she [Marjolein] said: 'I think scared', it was obvious what she meant. Nevertheless, I would have been able to shelter her so much better if she could also explain what she was afraid of" (translated from Welle Donker-Gimbrère et al., 2001; 36). For children such as Marjolein, the social sharing of emotional experiences has been limited due to their impairment and this may have consequences for the child's social life. Given the social-emotional and behavioural problems of children with a language impairment, the limited possibility for social sharing of emotions might possibly be causally related to such problems. It would be interesting to further investigate this hypothesis.

3.3.1 Neural substrates of the verbalization of emotions
The most general and well-known brain mechanisms of emotional processing have already been discussed and will put the following section in a broader perspective. In this section, the studies that have looked at the neural substrates of emotion communication, and in particular the verbalization of emotions, will be reviewed. In the understudied field of emotion communication, most studies have focused on the recognition and comprehension of emotion communication, and in particular on facial expressions. An important finding of these studies has been that the perception of emotion communication mainly seems to rely on the right brain hemisphere. This applies to both the perception of emotional prosody, meaning the expression of emotions through variations of different parameters such as pitch, intensity and duration of the voice, and linguistic prosody in general. Furthermore, facial expressions as well as the identification and comprehension of the presence of emotion words, such as 'happy' and 'sad', are observed to be processed in the right hemisphere (Beaucousin et al., 2007).

The few studies that have examined the neural correlates of the production of emotion words, and thus the "lexical channel of emotional communication" (Borod et al., 1996: 351), also find right hemisphere dominance (Lieberman et al., 2007; Hariri, Bookheimer & Mazziotta, 2000; Borod et al., 1996; Borod, 1993). Borod (et al. 1996; 1993) looked into

research on brain damaged native speakers of English around the age of 60 and their ability to lexically express their emotions. Although most linguistic functions are subserved by the left hemisphere, it appears that some emotional words, for example curses, can be spared in aphasic patients with a left hemisphere lesion. Moreover, this research shows that patients with a right hemisphere lesion perform worse on lexical emotional expression tasks. These tasks include producing monologues about positive and negative emotional experiences and non-emotional experiences. The emotional intensity of the monologues was rated on a 6-point Likert scale by objective judges. The monologues were written out so that the judges would only rate emotional content and prosodic cues would be avoided. As expected, patients with a left hemisphere lesion performed worse on the non-emotional condition whereas patients with right hemisphere damage were more impaired in the emotional rather than the non-emotional condition. This finding suggests that the right hemisphere plays a special role in the verbal expression of emotional content.

Lieberman et al. (2007) and Hariri et al. (2000) used fMRI to examine the neural substrates of affect labelling (or simply said, putting feelings into words). Through emotionally evocative images, healthy volunteers were asked to categorize the image by choosing between two options. In the affect-label condition (the linguistic processing of the emotion), these two options are two emotion words: angry and afraid. In the affect-match condition (the non-linguistic and perceptual processing of the emotion), the options are two faces each expressing a different emotion: fright and anger. In the study of Lieberman et al. (2007), gender-label and gender-match conditions were added to the experiment to serve as controls. These conditions would enable the researchers to see whether activity in the brain was really related to affect labelling or just labelling in general. The results of these studies showed three interesting points. First, affect labelling, in contrast to affect matching, dampened activity in the amygdala and other limbic regions in response to negative emotional stimuli. This means that linguistic processing of an emotion produces less activity in the amygdala compared to perceptual processing of the same emotion. Secondly, affect labelling increased brain activity in the right ventrolateral prefrontal cortex (located next to the orbitofrontal cortex) whereas increased activity in this region was not observed for the affect-match condition. Moreover, this region was the only region in the brain that was more active during affect labelling compared to gender labelling, and, thus, labelling in general. Thirdly, the right ventrolateral prefrontal cortex and the medial prefrontal cortex were the only two regions for which the brain activity during affect labelling, compared to gender labelling, was

inversely correlated with activity in the amygdala. The medial prefrontal cortex was found to statistically mediate the relationship between activity in the right ventrolateral prefrontal cortex and the amygdala, which basically means that a change in the right ventrolateral prefrontal cortex produces a change in activity in the amygdala by way of an intermediate connection through the medial prefrontal cortex. Due to this observation, the authors suggest that there might be a pathway in the brain that regulates or manages negative emotions. That is, activity in the right ventrolateral prefrontal cortex during affect labelling produces change in the medial prefrontal cortex, which, on its turn, disrupts the response of the amygdala to negative emotional stimuli. In this sense, the amygdala is functionally inhibited by affect labelling because the normal reaction of the amygdala to negative emotions is controlled. This is an important finding as it suggests a neurological ground for why putting feelings into words might actually contribute to better mental and physical health (Lieberman et al. 2007).

These results can indeed be linked to behavioural research that has provided evidence for the benefits of socially sharing emotional experiences. When human beings verbally share their emotions, a pathway in the brain is activated that helps to regulate these emotions. If part of this partway is not well-developed or damaged, the regulation of emotions might be disrupted. Relating these findings to children with a language impairment, it is possible that, sometime, this pathway does not develop properly in children with SLI. Such a defect would produce the problems that these children have with the verbal expression of emotions. Given the knowledge that the prefrontal cortex is crucial for both language and the procedural memory system and given the prefrontal brain abnormalities that have been found in children with SLI, it would be possible that such verbalization problems are in some way connected to a defect in the prefrontal cortex. However, for now, it is too early to conclude anything about this suggested connection or about the direction of any cause or effect. More research is needed to further understand the relation between the prefrontal cortex, SLI and the verbalization of emotions. More specifically, research could look into the remarkable finding that, while the left ventrolateral part of the prefrontal cortex (Broca's area) has been implicated in language processing and the procedural memory system, its right counterpart, the right ventrolateral prefrontal cortex, is thought to be important for the verbalization of emotions.

3.3.2 Development of emotional expression in children

Now that the behavioural and biological level of emotional expression have been discussed, it is necessary to look at the development of the verbalization of emotional expression in typically developing children. This will give insight into the question whether a child with SLI deviates from this development or not.

Most research concerning the development of emotional expression in children indicates that children can express themselves emotionally from a very early age onwards. Young infants of three months have the ability to show universal facial expressions that are associated with basic emotions as anger, fear and joy (Zeman, Cassano, Perry-Parrish & Stegall, 2006). However, the emotions of babies are almost totally physical, primitive and undifferentiated. As greater differentiation of emotions arises, verbalization and more complexity develop (Thunissen, 2007). Longitudinal studies have indicated that almost as soon as children start to talk, they report on their own feelings, feelings of others and project feelings onto toys and other objects (Lewis, Haviland-Jones & Feldman Barrett, 2010). Kauschke & Klann-Delius (1997) even mention that the first verbal expressions for internal states can be identified during the 'vocabulary spurt', when the lexicon rapidly expands. This takes place somewhere between 1;3 and 2;0 years of age. Although it is argued that these verbal expressions are just lexical substitutes for facial expressions or vocal exclamations, Lewis et al. (2010) found that half of the references to emotion of 2-5 year old children were related to feelings experienced in the past or feelings that they might experience in the future. Next to this, children maintain dialogues about the causes and consequences of their emotions around the time that they go to school. At this time they use a variety of words to express their feelings instead of just single representations for separate emotions (Way et al., 2007).

The observation that children have acquired emotion words at a young age would predict that children also already share their emotions with others. Research indeed supports this prediction and it was found that children between 6 and 12 socially share their emotions in the same way as adults. A single difference was that the sharing target of the child was frequently the parents (Rimé, 2009; Rimé et al., 2002). No single research has yet compared the social sharing of emotional experience of typically developing children with children with a language disorder. Nevertheless, in the next section, difficulties with emotional expression will be connected to children with a language impairment.

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3.3.3 A deficit in emotional expression: alexithymia

Alexithymia is a personality construct that has also been described as 'no words for feelings'. It comprises five components: "(1) a reduction or incapacity to experience emotions; (2) a reduction or incapacity to verbalize emotions; (3) a reduction or incapacity to fantasize; (4) an absence of tendencies to think about one's emotions; and (5) difficulty in identifying emotions" (Larsen, Brand, Bermond & Hijman, 2003; 533). One of the five components of the construct is a difficulty in verbally expressing emotions. Therefore, it is interesting to see whether relationships or similarities between alexithymia and children with language problems can be identified.

Studies that have examined the prevalence of alexithymia in the general population have found percentages between the 5% and 10% (Joukamaa et al., 2007; Mason, Tyson, Jones & Potts, 2005). A standardized scale, a questionnaire called the Toronto Alexithymia Scale, is used to measure this prevalence. The scale defines if a person scores high or low on alexithymia. The construct can thus be thought of as existing on a continuum (Way et al., 2007). Alexithymia can be a result of a traumatic life experience which has restricted the emotional expression or a brain lesion. However, the trait can also be present from birth. Neurobiological studies have not yet found a conclusive origin of the trait. Some studies have suggested a defective interaction between the left hemisphere and the right hemisphere in persons with alexithymia. Other studies find damage to the frontal lobe, in particular to the orbitofrontal cortex and the anterior cingulate cortex in persons scoring high on alexithymia. Moreover, patients with lesions in these regions, show alexithymic characteristics. Although it is interesting to see that the prefrontal cortex might also play a role in alexithymia, a link between this brain area and the personality construct is premature (for a review: Larsen et al., 2003). Research will need to examine this link further. If support is found, the hypothesis that the prefrontal cortex is important for the verbalization of emotions would be strengthened. Support for this hypothesis would, in its turn, bring the research world a step closer to unravelling the relation between SLI, the prefrontal cortex and the verbalization of emotions.

Most research about alexithymia has been done in the adult population. Nevertheless, Thunissen (2007) explains that children who show alexithymic characteristics have less differentiated emotions. In emotional stress situations, these children fall back on a physical reaction (a less differentiated level) whereas normally developing children would react more verbally (a more differentiated level). Thunissen (2007) relates this to the emotional circuits in the brain. Primitive, undifferentiated, emotional reactions rely on the lower parts of the

limbic system: the amygdala. For more complex emotional reactions, such as verbalization, the prefrontal cortex, a brain region which is late to mature in humans, is involved.

Studies that have looked at children with a high score on alexithymia have revealed that the difficulties with the awareness and expression of emotions are associated with problems with interpersonal relationships. High comorbidity rates have been found for alexithymia and ASD. Results of several studies indicate that more than 50% of persons with ASD showed severe degrees of alexithymia (e.g. Bird et al. 2010; Hill, Berthoz & Frith, 2004). Fitzgerald & Bellgrove (2006) even stress the great overlap that exists between Asperger's syndrome and alexithymia. Furthermore, association has been found between alexithymic characteristics and behaviour problems, such as aggression (Way et al., 2007). Although no studies have been found on the relation between a language impairment and alexithymia, the problems that are observed in both disorders are similar. As Way et al. (2007) argue, "development of emotional language and expression of emotions are closely related to pragmatic language skills" (p. 132). An interesting prediction would therefore be that children with SLI who have problems with emotional expression are likely to have poor pragmatic language skills as well. As a consequence, these difficulties could negatively impact social relations and behaviour. This is a hypothesis that will be looked at further in this study.

As indicated, in the literature little is known about the extent to which children with a language impairment also have alexithymia, or the extent to which persons with alexithymia have normal language skills. Very little research has been devoted to the language abilities of persons with alexithymia. Some remarks could be found that described the language of persons with alexithymia as being unsubtle and repetitive as well as lacking affect (Taylor, Bagby & Parker, 1997; Krystal, 1998). Furthermore, some children with a language disorder have shown some characteristics that are associated with alexithymia (Way et al., 2007). A few other studies have looked at children with SLI and emotional competence or emotion regulation without making a direct link to alexithymia. The studies by Fujiki, Brinton & Clarke (2002) and Spackman, Fujiki & Brinton (2006), which have already been briefly discussed, suggest that children with SLI have poor emotional regulation skills and emotional competence respectively. The study of Spackman, Fujiki & Brinton (2006) even observed poor emotional competence despite the attempt to minimize language and memory demands of the task. All scenarios were supported by pictures to give visual cues and the children did not have to give an answer verbally but could point to a card that illustrated a particular

emotion. Furthermore, this study also showed that children with a language impairment lacked sophistication in talking about their emotional experience, "even within the limits of their language formulation abilities" (pp. 186). In sum, these studies indicate that, taking their language problems into account, children with a language impairment seem to be less emotionally competent, having difficulties with emotion regulation and the (verbal) expression of their emotional experiences. As the emotional competence of a child contributes to their social competence (Denham et al., 2003), these difficulties might be one of the explanations for the social problems that children with SLI have. This following study will further elaborate on these findings and aims to give more insight into the problems that children with a language impairment have with emotional expression.

3.4 Research questions
This exploratory study will compare children with a language disorder that have problems with the verbalization of their emotions and children with a language disorder that do not have difficulties with this. The main question that this study aims to answer is whether these two groups differ in terms of language and cognitive ability, developmental and behavioural patterns as well as their social contact with peers. Through this question, the study should give insight into whether the verbalization of emotions can be related to a larger area of impairment, such as pragmatics. Moreover, results will clarify to what extent the two groups show similarities with children with ASD.

4. The study

4.1 Methods
The data that will be used for this study are not obtained through an experimental design but are retrieved from files of clients that (have) receive(d) care from Koninklijke Kentalis (translated: Royal Dutch Kentalis. Further on called Kentalis). Kentalis is an institution which offers help for people for whom hearing or communicating is not self-evident. The target group of Kentalis is thus broad, consisting of the deaf population (or deaf-blind) and people with severe communication problems. Besides these main problems, this target group can have other impairments such as cognitive retardation, motor problems, behavioural problems and psychological problems. Due to the broad nature of the target group, the employees that work for Kentalis come from very different backgrounds. A multidisciplinary approach is

needed to help clients in the most optimal way, considering the fact that the situation often goes beyond the field of communication. Therefore the team of Kentalis includes play therapists, behavioural therapists, neuropsychologists, linguists, speech therapists, youth coaches and parental guidance.

The information in the files from Kentalis which have been used in this study, can include reports from speech therapists, play therapists and parental coaches as well as information from (neuro)psychological research. Other examples of data sources are hospitals, audiological centres, physiotherapists and youth facilities. Combined, such information provides a complete view of a child's profile, its development and any factors affecting this development. This dataset enables us to compare children on many different levels which is a prerequisite for answering the research questions. Moreover, the findings of this exploratory approach can be used to reproduce a more precise description of the problem and determine how a future, more elaborate study, can be best set up.

4.1.1 Participants

Two groups of children were studied, both containing children that were diagnosed with a language disorder (SLI). There is no group with typically developing children. Elaborate experimental research would have been necessary to collect the same type of information for typically developing children as was already present in the files of the children that receive(d) care at Kentalis. This was beyond the scope of this study.

Data collection and file analysis were conducted for children whose characteristics fit the criteria set prior to analysis (see Table 1). As can be seen, the selection of children has resulted in two groups of children that differ with respect to the most important skill for this study: the ability to verbalize their emotions. Reports of speech therapists and play therapists in the files of Kentalis contain information on whether a child can adequately express his or her emotions verbally and non-verbally. When this information was not conclusive, the therapists were personally contacted to check whether the child files could be used for the study. In the case of contradictory information, the child was excluded.

For the sake of simplicity, group 1 is called SLI_VB because this is the group that has SLI and has difficulty with the verbalization of their emotions. Group 2, called SLI_noVB, has also been diagnosed with SLI but does not have difficulty verbalizing their emotions.

	Group 1 (SLI_VB)	Group 2 (SLI_noVB)
Inclusion criteria	*Between 6-14 years old *Diagnosed with ESM *IQ > 80 *Difficulty with the verbalization of emotions	*Between 6-14 years old *Diagnosed with ESM *IQ > 80 *No difficulty with the verbalization of emotions
Exclusion criteria	*Diagnosed with ASD *Hearing Impaired *Trauma experience	*Diagnosed with ASD *Hearing Impaired *Trauma experience

Table 1: Inclusion and exclusion criteria

Below, all criteria will be shortly discussed to justify why these criteria were applied. First, for the present study, children need to be older than 6 years when receiving care from Kentalis. This age was chosen because previous research has indicated that typically developing children are able to produce and recognize all basic emotion words around the age of five or six (Rigdeway, Waters & Kuczaj, 1985). At the age of six, children would normally be able to express their (basic) emotions verbally. In order to avoid a very large age range between the participants, subjects could not be older than 14 years old.

Secondly, this study used data of children who were already diagnosed with ESM. Taking into account the definitions of ESM and SLI, the other inclusion and exclusion criteria might seem superfluous as children that are diagnosed with such a language disorder by definition do not have problems that can be accounted for by mental retardation, ASD or impaired hearing. Nevertheless, during the participant selection, it came to light that ESM can be diagnosed in children who would most likely not have been diagnosed with SLI. Therefore, additional inclusion and exclusion criteria were created to make sure that the children that would be selected to participate in this study would satisfy the criteria for SLI as well and would therefore not be different than children participating in other studies on SLI. Thus, if a child with an IQ lower than 80 was diagnosed with ESM, the child was excluded. Moreover, children could not be diagnosed with an autism spectrum disorder (ASD) which includes Classic Autism, PDD-NOS and Asperger. Children who have such a disorder also face communication problems but these problems do not occur in the context of otherwise

normal development, which is the case with SLI. Next, children should be able to hear normally. Kentalis also offers care for children with an impaired hearing which can cause language problems. Such children were also excluded from this research. Finally, children suspected to have emotional problems due to a traumatic experience, for example abuse or a history of being severely bullied, were also excluded from this study. Traumatic experiences can cause children to numb all emotions, hereby dissociating themselves from the painful experience (American Psychiatric Association, 1994). This often results in problems with the verbalizing of emotions as well. As this type of problem with the verbalization of emotion has an external cause, it is not the type of problem that this study targets.

To assess whether children were suitable for this research, 12 employees of Kentalis, including play therapists, care coordinators, speech therapists and linguists, were contacted and were given the list of inclusion and exclusion criteria. They were all familiar with the children and were able to assess whether a child fitted the profile of either group. This resulted in a list of 43 names of which 31 were possibly suitable for the group SLI_VB and 12 for the group SLI_noVB. The files of these children were carefully explored by the researcher to see whether they could be used for the study. When in doubt, the researcher would consult specialists who were working closely with the child to obtain additional information. In four cases, files of children were excluded because no report from a speech therapists was included in the file. This is essential information for this research. The reason to exclude two other files was contradictory information in files, making it impossible to place the child in either group. An example of this is that a speech therapist had reported a child has difficulty expressing his or her emotions verbally while a play therapists had reported the opposite. Three other children were excluded because of severe hearing problems. One file was excluded due to the fact that the child experienced a traumatic event and another file was excluded because the child was too old. This procedure eventually resulted in a list of 32 candidates; 25 were suitable for the group SLI_VB and seven for the group SLI_noVB. For these candidates, letters of permission were written to parents, caregivers or guardians. This letter can be found in Appendix A. From these 32 permission-request letters, 21 were returned with approval; 16 were suitable for the group SLI_VB and five for the group SLI_noVB. From these, one was answered with a phone call. The other 20 were answered by mail. From the remaining 11 letters, one letter was received with a refusal. Ten out of the 32 letters were not returned to the experimenter.

During this selection process, it became apparent that the group SLI_noVB was smaller than the group SLI_VB. This problem was anticipated because the children who receive extra care from Kentalis usually experience additional problems on top of the language difficulties, such as the inability to verbalize their emotions. Therefore, only few children fit the profile of the group SLI_noVB. To increase the participation pool, two further steps were taken. First, a special educational needs school with which Kentalis has close contact, named *Het Rotsoord*, was approached. It was expected to find children with an SLI_noVB profile at this school as such children usually attend a special educational needs school but do not require any further care. However, due to the exploratory nature of the present study, the school declined participation. Secondly, closed files from Kentalis were explored from the years 2003 up to 2010. This led to the inclusion of five more children who fitted the profile. Parents or caregivers of these children were contacted for their permission and four answered positively. Although the size of the group SLI_noVB is still restricted, the size (9) does allow a first comparison between the two groups.

Participant number	Group SLI_VB		
	Gender	Age	IQ
12	F	7-9	86
8	F	8	105
10	M	8-9	99/84[1]
4	M	9	101
2	M	9	81
1	F	9	83
14	M	9	84/109[1]
3	M	10	90
6	M	10	96
15	M	10	99
16	M	10-12	112
7	F	11-12	89
5	M	12	91
11	F	12-14	86
9	M	12-14	95
13	F	13-14	80

Participant number	Group SLI_noVB		
	Gender	Age	IQ
4	F	8-12	105
3	F	9	82
9	F	9	86
1	F	10	110
8	M	10	128
2	M	11	83
6	M	11-12	99
7	F	12-13	80
5	M	14	90

Table 2: Participant information, sorted by age during treatment

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[1] Two IQ scores are depicted for participant number 10 and 14 as the scores diverged to a great extent depending on time of measurement or type of IQ test

4.1.2 Data analysis

All information that possibly relevant for the study was copied to an excel file. This was basically all information that pertained to the child. Other content, such as letters about setting a date for a consultation or administrative/financial data were not used for this study. In total, 34 categories were distinguished, varying from simple raw data such as the level of IQ to more subjective contents about, for example, the social contacts of the child. As all files from Kentalis have essentially the same format, most information was available for all children. Nevertheless, the information in reports from speech therapists and play therapists differs to some extent from child to child. This is the reason why not all categories could be filled in for all children.

To allow analysis of this substantial data sheet, the 34 categories were converted into 55 indicators that could be answered with 'yes' or 'no' (after an example of Nag & Snowling, 2010). To clarify, in some cases, a 'yes' just means an affirmative answer (e.g. in the case of 'has many social contacts'). In other cases, it means that a certain skill is present and was observed in the child (e.g. in the case of 'greets'). The conversion of categories into indicators resulted in a more organized file that allows between and within-group comparison. Almost all 34 categories were converted into one or more indicator(s). Four categories were not converted into an indicator because they did not seem to be relevant to the study, after all. An example of such a category gives information on whether or not the child has problems with eating. No pattern could be found between or within the groups and, therefore, this category was not converted into a 'yes/no' indicator. Some categories could be simply converted into one indicator. For example, the gender of a child is either male or female. Another example is the motor development of the child. This development can either be delayed/distorted or normal.

Other categories were more complicated and sometimes had to be converted into more indicators. The category about the naming of emotion words, for example, contained important information for the study. Looking at the excel file, three abilities could be distinguished that concerned the naming of emotion words. In consensus with a play therapist, these three abilities were converted into three indicators, i.e. 1) Can name basic emotions with the help of pictures 2) Can name basic emotions without the help of pictures 3) Can name emotion words and apply them to themselves. Secondly, the categories about expressive and receptive language were converted into indicators, such that it would give a good view of the language profile of the child. For the indicators that were measured with speech therapy tests

(i.e., word/sentence formation, active/passive vocabulary, sentence comprehension and phonological discrimination), the answer 'yes' or 'no' depended on the scores of the participant on that particular test. Scores with a standard deviation below 1 were regarded as under average and in such a case, the indicator would be answered with 'no'. Thirdly, the category that provides insight into whether a child shows features that are related to an autism spectrum disorder (ASD), requires some explanation. If a child shows one or two such features, this would not be abnormal as this is true for most people. The difficulty is to select those children that are remarkable in this respect. Therefore, a child now only scores 'yes' on this indicator if specialists (e.g. a play therapist or a medical pedagogue) clearly suspect a child of possibly having ASD. For some children, this was actually already investigated. For other children, there was just an explicit suspicion but no plan to investigate it yet. What should be clear, though, is that none of the children were actually diagnosed with ASD.

When the information sheet in the excel file did not give a decisive answer on whether an indicator should be filled in with 'yes' or 'no' (or a skill being absent or present), the researcher went back to the original file or contacted a specialist to find conclusive information. In some cases, the information was simply not known which meant that this particular indicator could not be filled in for that particular child. Appendix B presents the complete data sheet with the 55 indicators.

4.2 Results

Below, the results of this exploratory study will be presented. First, the differences between groups will be described, followed by within-group observations. The calculations of the percentages that are presented in this section can be found in Appendix C. Two types of calculations are made: an item analysis and a subject analysis. The differences between the results of the two types of analyses were found to be minimal in almost all cases and, for that reason, only the subject analysis is presented. To compare the subject analysis and the item analysis, Appendix C can be consulted.

4.2.1 Between-group differences

The most interesting finding of this study concerns the pragmatic abilities of the children in the two groups. Table 3 and 4 show the pragmatic skills of the groups SLI_VB and SLI_noVB respectively. The tables show five different communicative functions and seven conversation skills. These indicators for pragmatic abilities are chosen because information

about these functions and skills were usually present in the files of the participants. Obviously, there is more to pragmatics than these 12 indicators. Nevertheless, they give a first view of how the pragmatic abilities of the participants have developed. It was expected that both groups would perform under average compared to typically developing children as children with a language impairment are known to have difficulties with the field of pragmatics, next to their grammatical language problems (Bishop, 2000). This can, in fact, be observed in the table. Typically developing children from the ages seven to fourteen are able to use the selected communicative functions (the intentions with which a speaker uses language in interaction) and conversation skills (abilities to take into account the interlocutor and the situation) in daily communication (Embrechts, 2004). For all children with SLI in both groups, however, at least one pragmatic skill is absent which points to the fact that this is difficult for them.

Many more pragmatic skills are present in the group SLI_noVB in comparison with the group SLI_VB. As can be seen, expressing feelings verbally is also a communicative function which is included in the tables. This indicator is excluded from the following calculations because the ability to express emotions verbally determined in which group a participant was placed. Thus, the score on this indicator is by definition different between the groups and the same for all participants within the groups. Summing the remaining four communicative functions and the seven conversation skills together (blanks not included), 84% of the skills are absent for the group SLI_VB whereas for the group SLI_noVB only 29% of the skills are not used. The difference between the groups is biggest for the communicative functions for which the group SLI_VB have 76% absent skills compared to 5% for the group SLI_noVB. Looking at the conversation skills, it can be observed that these are more complex than the communicative functions for both groups. The group SLI_noVB fails to use the seven conversation skills 43% of the time. For the group SLI_VB, this percentage is much higher (90%) although, compared to the communicative functions, it is a relatively smaller difference.

Participant number	Group	Pragmatics Communicative functions					Conversation Skills						
		Asks for clarification and/or repetition	Indicates when he/she does not understand	Can express feelings	Greets	Eye contact	Takes initiative to speak	Good turn taking	Responds adequately to a question	Takes into account the knowledge of the listener	Can keep a conversation going	Can maintain a topic	Tells coherent stories
1	SLI_VB	-	-	-		✔	-		-	-		-	-
2	SLI_VB	✔	-	-	✔	-	-		-	-		-	-
3	SLI_VB	✔	✔	-		✔	✔	✔	-	-	-	-	-
4	SLI_VB			-			✔	✔	-	-	-	-	-
5	SLI_VB	-	-	-	-		-		-	-	-		
6	SLI_VB	-	-	-			-		-	-	-		-
7	SLI_VB	-	-	-	-	-	✔		-	-	-	-	-
8	SLI_VB	-	-	-	-	✔	-		-	-	-	-	-
9	SLI_VB	-	-	-		✔	✔	-	-	-		-	-
10	SLI_VB	-	-	-		-	-		-	-	-		-
11	SLI_VB	-	-	-		-	-		-	-	-		-
12	SLI_VB	-	-	-		✔	✔	✔	-	-	-	-	-
13	SLI_VB	✔	-	-		-	✔	-	-	-	-	-	-
14	SLI_VB	-	-	-	✔	-	-	-	-	-	-	-	-
15	SLI_VB	-	-	-	-	✔	-	✔	-		-	-	-
16	SLI_VB	-	-	-	-	-	-	✔	✔	-	-	-	-
Blanks		1	1	0	9	3	0	8	0	1	3	4	1

Table 3 Pragmatics skills of the group SLI_VB; ✔ = yes, ▬ = no

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Participant number	Group	Pragmatics Communicative functions					Conversation skills						
		Asks for clarification/ repetition	Indicates when he/she does not understand	Can express feelings	Greets	Eye contact	Takes initiative to speak	Good turn taking	Responds adequately to a question	Takes into account the knowledge of the listener	Can keep a conversation going	Can maintain a topic	Tells coherent stories
1	SLI_noVB	✔	✔	✔		✔	✔	✔	✔		-	-	-
2	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	-	-	✔	-	-
3	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	-	✔	✔	-
4	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	✔	-		-
5	SLI_noVB	✔	✔	✔	✔	✔	-	✔	✔	-	-	-	-
6	SLI_noVB	-	-	✔	✔	✔	-	-	✔	✔	-	✔	-
7	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	-	✔	✔	✔	-
8	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	-		-	-
9	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	-	✔	✔	✔	✔
Blanks		0	0	0	1	0	0	0	0	1	1	1	0

Table 4 Pragmatic skills of group SLI_noVB; ✔ = yes, - = no

Possibly related to the prior finding, three other interesting differences between the groups are observed. First, the SLI_VB group seems to have more difficulties with social contact, which includes making and maintaining friends in school and in the neighbourhood of their home. Table 5 shows how the two groups score on the two indicators that are related to social contact. In the group SLI_VB 12 out of 16 (75%) have difficulties with both skills whereas this is lower for the group SLI_noVB in which four out of nine (44%) children have problems with the two skills that represent social contact. Although there is a marked difference between the two groups, the percentage of children that have difficulties with social contact is quite large in both groups.

Participant Number	Group	Has many social contacts	Can make contact easily
1	SLI_VB	✔	-
2	SLI_VB	-	-
3	SLI_VB	-	-
4	SLI_VB	✔	✔
5	SLI_VB	-	-
6	SLI_VB	-	-
7	SLI_VB	-	-
8	SLI_VB	-	-
9	SLI_VB	-	-
10	SLI_VB	-	-
11	SLI_VB	-	-
12	SLI_VB	-	✔
13	SLI_VB	-	-
14	SLI_VB	✔	✔
15	SLI_VB	-	-
16	SLI_VB	-	-
Blanks		0	0

Participant Number	Group	Has many social contacts	Can make contact easily
1	SLI_noVB	✔	✔
2	SLI_noVB	-	-
3	SLI_noVB	-	-
4	SLI_noVB	✔	✔
5	SLI_noVB	✔	✔
6	SLI_noVB	-	-
7	SLI_noVB	✔	✔
8	SLI_noVB	-	-
9	SLI_noVB	✔	✔
Blanks		0	0

Table 5: Social contact of the two groups; ✔ = yes, - = no

Secondly, as table 6 presents, 12 out of 16 (75%) of the participants in the group SLI_VB show remarkable features that are characteristic of an autism spectrum disorder (ASD). Compared to the 22% (two out of nine) of the group SLI_noVB, this is a large percentage. As a reminder,

these children do not actually have ASD (as this was an exclusion criterion). It means that, looking at SLI and ASD on a continuum, these children can be located somewhere in the middle and thus lean a bit towards ASD.

Participant Number	Group	Suspicion of ASD
1	SLI_VB	✔
2	SLI_VB	✔
3	SLI_VB	✔
4	SLI_VB	-
5	SLI_VB	✔
6	SLI_VB	✔
7	SLI_VB	✔
8	SLI_VB	✔
9	SLI_VB	-
10	SLI_VB	✔
11	SLI_VB	✔
12	SLI_VB	-
13	SLI_VB	✔
14	SLI_VB	✔
15	SLI_VB	✔
16	SLI_VB	-
Blanks		0

Participant Number	Group	Suspicion of ASD
1	SLI_noVB	-
2	SLI_noVB	✔
3	SLI_noVB	-
4	SLI_noVB	-
5	SLI_noVB	-
6	SLI_noVB	-
7	SLI_noVB	-
8	SLI_noVB	✔
9	SLI_noVB	-
Blanks		0

Table 6: Suspicion of ASD for the two groups; ✔ = yes, - = no

Thirdly, a difference between the groups that concerns the IQ profiles of the participants can be observed, which is shown in table 7. Within the group SLI_VB, 13 out of 16 (81%) had a disharmonic IQ-profile. In the group SLI_noVB, only four out of nine (44%) of the participants had an IQ profile that was disharmonic. A disharmonic IQ profile means that there is a discrepancy of, usually, more than 15 points between the verbal IQ (VIQ) and the performance IQ (PIQ) (Wechsler, 1974). For the children with a disharmonic IQ profile whose files were used for this study, the PIQ exceeds the VIQ.

Participant number	Group	Disharmonic IQ-profile
1	SLI_VB	✔
2	SLI_VB	✔
3	SLI_VB	✔
4	SLI_VB	-
5	SLI_VB	✔
6	SLI_VB	✔
7	SLI_VB	✔
8	SLI_VB	✔
9	SLI_VB	✔
10	SLI_VB	✔
11	SLI_VB	✔
12	SLI_VB	-
13	SLI_VB	✔
14	SLI_VB	✔
15	SLI_VB	-
16	SLI_VB	✔
Blanks		0

Participant number	Group	Disharmonic IQ-profile
1	SLI_noVB	✔
2	SLI_noVB	✔
3	SLI_noVB	-
4	SLI_noVB	-
5	SLI_noVB	✔
6	SLI_noVB	-
7	SLI_noVB	-
8	SLI_noVB	✔
9	SLI_noVB	-
Blanks		0

Table 7: IQ-harmonicity profiles of the two groups;
✔ = yes, - = no

Looking at the expressive and receptive language profiles of the two groups, it can be observed that the group SLI_VB scores a little lower than the group SLI_noVB. Taking all indicators together (blanks not included), the group SLI_VB does not perform averagely, at least 1 SD below the mean, 79% of the time compared to 65% of the group SLI_noVB. On the receptive side of the language profile, the difference between the two groups is largest, with 81% versus 61% under average scores for the groups SLI_VB and SLI_noVB respectively. As table 8 presents, this difference is mainly due to the diverging scores on 'listening attitude', 'sentence comprehension' and 'average passive vocabulary'. In the group SLI_noVB, five out of nine children score averagely on two out of three receptive language measures. In the group SLI_VB, only two out of 16 children have mastered at least two out of the three receptive language skills. The contrast between the two groups on expressive language is small (72% versus 69% under average scores for the groups SLI_VB and SLI_noVB respectively).

Participant number	Group	Receptive		
		Listening attitude	Sentence comprehension	Average passive vocabulary
1	SLI_VB	-	-	✔
2	SLI_VB		✔	-
3	SLI_VB	✔	-	-
4	SLI_VB	-	-	✔
5	SLI_VB		-	-
6	SLI_VB	-	✔	✔
7	SLI_VB	-	-	-
8	SLI_VB	✔	✔	✔
9	SLI_VB	✔	-	-
10	SLI_VB	-	-	✔
11	SLI_VB	-	-	-
12	SLI_VB	-	-	-
13	SLI_VB	-	-	-
14	SLI_VB	-	✔	-
15	SLI_VB	-	-	-
16	SLI_VB		✔	-
Blanks		3	0	0

Participant number	Group	Receptive		
		Listening attitude	Sentence comprehension	Average passive vocabulary
1	SLI_noVB		-	-
2	SLI_noVB	-	-	-
3	SLI_noVB	✔	-	-
4	SLI_noVB	✔	✔	✔
5	SLI_noVB	✔	✔	✔
6	SLI_noVB	-	-	-
7	SLI_noVB	-	✔	✔
8	SLI_noVB	✔	✔	✔
9	SLI_noVB	✔	-	✔
Blanks		1	0	0

Table 8: Three measures of receptive language skills of both groups;

✔ = average score, - = score under average

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4.2.2 Within-group differences

In contrast to the between-group differences, the within-group differences were not substantial. Overall, the group SLI_noVB was more heterogeneous than the SLI_VB group. The results show that many skills have not yet been mastered by the children in the SLI_VB group. Looking at the results given in the between-group differences, the percentages indicating absent skills or under average scores for the SLI_VB group are quite large for all categories, usually above 75%. This indicates that this group is rather homogeneous and all participants within this group show limitations across a wide range. The percentages for the group SLI_noVB are lower but also more divergent, ranging from 60% to 4%. The group that does not have problems with the verbalization of emotions seems to be more diverse. Most likely, due to the small sample size, the reason for this is chance as the factor that differentiates the two groups, the ability to verbalize emotions, is not expected to cause such difference in diversity. As SLI is already a heterogeneous population, future research with larger sample sizes is required to reduce the effect of chance and obtain a better level of precision (Isreal, 1992).

An interesting difference within the group SLI_VB is presented in table 9. As was explained in the section on data analysis, three abilities related to emotion naming were distinguished. As can be seen in the table, these three abilities seem to differ in terms of complexity. Only one participant in the group SLI_VB was not able to name the four basic emotions with the help of pictograms. Without this help, emotion naming becomes much more difficult. Ten out of the 16 children (63%) were not able to name emotions without the pictograms. In order to make the task even harder, play therapists try to see if children are able to name emotion words and apply them to themselves (e.g. by telling a little story about a time that the child experienced that emotion). In the group SLI_VB, only one child was able to accomplish this task, in contrast with 15 children that did not master this skill.

Participant number	Group	During play therapy **Can name basic emotions with the help of pictures**	During play therapy **Can name basic emotions without the help of pictures**	During play therapy **Can name emotion words and apply them to themselves**
1	SLI_VB	-	-	-
2	SLI_VB	✔	-	-
3	SLI_VB	✔	✔	✔
4	SLI_VB	✔	✔	-
5	SLI_VB	✔	-	-
6	SLI_VB	✔	✔	-
7	SLI_VB	✔	✔	-
8	SLI_VB	✔	-	-
9	SLI_VB	✔	✔	-
10	SLI_VB	✔	-	-
11	SLI_VB	✔	-	-
12	SLI_VB	✔	-	-
13	SLI_VB	✔	✔	-
14	SLI_VB	✔	-	-
15	SLI_VB	✔	-	-
16	SLI_VB	✔	-	-
Blanks		0	0	0

Table 9: emotion naming abilities of the SLI_VB group;

✔ = yes, - = no

5. Discussion

The discussion of this study can be divided into two sections. The first section will discuss the most important results that have been presented in the previous part of the study and will link these results to the literature that has been discussed earlier. The second section will address how a future and more elaborate study can conduct experimental research that tackles the relation between a language disorder and problems with the verbalization of emotions.

5.1 Discussion of the results

The present study shows that all children, in both groups, had problems with applying at least some communicative functions and/or conversation skills, which represent the pragmatic

abilities of the children. In this respect, this study supports earlier research that demonstrated weaker pragmatics abilities of children with a language impairment (e.g. Bishop, 2000; Steegs, Klatter, van Hout, Embrechts & Geurts, 2010). Interestingly, children with problems with the verbalization of emotions were more pragmatically impaired than children that did not have such difficulties. Where children in the group SLI_noVB only failed to use a limited number of pragmatics skills in their daily communication, the children in the group SLI_VB failed to use many communicative functions and conversation skills. This result indicates that the verbalization of emotions is most likely not an isolated skill but can be related to pragmatic abilities. This relation was proposed by Way et al. (2007) and the data of the present study strengthen their hypothesis.

Looking at the receptive and expressive language of the children in both groups, the differences between the groups were not as large as the differences observed in the area of pragmatics. Overall, the group SLI_VB scored lower than the group SLI_noVB and seemed to be slightly more severely language impaired, especially on the receptive side of the language profile. This result can be related to research that has been conducted in the Netherlands by Steegs et al. (2010). Children scoring lower on the Peabody Picture Vocabulary Test, which tests receptive vocabulary, also scored lower on pragmatic measures. Consequently, the authors concluded that pragmatic abilities seemed to be in line with language proficiency. Nevertheless, future studies need to clarify whether the relatively small difference in expressive and receptive language ability found in this study can fully account for the large differences found in pragmatic abilities.

Next to differences concerning language skills, differences in other areas were found between the two groups. Children in the group SLI_VB had more difficulty with social contact than children in the group SLI_noVB. Previous research has suggested that children with a language impairment have a delayed social competence (McCabe & Meller, 2004). This study could add to this suggestion that especially children with a language impairment who have a broader range of difficulties, including a pragmatic deficit and problems with the verbal expression of emotions, have poor social relations. Denham et al. (2003) already claimed a strong connection between emotional competence and social competence. The results of this study give further insight into a possible relation between the verbalization of emotions (part of emotional competence) and social contact (part of social competence).

Furthermore, 75% of the children in the SLI_VB group showed features that led professionals working with the children to suspect an autism spectrum disorder. Children with

ASD are known to have language difficulties as well, especially in the area of pragmatics (Rice et al., 2005), and these children also have limitations in social interaction (Le Blanc & Volkers, 2007). The fact that the children in the group SLI_VB showed these characteristics could have fostered the suspicion that they had ASD. Although these children were never diagnosed with ASD, the results point to the question of how specific SLI really is and how far away the language disorder lies from ASD. By definition, SLI and ASD are seen as mutually exclusive disorders, as ASD is an exclusion criterion for diagnosing SLI (Bishop, 2010). This does not inevitably mean, however, that the two disorders cannot be related to some extent. In fact, the evident similarities and possible etiological overlap between the two disorders have been topic of recent debate (for example: Tomblin, 2011; Bishop, 2010; Williams, Botting & Boucher, 2008). The question at hand is whether SLI and ASD are two disorders with the same underlying cause or whether the two have distinct causal systems.

This question taps into a discussion led by Pennington (2006) which addresses types of cognitive models that intend to explain developmental disorders. Pennington argues that, although it has been widely accepted that the etiology of developmental disorders is complex and multifactorial, the cognitive analyses for the same disorders still focus on a single deficit model. Basically, such single deficit models assume that one cause necessarily and sufficiently produces a particular result. Thus, a phonological deficit (cause) would be necessary and sufficient to produce dyslexia (result). According to Pennington (2006), a contradiction exists between these single deficit models and the agreement that developmental disorders have a complex etiology with several underlying risk factors. Moreover, the single cognitive deficit models do not predict and have difficulty explaining comorbidity among developmental disorders. For these reasons, Pennington (2006) proposed a multiple deficit model which suggests that a developmental disorder is caused by the interaction of multiple risk factors, either genetic or environmental. In contrast to the single deficit models, no single risk factor is sufficient to produce the symptoms that define a disorder. "Consequently, comorbidity among complex behavioural disorders is to be expected because of shared etiologic and cognitive risk factors" (Pennington, 2006; 404).

In this line of reasoning and with reference to SLI and ASD, the behavioural similarities and etiological overlap between the two developmental disorders can be better explained. Adopting the suggestions of the multiple deficit model by Pennington (2006), SLI and ASD have shared etiological and cognitive risk factors that produce similarities between the two disorders. Some children with SLI might share more risk factors or impaired

underlying mechanisms with children with ASD than other children with SLI. Such individual differences produce the heterogeneity seen in a disorder as SLI. Moreover, it can be hypothesized that these individual differences also produce the difference between the group SLI_VB and SLI_noVB in the present study. It is possible that the group SLI_VB have more etiological overlap with children with ASD than the group SLI_noVB. In this sense, support could be given to the hypothesis of Bishop (2000) that SLI and ASD are a continuum of severity. In the case of this study, the group SLI_VB could be located more towards ASD compared to the group SLI_noVB, which could be described as having a more pure language deficit with relatively less shared underlying risk factors with children with ASD. The figure below illustrates this continuum.
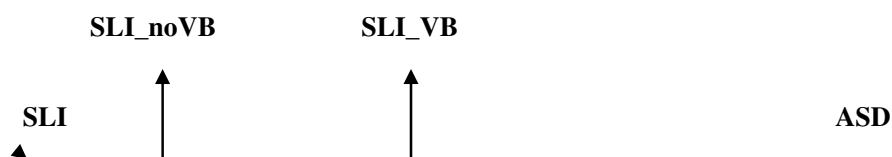
Figure 1: The groups SLI_noVB and SLI_VB located on an SLI-ASD continuum

Although this continuum seems to explain the differences between the two groups of this study reasonably well, it also makes no distinction between SLI and ASD anymore. Assuming an SLI-ASD continuum means that SLI slowly shades off into ASD. No clear line distinguishes the two. Taking into account that SLI and ASD are still, by definition, mutually exclusive disorders, at least some distinction seems to be necessary. Moreover, this continuum cannot explain what exactly causes the severity to be worse. A possible model that acknowledges the continuities but retains the differences between SLI and ASD can be made after an example of Bishop & Snowling (2004), who proposed a model for SLI and dyslexia. Figure 2 illustrates how SLI and ASD can be located on different areas of a two-dimensional space which concerns pragmatic and structural language difficulties. Children with classic SLI have relatively normal pragmatic language skills and poor structural language difficulties (such as the group SLI_noVB). For children with classic ASD, it is the other way around. Both pragmatic as well as structural language difficulties have been observed in some children with SLI (as the group SLI_noVB) and some children with ASD. These children are expected to share more underlying risk factors and, thus, more behavioural symptoms than

children that can be located in a different area of the model. Still, the children with SLI and ASD that have both pragmatic and structural language difficulties do not belong to one and the same group; they have been diagnosed differently for a reason. The distinction can be simply made by using the diagnostic criteria for ASD (American Psychiatric Association, 1994). If a child satisfies the criteria for ASD, he/she will belong to the children with ASD_broad, a category which corresponds to the terms ASLI or ASD-LI which are sometimes used in the literature for children with ASD and a structural language impairment (e.g. Williams et al., 2008). A child that shows some similarities with a child with ASD, but still does not satisfy such criteria, will belong to the group SLI_broad. In the present study, the group SLI_VB can be regarded as a group of children with SLI_broad. Based on the results of this study, children with SLI_broad are, as the term indicates, expected to have a broader range of problems than children with classic SLI, including problems with the verbalization of emotions and difficulties with social contact.
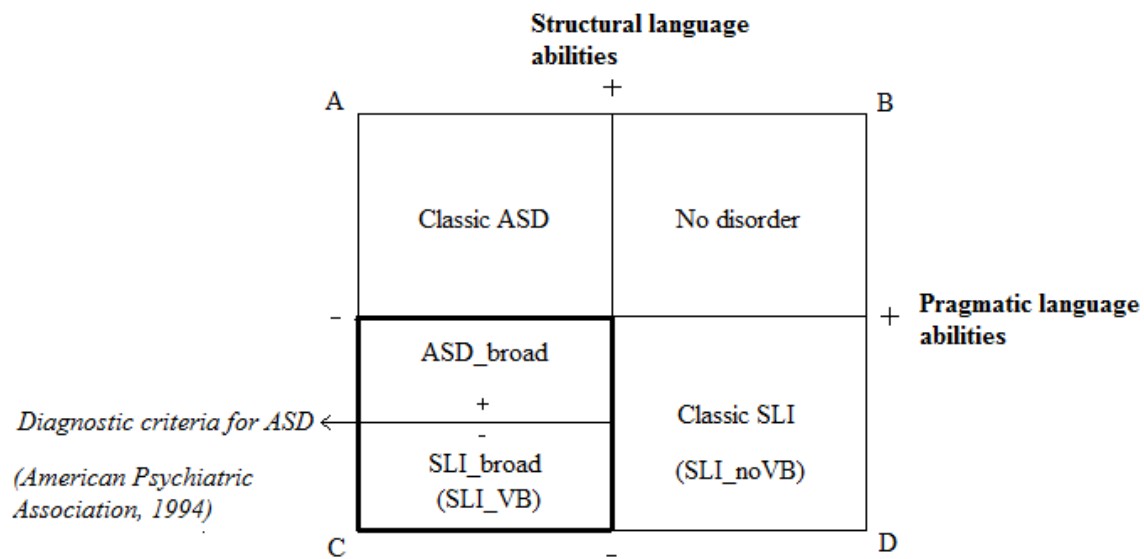
Figure 2: SLI and ASD located on a two-dimensional space

When discussing this model, two alternative possibilities about the underlying relation between SLI and ASD need to be considered as well. First, it is still possible that both structural and pragmatic language difficulties arise from one underlying source, for example, a deficit in lower-level perception, which would support a single risk model. Second, even if a multiple risk model is assumed, the different underlying causes of structural and pragmatic

language difficulties can partly overlap, which is not highly implausible as both structural language as well as pragmatics belong to the language faculty in general. Thus, it is not said that the model in figure 2 depicts the exact relation between SLI and ASD. Next to possible alternative explanations, both ASD and SLI are also more complex than shown in this model. A model completely capturing all characteristics of children with SLI and ASD needs more dimensions. This figure, however, is a first attempt that illustrates a possible and plausible relation between SLI and ASD, both taking into account shared etiology and behavioural similarities as well as existing differences.

Finally, a remarkable point needs to be discussed which attracted attention during the analysis of the data. As could be observed in table 9 in the results section, children in the SLI_VB group could all name basic emotions with the help of pictures but could not do this when applying these emotions to themselves or situations. In the literature (Rieffe, Oosterveld & Terwogt, 2006), 'a clear distinction (…) is made between moods (global affective states without a cause, object or onset) and emotions (affective states that are directly linked to a specific event or situation)' (Frijda, 1991). So, looking at the results of this study, it seems that children in the group SLI_VB can label basic <u>moods</u> which do not have any link to a particular situation. However, labelling <u>emotions</u> is much more difficult for these children. Interestingly, this exact pattern is seen in individuals with the personality construct alexithymia (Rieffe et al., 2006). This finding supports the comparison that has been made in the introduction between persons with alexithymia and children with a language disorder which have difficulty verbalizing their emotions. In the following section, the similarity between the two groups is used for future research.

5.2 Future studies

This study has been an exploratory study on a seemingly common phenomenon in children with a language impairment: problems with the verbalization of emotions. The results of this study point to a relation between the verbalization of emotions, pragmatics, language ability and social competence. This relation needs to be investigated in more detail and in a more elaborate experimental design, allowing systematic analyses in a larger study population. Below, some suggestions for such an experimental approach will be given. Ideally, an experimental approach that studies a developmental disorder as SLI would be longitudinal (de Bree, 2009). Through a longitudinal study, the child's development of language abilities, pragmatic skills, social and emotional competence can be mapped. Such a study can tackle the

causality dilemma of which problems arise first and which symptoms might be precursors of other symptoms.

First, three groups of at least each 30 children, aged 4-14, will need to be included in the research: 1) A control group with typically developing children, 2) A group with children with SLI who seem to be emotionally less competent than age peers, 3) A group with children with SLI who are emotionally competent. The control group can consist of ordinary primary school children and, for the two other groups, special educational needs schools will need to be involved. A fourth group with autistic children could be added to the study as this would create the possibility to directly compare children with ASD and SLI. Table 10 illustrates the selection criteria for the three groups, and a possible fourth group is added in red.

	Group 1 (Controls)	Group 2 (SLI_VB)	Group 3 (SLI_noVB)	Group 4 (ASD)
Inclusion criteria	* Between 4-14 years old *Diagnosed with ESM *IQ > 80	*Between 4-14 years old *Diagnosed with ESM *IQ > 80 *Difficulty with tasks of emotional competence	*Between 4-14 years old *Diagnosed with ESM *IQ > 80 *No difficulty with tasks of emotional competence	*Between 4-14 years old *Diagnosed with ASD *IQ > 80
Exclusion criteria	*Diagnosed with ASD *Hearing Impaired *Trauma experience	*Diagnosed with ASD *Hearing Impaired *Trauma experience	*Diagnosed with ASD *Hearing Impaired *Trauma experience	*Hearing Impaired *Trauma experience

Table 10: selection criteria for future research

As can be observed in the table, the selection criteria are similar to the criteria used in the present study. An important difference is the age of the children. Thanks to the longitudinal nature of the study, the children will be younger when the study begins. The exclusion criteria make sure that the children in the two groups with a language disorder would have been

diagnosed with SLI if they had been living in Great Britain or the United States of America. This is important as the results of the study can otherwise not be compared to international research about children with a language impairment.

A major challenge related to this topic of research is the absence of a standard experimental method to measure a child's ability to verbalize emotions, which is an important part of emotional competence. The present study relied on judgements of play and speech therapists. Although these therapists have a good professional view on the capabilities of a child they are working with, the variation can be large due to the fact that all therapists work in a slightly different way. One therapist might diagnose a child differently than a second therapist. A standardized measure that is carried out on all children, next to the judgments of therapists, would clear a study from such undesired variation. A possibility for such a measure is an adjustment of the Toronto Alexithymia Scale. This scale is used to see whether a person scores high or low on the personality construct alexithymia, of which one of the core problems is the difficulty of expressing emotions and with which children in the group SLI_VB showed quite some resemblance. A Dutch adjustment of this scale has already been made for children by Rieffe et al. (2006). As the Toronto Alexithymia Scale, the questionnaire made by Rieffe et al. (2006) is a self-reported questionnaire which means that children fill it out by themselves. For children with a language disorder, however, this would be problematic as their limited language would hamper them to adequately fill out the questionnaire. This problem can be solved in two ways. Firstly, the questionnaire could be slightly adapted such that parents or teachers can fill them out for the children. This solution takes away the problem of children having too limited language skills to fill out the questionnaire. Nevertheless, reports of parents and teachers can sometimes be highly subjective and reveal different results compared to scores on a test measure (Bishop, 1998; Embrechts, Mugge & van Bon, 2005). Secondly, an experimenter could read the questions out to the children and note their answers. This solution would be closer to the original questionnaire of Rieffe et al. (2006) as children answer the questions themselves. However, children with weak receptive language skills can still have difficulties with this task. Thus, using a version of the Toronto Alexithymia Scale has its advantages and its disadvantages. Overall, together with reports of speech and play therapists, the questionnaire could be a good way to systematically measure the ability of children to verbalize their emotions.

Such a questionnaire is an appropriate measure for children around the age of eight, because at this age, their verbalization skills are sufficiently developed. Another measure of

emotional competence is needed for when the children are younger. Denhem et al. (2003) conducted a research with the emotional and social competence of young children, aged three and four, as main interest. These authors used several measures to see how emotionally competent a child was, including maternal reports and natural observation as well as an emotion identification task with the use of puppets. These measures can be used for a longitudinal follow-up study because it can give insight into the question whether poor performance on measures of emotional competence can be related to later difficulties with the verbalization of emotions.

Next to measuring components of emotional competence, including the verbal expression of emotions, the pragmatic skills of the children need to be tested as the results of the present study pointed to a relation between pragmatic skills and the ability to verbalize emotions. Two Dutch methods have already been developed for this purpose: 1) the Nijmeegse Pragmatiek Test (NPT. Embrechts et al., 2005) and 2) the Children's Communication Checklist 2 in Dutch (CCC-2-NL. Geurts, 2007; originally Bishop, 2003). The NPT is designed for children between the age of four to seven and is, thus, a correct measure for young children. In contrast, the CCC-2-NL can be used for when the children are older. A disadvantage of this measure is that it, again, relies on reports of parents or teachers. Nevertheless, Steegs et al. (2010) compared the CCC-2-NL with the NPT and the scores on the two methods corresponded. This result indicates that parents'/teacher's reports do not always deviate from other measures.

On top of the measures for the pragmatic skills and the ability to verbalize emotions, expressive and receptive language competence and general cognitive abilities need to be examined. First, all children will need to do the same IQ test. Next, data from reports of speech therapists can be used to assess the expressive and receptive language skills of the children with a language disorder as they all receive speech therapy at their own primary school. If this method turns out to be insufficient, it could be decided to carry out some speech therapy measures that will give a good overview of the language proficiency of the child.

In addition to examining the relation between emotional competence, pragmatics and other language skills, the study could also look into the question of whether social competence can be related to these three variables. Quite some research has already looked into this possible relation between emotional and social competence. Finding support for this relation in children with a language disorder is important as it can influence treatment of these children. Enhancing children's emotional competence, and thereby the ability to verbalize

their emotions, might improve their social life, which is, in turn, significant for a child's well-being (Ryan & Deci, 2001). Social competence can be measured in different ways. Examples which could be used for research are the Social Skills Rating Scale (SSRS; Gresham & Elliot, 1990; Farmer, 2000) which uses ratings of parents and teachers as well as sociometric peer ratings which measures the likability of a child in the classroom (Denham et al. 2003).

6. Conclusion

To conclude, this study has shown that children with SLI who have problems with the verbalization of emotions have more difficulties with receptive language, pragmatic language and social contact than children with SLI that do not have problems with verbally expressing emotions. Moreover, professionals suspected many of the children which experienced problems with verbalizing their emotions to have ASD, although none of the children were ever diagnosed with a disorder within this spectrum.

These findings suggest the prediction that children with SLI may be children with problems beyond the language domain. Although it is still a matter of discussion which problems are secondary to the language difficulties and which problems are concurrent, it is clear that SLI is not specific to language. Language development seems to be crucial for both normal communication with parents, teachers and peers as well as for the development of other cognitive skills. A further prediction, based on the results of this study, regard children with SLI which have problems with the verbalization of emotions. These children will have even more broader problems than children with (classic) SLI. Children who have difficulties with the verbalization of emotions will likely be less socially and emotionally competent, will have a severe pragmatic impairment and will show behavioural problems. In this sense, these children will have features that are similar to those that characterise a child with ASD and will expectedly share etiological risk factors with children with ASD. Although it is still questionable what exactly produces the difficulties of children with SLI, it is likely that there are more underlying causes which interact. SLI is a complex and multifactorial disorder that "appears to arise as the consequence of a specific constellation of underlying deficits" (Pennington & Bishop, 2009; 301). One individual with SLI can have a slightly different constellation of underlying deficits than a second individual with SLI. This produces the heterogeneity at the behavioural level of the language disorder.

This study gives rise to many more questions about SLI and the verbalization of emotions. For example, a question that needs more research concerns the importance of

regions in the prefrontal cortex for both language development as well as the ability to verbally express emotions. Another example of a question that arises from this study regards the relation between SLI and the personality trait alexithymia. Furthermore, this exploratory study calls for a large longitudinal study that systematically looks at language abilities, pragmatic skills and social and emotional competence of children with SLI and children with ASD. Such a study would give insight into the questions of what causes what, which symptoms are concurrent and which are secondary. Ultimately, decisive information about such questions will benefit children with SLI which should, in the end, be the purpose of any research about SLI.

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Appendix A - Letter of permission

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F 030 236 75 75
E info-midden@kentalis.nl
www.kentalis.nl
KvK 41055843
Vlampijpstraat 78 - 3534 AR Utrecht - NL

Aan de ouder(s)/verzorger(s) van
«Voornaam» «tssvgsl» «Naam»
«Adres»
«PC» «Plaats»

Datum

Betreft Onderzoek naar het uiten van emoties bij kinderen met taalstoornissen

Geachte ouder(s)/verzorger(s) van «Voornaam»,

Via deze brief wil ik u graag op de hoogte brengen van een onderzoek dat ik wil gaan doen bij Koninklijke Kentalis. Voor dit onderzoek zou ik graag dossiers bekijken van een aantal kinderen dat bij Kentalis is aangemeld (of aangemeld is geweest), onder andere het dossier van uw kind. Hierbij wil ik nadrukkelijk zeggen dat ik u of uw kind niet persoonlijk hoef te zien of te onderzoeken. Het enige wat ik zal gebruiken voor mijn onderzoek is de informatie uit de dossiers die aanwezig zijn bij Kentalis. Dit betekent dat u en uw kind hierbij verder niet betrokken hoeven te zijn.

Daarnaast wil ik u graag verzekeren van het feit dat alle gegevens die ik verzamel tijdens het onderzoek, **anoniem** behandeld zullen worden. De naam van uw kind zal dus nergens genoemd worden. Alles zal onder een code (d.w.z. zonder naam) worden opgeschreven. Buitenstaanders hebben geen toegang tot de gegevens.

Voor ik u om toestemming vraag, zal ik mijzelf even introduceren. Ik ben Tessel Boerma, masterstudente bij de Universiteit Utrecht, en ik ben stagiaire taalkunde geweest bij Kentalis. Nu ben ik bezig met mijn scriptie. Deze scriptie is een dossieronderzoek. Ik wil gaan kijken naar kinderen met taalstoornissen en problemen die deze kinderen kunnen hebben met het uiten van hun emoties. Er is daar nog maar weinig over bekend. Aangezien emoties belangrijk zijn voor een goede ontwikkeling, is het waardevol om hiernaar onderzoek te doen. Uiteindelijk zullen de resultaten van deze scriptie wellicht aanwijzingen kunnen opleveren voor behandeling van kinderen met een taalstoornis.

Met deze informatie in gedachten, wil ik u graag toestemming vragen om het dossier van uw kind te mogen inzien voor mijn onderzoek. Mocht u toestemmen, dan kunt u het bijgevoegde toestemmingsformulier ingevuld opsturen of (als dit voor u van toepassing is) aan uw

behandelcoördinator/ouderbegeleider/speltherapeut van Kentalis geven. U kunt mij ook bellen of mailen met uw toestemming.

Mocht u naar aanleiding van deze brief nog vragen hebben of meer informatie willen over het onderzoek, dan kunt u mij ook altijd mailen of bellen:

Telefoon: 06-49888412
Email: T.Boerma@kentalis.nl

Met vriendelijke groet,
Tessel Boerma – Ambulante Zorg Utrecht

Toestemmingsformulier

Ik geef toestemming voor het gebruik van het dossier van mijn kind voor het onderzoek door Tessel Boerma dat beschreven is in bijgevoegde brief.

Naam kind…………………………………………………………..

Naam ouder/verzorger……………………………………………

Datum: ……………………………………

Plaats: ……………………………………

Handtekening: ………………………………

Appendix B - Data sheet with indicators

Participant number	Group	ESM	Male	Special education	Hearing	Multilingual	Normal pregnancy / delivery	Easy baby	IQ > 85	IQ > 80	Disharmonic IQ-profile
1	SLI_VB	✔	-	✔	✔	✔	✔	-	-	✔	✔
2	SLI_VB	-	✔	-	✔	✔	✔	✔	✔	✔	✔
3	SLI_VB	✔	✔	✔	✔	✔	-	✔	✔	✔	✔
4	SLI_VB	✔	✔	✔	✔	-	✔	✔	✔	✔	-
5	SLI_VB	✔	✔	✔	✔	-	✔	-	✔	✔	✔
6	SLI_VB	✔	✔	✔	✔	-	✔	✔	✔	✔	✔
7	SLI_VB	✔	-	✔	✔	-	✔	-	✔	✔	✔
8	SLI_VB	✔	-	✔	✔	-	-	✔	✔	✔	✔
9	SLI_VB	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
10	SLI_VB	✔	✔	✔	✔	-	-	✔	✔	✔	✔
11	SLI_VB	✔	-	✔	✔	-	-	-	✔	✔	✔
12	SLI_VB	✔	-	✔	✔	✔	✔	-	✔	✔	-
13	SLI_VB	✔	-	✔	✔	✔	✔	-	-	✔	✔
14	SLI_VB	✔	✔	✔	✔	-	✔	-	✔	✔	✔
15	SLI_VB	✔	✔	✔	✔	-	✔	✔	✔	✔	-
16	SLI_VB	✔	✔	✔	✔	-	✔	-	✔	✔	✔

Participant number	Group	Normal onset language	Normal motoric development	Suspicion of ASD	Emotionally competent	*During play therapy* Can name basic emotions with the help of pictures	*During play therapy* Can name basic emotions without the help of pictures	*During play therapy* Can name emotion words and apply them to themselves	Shows frustrated behaviour (due to the inability to express themselves verbally)
1	SLI_VB	-	-	✔	-	-	-	-	✔
2	SLI_VB	-	✔	✔	-	✔	-	-	✔
3	SLI_VB	-	✔	✔	-	✔	✔	✔	✔
4	SLI_VB	-	-	-	-	✔	✔	-	✔
5	SLI_VB	-	✔	✔	-	✔	-	-	✔
6	SLI_VB	-	-	✔	-	✔	✔	-	✔
7	SLI_VB	-	-	✔	-	✔	✔	-	✔
8	SLI_VB	-	-	✔	-	✔	-	-	✔
9	SLI_VB	✔	✔	-	-	✔	✔	-	✔
10	SLI_VB	-	✔	✔	-	✔	-	-	✔
11	SLI_VB	-	-	✔	-	✔	-	-	✔
12	SLI_VB	-	✔	-	-	✔	-	-	✔
13	SLI_VB	-	✔	✔	-	✔	✔	-	✔
14	SLI_VB	-	✔	✔	-	✔	-	-	✔
15	SLI_VB	-	✔	✔	-	✔	-	-	✔
16	SLI_VB	-	✔	-	-	✔	-	-	✔

Participant number	Group	Confident	Proper self-image	Has many social contacts	Can make contact easily	Can express their boundaries	Level of play is age appropriate	Good concentration	Work ethic	On command problems	Communicatively self-relaint	Normal auditory memory
1	SLI_VB	-	-	✔	-	✔	✔	✔	✔	✔	-	-
2	SLI_VB	-	-	-	-	-	✔	-	✔	✔	-	-
3	SLI_VB	✔	✔	-	-	-	✔	-	✔	✔	-	-
4	SLI_VB	-	-	✔	✔	-	✔	✔	✔	✔	-	-
5	SLI_VB	-	-	-	-	-	✔	-	✔	✔	-	-
6	SLI_VB	-	-	-	-	-	✔	-	✔	✔	-	-
7	SLI_VB	-	-	-	-		-	-	-	-	-	-
8	SLI_VB	-		-	-		-	-	✔	✔	-	-
9	SLI_VB	-	-	-	-	-	-	-	-	-	-	-
10	SLI_VB	-	-	-	-		-	-	-	✔	-	-
11	SLI_VB	-	-	-	-	-	✔	-	✔	✔	-	-
12	SLI_VB	-	-	-	✔	-	✔	✔		✔	-	-
13	SLI_VB	-	-	-	-		-	-	✔	-	-	-
14	SLI_VB	-	-	✔	✔	-	✔	-	✔	✔	-	-
15	SLI_VB	-	-	-	-	-	-	✔	✔	✔	-	
16	SLI_VB	-	-	-	-		✔	✔	✔	✔	-	-

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Expressive

Participant number	Group	Sufficiently intelligible	Articulation errors	Phonological disorder	Average scores on word formation	Average scores on sentence formation	Average active vocabulary	word finding difficulties	Makes logical relations in a story
1	SLI_VB	✔	✔	-	-	-	-		-
2	SLI_VB	✔	-	-	-	-	-		-
3	SLI_VB	✔	-	-	✔	-	-		-
4	SLI_VB	-	✔	✔	-	-	-	✔	-
5	SLI_VB	-	✔	✔	-	-	-	✔	-
6	SLI_VB	✔	✔	✔	-	-	-	✔	-
7	SLI_VB	✔	✔	✔	-	-	-	✔	-
8	SLI_VB	-	✔	✔	-	-	-	✔	✔
9	SLI_VB	✔	✔	-	-	-	-	✔	-
10	SLI_VB	✔	✔	-	-	-	-	✔	-
11	SLI_VB	✔	-	-	-	-	-	✔	-
12	SLI_VB	-	✔	✔	-	-	-	✔	-
13	SLI_VB	✔	✔	-	-	-	-	✔	-
14	SLI_VB	✔	-	-	-	-	-		-
15	SLI_VB	-	✔	✔	-	-	✔	✔	-
16	SLI_VB	✔	-	-	-	-	-	✔	-

Participant number	Group	Auditory working memory	Auditory processing	Listening attitude	Phonological discrimination	Sentence comprehension	Average passive vocabulary
1	SLI_VB	−	−	−	✔	−	✔
2	SLI_VB	−	−			✔	−
3	SLI_VB	−	−	✔	−	−	−
4	SLI_VB	−	−	−	−	−	✔
5	SLI_VB	−	−		−	−	−
6	SLI_VB	−	−	−	−	✔	✔
7	SLI_VB	−	−	−		−	−
8	SLI_VB	−	−	✔		✔	✔
9	SLI_VB	−	−	✔		−	−
10	SLI_VB	−	−	−	✔	−	✔
11	SLI_VB	−	−	−	✔	−	−
12	SLI_VB	−	−	−	−	−	−
13	SLI_VB	−	−	−		−	−
14	SLI_VB	−	−	−		✔	−
15	SLI_VB			−		−	−
16	SLI_VB	−	−			✔	−

Participant number	Group	Communicative functions		Conversation skills									
		Asks for clarification/ repetition	Indicates when he/she does not understands	Can express feelings	Greets	Eye contact	Takes initiative to speak	Good turn taking	Responds adequately to a question	Takes into account the knowledge of the listener	Can keep a conversation going	Can maintain a topic	Tells coherent stories
1	SLI_VB	-	-	-		✔	-		-	-		-	-
2	SLI_VB	✔	-	-	✔	-	-		-	-		-	-
3	SLI_VB	✔	✔	-		✔	✔	✔	-	-	-	-	-
4	SLI_VB			-			✔	✔	-	-	-	-	-
5	SLI_VB	-	-	-	-		-		-	-	-	-	-
6	SLI_VB	-	-	-			-		-	-	-	-	-
7	SLI_VB	-	-	-	-	-	✔		-	-		-	-
8	SLI_VB	-	-	-	-	✔	-		-		-		
9	SLI_VB	-	-	-		✔	✔	-	-	-	-	-	-
10	SLI_VB	-	-	-		-	-	-	-	-	-	-	-
11	SLI_VB	-	-	-		-	-	-	-	-	-		-
12	SLI_VB	-	-	-		✔	✔	✔	-	-	-	-	-
13	SLI_VB	✔	-	-		-	✔	-	-	-	-		-
14	SLI_VB	-	-	-	✔	-	-		-	-	-	-	-
15	SLI_VB	-	-	-	-	✔	-	✔	-	-	-	-	-
16	SLI_VB	-	-	-	-	-	-		✔	-	-	-	-

Participant number	Group	ESM	Male	Special education	Hearing	Multilingual	Normal pregnancy / delivery	Easy baby	IQ > 85	IQ > 80	Disharmonic IQ-profile
1	SLI_noVB	✔	-	✔	✔	-	-	✔	✔	✔	✔
2	SLI_noVB	✔	✔	✔	✔	-	-	✔	-	✔	✔
3	SLI_noVB	✔	-	✔	✔	-	✔		-	✔	-
4	SLI_noVB	✔	-	✔	✔	-	✔	✔	✔	✔	-
5	SLI_noVB	✔	✔	✔	✔	-	✔		-	✔	✔
6	SLI_noVB	✔	✔	✔	✔	✔	-	✔	✔	✔	-
7	SLI_noVB	✔	-	✔	✔	-	-	-	-	✔	-
8	SLI_noVB	✔	✔	✔	✔	-	✔	✔	✔	✔	✔
9	SLI_noVB	✔	-	-	✔	-	-	-	✔	✔	-

Participant number	Group	Normal onset language	Normal motoric development	Suspicion of ASD	Emotionally competent	*During play therapy* Can name basic emotions with the help of pictures	*During play therapy* Can name basic emotions without the help of pictures	*During play therapy* Can name emotion words and apply them to themselves	Shows frustrated behaviour (due to the inability to express themselves verbally)
1	SLI_noVB	-	✔	-	✔	✔	✔	✔	-
2	SLI_noVB	-	-	✔	✔	✔	✔	✔	✔
3	SLI_noVB	-	-	-	✔	✔	✔	✔	-
4	SLI_noVB	-	✔	-	✔	✔	✔	✔	✔
5	SLI_noVB	-	-	-	✔	✔	✔	✔	-
6	SLI_noVB		✔	-	✔	✔	✔	✔	-
7	SLI_noVB	-	✔	-	✔	✔	✔	✔	-
8	SLI_noVB	-	-	✔	✔	✔	✔	✔	✔
9	SLI_noVB	-	✔	-	✔	✔	✔	✔	✔

Participant Number	Group	Confident	Proper self-image	Has many social contacts	Can make contact easily	Can express their boundaries	Level of play is age appropriate	Good concentration	Work ethic	On command problems	Communicatively self-relaint	Normal auditory memory
1	SLI_noVB	✔	✔	✔	✔	✔	-	✔	✔	✔	✔	-
2	SLI_noVB	-	✔	-	-	✔	-	-	✔	-	✔	-
3	SLI_noVB	-	✔	-	-	✔	✔	✔	✔	-	✔	-
4	SLI_noVB	✔	-	✔	✔	✔	✔	✔	✔	-	✔	-
5	SLI_noVB	-	✔	✔	✔	-	✔	-	-	-	-	-
6	SLI_noVB	-	✔	-	-	✔	✔	✔	✔		-	-
7	SLI_noVB	-	-	✔	✔	✔	✔	✔	✔		✔	-
8	SLI_noVB	-	-	-	-	-	✔	✔	✔	✔	-	✔
9	SLI_noVB	-	✔	✔	✔	✔		✔	✔	✔	-	-

Expressive

Participant number	Group	Sufficiently intelligible	Articulation errors	Phonological disorder	Average scores on word formation	Average scores on sentence formation	Average active vocabulary	word finding difficulties	Makes logical relations in a story
1	SLI_noVB	✔	-	-	-	-	-	✔	-
2	SLI_noVB	✔	-	-	-	-	-	-	✔
3	SLI_noVB	-	✔	✔	-	-	-		-
4	SLI_noVB	✔	✔	✔	-	-	-	✔	-
5	SLI_noVB	✔	-	-	-	-	-	✔	-
6	SLI_noVB	✔	-	-	-	-	-	✔	-
7	SLI_noVB	✔	✔	-	-	-	-	✔	-
8	SLI_noVB	✔	✔	-	-	-	✔	✔	-
9	SLI_noVB	✔	✔		✔	-	✔	✔	✔

Receptive

Participant number	Group	Auditory working memory	Auditory processing	Listening attitude	Phonological discrimination	Sentence comprehension	Average passive vocabulary
1	SLI_noVB	-	-		✔	-	-
2	SLI_noVB	-	✔	-		-	-
3	SLI_noVB	-	-	✔		-	-
4	SLI_noVB	-	-	✔	-	✔	✔
5	SLI_noVB	-	-	✔		✔	✔
6	SLI_noVB	-		-		-	-
7	SLI_noVB	-	-	-		✔	✔
8	SLI_noVB	✔	✔	✔	✔	✔	✔
9	SLI_noVB	-	-	✔		-	✔

Participant Number	Group	Communicative functions					Conversation skills						
		Asks for clarification/ repetition	Indicates when he/she does not understands	Can express feelings	Greets	Eye contact	Takes initiative to speak	Good turn taking	Responds adequately to a question	Takes into account the knowledge of the listener	Can keep a conversation going	Can maintain a topic	Tells coherent stories
1	SLI_noVB	✔	✔	✔		✔	✔	✔	✔		−	−	−
2	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	−	−	✔	−	−
3	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	−	✔	✔	−
4	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	✔	−		−
5	SLI_noVB	✔	✔	✔	✔	✔	−	✔	✔	−	−	−	−
6	SLI_noVB	−	−	✔	✔	✔	−	−	✔	✔	−	✔	−
7	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	−	✔	✔	✔	−
8	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	✔	−		−	−
9	SLI_noVB	✔	✔	✔	✔	✔	✔	✔	−	✔	✔	✔	✔

Appendix C - Calculations for item and subject analysis

<u>Item analysis</u>

Pragmatics overall:
SLI_noVB: 104/108 answers (96%) – 28/104 filled in with 'no' (27%)
SLI_VB: 161/192 answers (84%) – 139/161 filled in with 'no' (86%)

Pragmatics overall (-expressing feelings)
SLI_noVB: 95/99 answers (96%) – 28/95 filled in with 'no' (29%)
SLI_VB: 145/176 answers (82%) – 123/145 filled in with 'no' (85%)

Communicative functions:
SLI_noVB: 44/45 answers (98%) – 2/44 filled in with 'no' (5%)
SLI_VB: 66/80 answers (83%) – 54/66 filled in with 'no' (82%)

Communicative functions (-expressing feelings):
SLI_noVB: 35/36 answers (97%) – 2/35 filled in with 'no' (6%)
SLI_VB: 50/64 answers (78%) – 38/50 filled in with 'no' (76%)

Conversation skills:
SLI_VB: 60/63 answers (95%) – 27/60 filled in with 'no' (45%)
SLI_noVB: 95/112 answers (85%) – 84/95 filled in with 'no' (88%)

Social contact
SLI_noVB: 18/18 answers (100%) – 8/18 filled in with 'no' (44%)
SLI_VB: 32/32 answers (100%) – 26/32 filled in with 'no' (81%)

Features ASD
SLI_noVB: 9/9 answers (100%) – 2/9 filled in with 'yes' (22%)
SLI_VB: 16/16 answers (100%) – 12/16 filled in with 'yes' (75%)

Disharmonic profile:
SLI_noVB: 9/9 answers (100%) – 4/9 filled in with 'yes' (44%)
SLI_VB: 16/16 answers (100%) – 13/16 filled in with 'yes' (81%)

Receptive language all measures:
SLI_noVB: 46/54 answers (85%) – 27/46 filled in with 'no' (59%)
SLI_VB: 83/96 answers (86% blanks) – 67/83 filled in with 'no' (81%)

Receptive language 3 measures
(listening attitude, sentence comprehension and average passive vocabulary):
SLI_noVB: 26/27 answers (96%) – 13/26 filled in with 'no' (50%)
SLI_VB: 45/48 answers (94%) – 32/45 filled in with 'no' (71%)

Receptive language (-phonological discrimination)
SLI_noVB: 43/45 answers (96%) – 26/43 filled in with 'no' (61%)
SLI_VB: 75/80 answers (94%) – 62/75 filled in with 'no' (83%)

Expressive language:[2]
SLI_noVB: 70/72 answers (97%) – 46/70 filled in with 'no/yes' (66%)
SLI_VB: 124/128 answers (97%) – 96/124 filled in with 'no/yes' (77%)

Overall (expressive + receptive language):
SLI_noVB: 116/126 answers (92%) – 73/116 filled in with 'no/yes' (63%)
SLI_VB: 207/224 answers (92%) – 163/207 filled in with 'no/yes' (79%)

<u>Subject analysis</u>

Pragmatics overall:
SLI_noVB: 3/10 + 4/12 + 2/12 + 2/11 + 5/12 + 6/12 + 2/12 + 3/11 + 1/12 = 2.421
                 2.421 / 9 = 0.269 = 27%
SLI_VB: 8/9 + 8/10 + 6/11 + 6/8 + 10/10 + 9/9 + 9/10 + 7/8 + 9/11 + 10/10 + 10/10 + 8/11
                 + 8/10 + 10/11 + 10/12 + 10/11 = 13.758
                 13.758 / 16 = 0.860 = 86%

Pragmatics overall (-expressing feelings):
SLI_noVB: 3/9 + 4/11 + 2/11 + 2/10 + 5/11 + 6/11 + 2/11 + 3/10 + 1/11 = 2.651
                 2.651 / 9 = 0.2946 = 29%
SLI_VB: 7/8 + 7/9 + 5/10 + 5/7 + 9/9 + 8/8 + 8/9 + 6/7 + 8/10 + 9/9 + 9/9 + 7/10 + 7/9 +
                 9/10 + 9/11 + 9/10 = 13.506
                 13.506 / 16 = 0.844 = 84%

Communicative functions:
SLI_noVB: 0/4 + 0/5 + 0/5 + 0/5 + 0/5 + 2/5 + 0/5 + 0/5 + 0/5 = 0.4
                 0.4 / 9 = 0.04 = 4%
SLI_VB: 3/4 + 3/5 + 1/4 + 1/1 + 4/4 + 3/3 + 5/5 + 4/5 + 3/4 + 4/4 + 4/4 + 3/4 + 3/4 + 4/5 +
                 4/5 + 5/5 = 13.25
                 13.25 / 16 = 0.828 = 83%

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[2] The calculations for the indicators representing expressive language of the participants needed a slightly different approach in comparison to the calculations for other categories. That is, within the expressive language category, some indicators express abilities/average scores (e.g. word formation or intelligibility) whilst other indicators express the presence of a disorder/difficulty (e.g. word finding difficulties or phonological disorder). To calculate how much difficulty a participant had with the expressive language function, the amount of 'no' answers on the indicators expressing abilities/averages scores were counted as well as the amount of 'yes' answers on the indicators expressing the presence of a disorder/difficulty. Together, this leads to a good view of the performance of a participant on the expressive language function.

Communicative functions (-expressing feelings):

SLI_noVB: 0/3 + 0/4 + 0/4 + 0/4 + 0/4 + 2/4 + 0/4 + 0/4 + 0/4 = 0.5

                  0.5 / 9 = 0.05 = 5%

SLI_VB:[3]   2/3 + 2/4 + 0/3 + 3/3 + 2/2 + 4/4 + 3/4 + 2/3 + 3/3 + 3/3 + 2/3 + 2/3 + 3/4 + 3/4 +

                  4/4 = 11.43

                  11.43 / 15 = 0.762 = 76%

Conversation skills:

SLI_noVB: 3/6 + 4/7 + 2/7 + 2/6 + 5/7 + 4/7 + 2/7 + 3/6 + 1/7 = 3.883

                  3.883 / 9 = 0.431 = 43%

SLI_VB: 5/5 + 5/5 + 5/7 + 5/7 + 6/6 + 6/6 + 4/5 + 3/3 + 6/7 + 6/6 + 6/6 + 5/7 + 5/6 + 6/6 +

                  6/7 + 5/6 = 14.34

                  14.34 / 16 = 0.896 = 90%

Social contact

SLI_noVB: 0/2 + 2/2 + 2/2 + 0/2 + 0/2 + 2/2 + 0/2 + 2/2 + 0/2 = 4

                  4 / 9 = 0.444 = 44%

SLI_VB: 1/2 + 2/2 + 2/2 + 0/2 + 2/2 + 2/2 + 2/2 + 2/2 + 2/2 + 2/2 + 2/2 + 1/2 + 2/2 + 0/2 +

                  2/2 + 2/2 = 13

                  13 / 16 = 0.813 = 81%

Features ASD

SLI_noVB: 0/1 + 1/1 + 0/1 + 0/1 + 0/1 + 0/1 + 0/1 + 1/1 + 0/1 = 2

                  2 / 9 = 0.222 = 22%

SLI_VB: 1/1 + 1/1 + 1/1 + 0/1 + 1/1 + 1/1 + 1/1 + 1/1 + 0/1 + 1/1 + 1/1 + 0/1 + 1/1 + 1/1 +

                  1/1 + 0/1 = 12

                  12 / 16 = 0.75 = 75%

Disharmonic profile:

SLI_noVB: 1/1 + 1/1 + 0/1 + 0/1 + 1/1 + 0/1 + 0/1 + 1/1 + 0/1 = 4

                  4 / 9 = 0.444 = 44%

SLI_VB: 1/1 + 1/1 + 1/1 + 0/1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/1 + 0/1 + 1/1 + 1/1 +

                  0/1 + 1/1 = 13

                  13 / 16 = 0.813 = 81

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[3] For this category, one participant (nr. 4) in the SLI_VB group was excluded from the calculations because the only communicative function that was known for this participant was whether he/she could express his/her emotions. The other four indicators representing communicative functions were unknown and, thus, blank. For the category 'communicative functions (-expressing emotions)', therefore, only 15 participants were used in the subject analysis.

Receptive language all measures:

SLI_noVB: 4/5 + 4/5 + 4/5 + 3/6 + 2/5 + 4/4 + 3/5 + 0/6 + 3/5 = 5.5

5.5 / 9 = 0.611 = 61%

SLI_VB: 4/6 + 3/4 + 5/6 + 5/6 + 5/5 + 4/6 + 5/5 + 2/5 + 4/5 + 4/6 + 5/6 + 6/6 + 5/5 + 4/5 + 3/3 + 3/4 = 13

13 / 16 = 0.81 3 = 81%

Receptive language 3 measures
(listening attitude, sentence comprehension and average passive vocabulary):

SLI_noVB: 2/2 + 3/3 + 2/3 + 0/3 + 0/3 + 3/3 + 1/3 + 0/3 + 1/3 = 4.333

4.333 / 9 = 0.481 = 48%

SLI_VB: 2/3 + 1/2 + 2/3 + 2/3 + 2/2 + 1/3 + 3/3 + 0/3 + 2/3 + 2/3 + 3/3 + 3/3 + 3/3 + 2/3 + 3/3 + 1/2 = 11.334

11.334 / 16 = 0.708 = 71%

Receptive language (-phonological discrimination)

SLI_noVB: 4/4 + 4/5 + 4/5 + 2/5 + 2/5 + 4/4 + 3/5 + 0/5 + 3/5 = 5.6

5.6 / 9 = 0.622 = 62%

SLI_VB: 4/5 + 3/4 + 4/5 + 4/5 + 4/4 + 3/5 + 5/5 + 2/5 + 4/5 + 4/5 + 5/5 + 5/5 + 5/5 + 4/5 + 3/3 + 3/4 = 13.3

13.3 / 16 = 0.831 = 83%

Expressive language:[4]

SLI_noVB: 5/8 + 5/8 + 7/7 + 7/8 + 5/8 + 5/8 + 6/8 + 5/8 + 3/7 = 6.179

6.179 / 9 = 0.687 = 69%

SLI_VB: 5/7 + 4/7 + 3/7 + 8/8 + 8/8 + 7/8 + 7/8 + 7/8 + 6/8 + 6/8 + 5/8 + 8/8 + 6/8 + 4/7 + 7/8 + 5/8 = 11.535

11.535 / 16 = 0.721 = 72%

Overall (expressive + receptive language):

SLI_noVB: 9/13 + 9/13 + 11/12 + 10/14 + 7/13 + 9/12 + 9/13 + 5/14 + 6/12 = 5.853

5.853 / 9 = 0.650 = 65%

SLI_VB: 9/13 + 7/11 + 8/13 + 13/14 + 13/13 + 11/14 + 12/13 + 9/13 + 10/13 + 10/14 + 10/14 + 14/14 + 11/13 + 8/12 + 10/11 + 8/12 = 12.560

12.560 / 16 = 0.785 = 79%

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[4] See footnote 3

Category	Group	Subject analysis	Item analysis
Pragmatics overall	SLI_noVB	27%	27%
	SLI_VB	86%	86%
Pragmatics (-expressing feelings)	SLI_noVB	29%	29%
	SLI_VB	84%	85%
Communicative functions	SLI_noVB	4%	5%
	SLI_VB	83%	82%
Communicative functions (-expressing feelings)	SLI_noVB	5%	6%
	SLI_VB	76%	76%
Conversation skills	SLI_noVB	43%	45%
	SLI_VB	90%	88%
Social contact	SLI_noVB	44%	44%
	SLI_VB	81%	81%
Features ASD	SLI_noVB	22%	22%
	SLI_VB	75%	75%
Disharmonic IQ-profile	SLI_noVB	44%	44%
	SLI_VB	81%	81%
Receptive language (all measures)	SLI_noVB	61%	59%
	SLI_VB	81%	81%
Receptive language (3 measures)	SLI_noVB	48%	50%
	SLI_VB	71%	71%
Receptive language (-phonological discrimination)	SLI_noVB	62%	61%
	SLI_VB	83%	83%
Expressive language	SLI_noVB	69%	66%
	SLI_VB	72%	77%
Language overall (expressive + receptive)	SLI_noVB	65%	63%
	SLI_VB	79%	79%