Associations between language, false belief understanding and children's social competence

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Abstract

The current longitudinal study explores associations between language and social competence. Specifically, I examine whether language variables, such as using and hearing mental state words and specific aspects of communication, are linked to social competence through the social skill of perspective-taking and the ability to understand that other people might hold a false belief. A cohort of 67 children were assessed at three time points. The initial assessment took place at ages of 24–30 months; and the first follow-up assessment occurred at ages of 41–49 months, and the outcome assessment took place when the children were aged 52–60 months. Data were collected through standardised tests of language and cognition, coded spontaneous play-based language samples, a nonverbal false-belief task and parental questionnaires that represent aspects of Cavell's (1990) social competence model.

The findings indicated that mothers' connected communication played a role in their children's social development. Mothers who more often referred to their 2-year-old child's utterances, reformulated, elaborated or answered to them in an appropriate manner described their children as socially more advanced later in development compared to mothers who were less connected in communication with their child. However, mothers' connectedness in communication with their children was no longer a significant predictor once the children's expressive and receptive language abilities were added to the regression model. Children's expressive vocabulary including words to refer to mental states at the age of two years was a predictor of their social competence at five years. Children who produced more words in general and more often used words to refer to their own and others' mental states such as emotions, desires or cognition at two years had fewer social difficulties at five years than children who produced fewer words and made fewer references to mental states.

No relationship was found among mental-state talk, communication connectedness and false-belief understanding and between false-belief understanding and social competence.

These findings indicate that being able to express oneself and to refer to mental states helps young children to interact more effectively in the social world. Therefore, considering the impact that early language competency has on social development identification of children with language difficulties becomes even more important.

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List of Abbreviations

ASD	Autism Spectrum Disorder
CDI	MacArthur Bates Communicative Development Inventory
CELF-P2	Clinical Evaluation of Language Fundamentals - Preschool (Second Edition)
CPM	Coloured Progressive Matrices
SLI	Specific Language Impairment
OAE	Otoacoustic Emissions
PQ	Parental Questionnaire
ROWPVT-4	Receptive One Word Picture Vocabulary Test (Fourth Edition)
SALT	Systematic Analysis of Language Transcription
SDQ	Strengths and Difficulties Questionnaire
SRS-2	Social Responsiveness Scale (Second Edition)
VIFs	Variance Inflation Factors

1 Introduction

1.1 Aim of the current study

There has been a long-standing interest in the relationship between early language measures and later social competence, but lately, this topic has been discussed with renewed interest (Clegg, Law, Rush, Peters, & Roulstone, 2014; Conti-Ramsden, Mok, Pickles, & Durkin, 2013; Lindsay, Dockrell, & Strand, 2007). A robust association between language and social competence has been reported (Conti-Ramsden & Botting, 2008; Van Daal, Verhoeven, & Van Balkom, 2007). One major source of past research regarding this relationship has been clinical groups such as children with language delay or impairment (Fujiki, Brinton, & Clarke, 2002; Horwitz et al., 2003; Irwin, Carter, & Briggs-Gowan, 2002; Knox & Conti-Ramsden, 2003). Some of these children have been described as having poor social skills, social cognitive abilities as well as emotional and behavioural self-regulation (Cohen et al., 1998; Fujiki et al., 2002; Fujiki, Brinton, & Todd, 1996; Lindsay & Dockrell, 2000; Lindsay et al., 2007; Marton, Abramoff, & Rosenzweig, 2005; Qi & Kaiser, 2004). These difficulties are in turn the bases for poorer social adjustment, especially in terms of a low status among peers. However, when children with language difficulties were further examined, individual differences in being socially competent became apparent. Some children with language difficulties also displayed social problems, but others were doing just fine in a broad range of social contexts. They had friends and displayed good social skills (Fujiki, Brinton, Morgan, & Hart, 1999; Guralnick, Connor, Hammond, Gottman, & Kinnish, 1996; McCabe & Meller, 2004). This indicates that the relationship between language and social competence is not straightforward and that it is very likely that specific variables of language and additional aspects of development further influence the ability to interact effectively in children

with language difficulties. To date, little is known about which aspects of language or development are important for children to become socially competent.

In the current study, I examine whether specific aspects of language are linked to social competence through the social skill of perspective-taking and the ability to understand that a person might be mistaken about the reality and thus holding a false belief. It has been reported that language measures are associated with false-belief understanding in both typically developing children (Astington & Jenkins, 1999; Hughes & Dunn, 1998; Slade & Ruffman, 2005) and clinical groups (Happé, 1995; Nilsson & Jensen de Lopéz, 2016; Peterson & Siegal, 1995*;* Siegal & Peterson, 2008; Tager-Flusberg & Joseph, 2005). By contrast, considering another person's perspective and understanding that someone else might hold a false belief is an essential skill in developing social competence (De Rosnay, Fink, Begeer, Slaughter, & Peterson, 2013; Nangle, Grover, Holleb, Cassano, & Fales, 2010; Slaughter, Dennis, & Pritchard, 2002). Even though this indicates a probable relationship among these variables, the degree of association has not been established, thus warranting further investigation into associations among these aspects of development.

Three corresponding research questions aimed at addressing this aim have been formulated and are presented in the current study. The first question relates to the relationships among mental state talk, communication connectedness and false-belief understanding in young children. The second research question concerns the relationships between measures of child and maternal mental-state talk, communication connectedness and social competence. The third question addresses the relationship between false-belief understanding and social competence. The goal is to clarify the relationship among children's developing language skills, false-belief understanding and social competence.

1.2 Overview of the current study

This thesis consists, in addition to this chapter (Chapter 1), of four additional chapters. In Chapter 2, the current study is related to the existing literature. In this chapter, background information for a full understanding is provided. The literature related to social competence, false-belief understanding, mental state talk and communication is examined. The main constructs of social competence and false-belief understanding are defined, and associations between the constructs are investigated. The main argument put forward in this chapter is that the relationship between false-belief understanding and social competence might be mediated by individual differences in language ability. In other words, specific language assessments may reflect the extent to which children's false-belief understanding hinges on their language abilities and how this influences their social competence. Specific research questions and hypotheses are formulated accordingly. Chapter 3 establishes the methodological issues and describes the research design of the current study. Instruments and assessments used to collect and analyse data are presented. A detailed coding scheme of transcripts of spontaneous play-based language samples is provided. In chapter 4 the results of data analysis are presented. This chapter includes descriptive statistics for all mother and child variables, correlation and regression analysis that provides specific results to answer the stated research questions and secondary analysis. Chapter 5 provides conclusions of the current study and discusses them in the context of the existing literature. This chapter is the discussion on the key findings and the contribution of the current study. It further contains the study's conclusions, an evaluation of the study and suggestions for further research.

2 Literature review and the rationale of the study

This chapter introduces and defines social competence and false-belief understanding, which are the main constructs in the current study. It consists of four main sections. In Section 2.1, a possible understanding of social competence and according tripartite model are introduced and discussed. This model provides important links for the assessment of children's social competence. In Section 2.2, false-belief understanding in children is described as a critical social skill in becoming socially competent; therefore, it is explored further. A possible view of the developmental trajectory of false-belief understanding is stated in this section. In Section 2.3, studies are reviewed that observed social competence in children who display either expressive language delay or a specific language impairment. This section builds the case that language and social competence are related, and this relationship is provided in Appendix A. In Section 2.4, this relationship is examined in more depth, and it is argued that language is linked to social competence through the social skill of perspective-taking and the ability to understand that other people might hold a false belief. How language is related specifically to this social skill is discussed in the subsequent subsections. Subsequently, specific research questions and hypotheses are presented. Finally, a summary and a conclusion of this chapter are provided.

2.1 Children's social competence

Over the last 40 years, there has been a considerable increase in research on how children develop socially (see a review by Parker, Rubin, Price, & DeRossier, 1995). Several factors had led to this widespread interest, including an increasing recognition of associations between difficulties in peer relationships and poor social, emotional and academic adjustment

(Newcomb, Bukowski, & Pattee, 1993; Parker et al., 1995). The term 'social competence' is often used as if researchers shared a common understanding. However, there are various published definitions of social competence that have little agreement on its attributes (Dodge, 1985; Hubbard & Coie, 1994; Nangle, Grover, Holleb, Cassano, & Fales, 2010). Table 1 presents a sample of research definitions of social competence to demonstrate the variety of definitions, as reviewed by Rose-Krasnor (1997).

Table 1
Definitions of 'social competence'

Author	Definition of 'social competence'
Attili (1990)	'social success' (p. 241)
Canino, Costello, & Angold (1999)	'ability to function appropriately in interpersonal interaction' (cited in John, 2001, p. 182)
Conger & Conger (1982)	'degree to which a person is successful in interpersonal interactions or transactions taking place in the social sphere' (p. 314)
Duck (1989)	'ability to achieve desired outcomes and show adaptability across contexts' (p. 92)
Goldfried & D'Zurilla (1969)	'the effectiveness or adequacy with which an individual is capable of responding to various problematic situations that confront him' (p. 161)
Gresham (1986)	'evaluative term based on judgments that a person has performed adequately' (p. 145)
Greenspan (1981)	'that portion of an individual's perceived effectiveness in interpersonal situations and social roles that is attributable to qualities of temperament, character, and social awareness' (p. 24)
McFall (1982)	'quality or adequacy of a person's overall performance in a particular task' (p.12)
Rubin & Rose-Krasnor (1992)	'the ability to achieve personal goals in a social interaction while maintaining positive relationships with others over time and across situations' (p. 285)
Taylor & Asher (1984)	'the formulation and adaption of personal goals that are appropriate and adaptive to specific social situations and implementing effective behaviour strategies for achieving goals' (p. 57)

Trower (1982)	'the possession of the capability to generate skilled behaviour' (p. 57)
Waters & Sroufe (1983)	'an ability to generate and coordinate flexible, adaptive responses to demands and to generate and capitalise on opportunities in the environment (i.e., effectiveness)' (p. 80)
White (1959)	'an organism's capacity to interact effectively with its environment' (p. 297)
Yeates & Selman (1989)	'the development of the social-cognitive skills and knowledge, including the capacity for emotional control, to mediate behavioural performance in specific contexts, which in turn are judged by the self and others to be successful and thereby increase the likelihood of positive psychosocial adjustment' (p. 66)

Note: Reprinted with permission from "The Nature of Social Competence: A Theoretical Review," by L. Rose-Krasnor, 1997, pp. 111–135.

Although these definitions differ in focus and detail, common elements are apparent. Most of these researchers appear to agree that social competence entails being effective within a social context which means activating the most appropriate social skill to handle a given social situation and to manipulate others to achieve a desired goal. Appropriate and effective social interactions are needed for successful performance across diverse settings (e.g., home, work, school, and social events) and with a variety of people, including family, friends, supervisors and other members of the community (Hansen, Giacoletti, & Nangle, 1995). Individuals who are regarded as being socially competent and interpersonally skilful display the ability to relate to other people effectively in various social settings (Kelly, 1982).

However, despite this general agreement, discordance arises at more specific levels of definition. Several models of social competence have included a wide range of possible skills associated with competence. Cavell (1990) proposed a tripartite model (illustrated in Figure 1) that summarises the most important types of operational definitions that have emerged in the social development literature. This model portrays social competence as a multilevel, hierarchical construct made up of social adjustment, social performance and social skills.

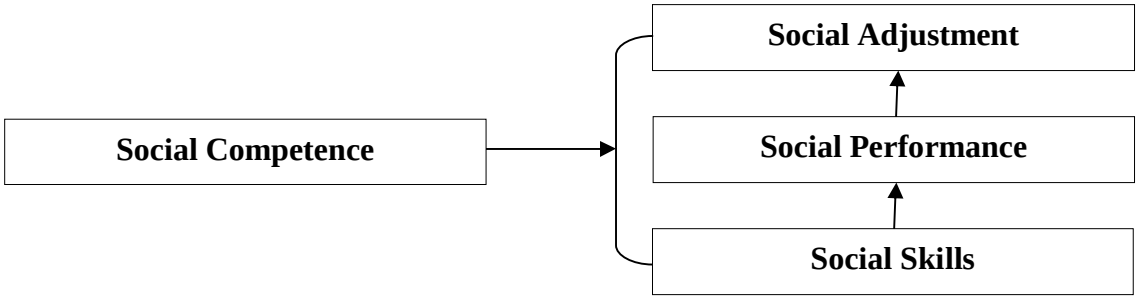


Figure 1. Cavell's (1990) tripartite model of social competence.

Social adjustment is at the top of the hierarchy and reflects the extent to which individuals achieve societally determined, developmentally appropriate goals (Ford, 1982; Zigler & Trickett, 1978). These goals are age-appropriate accomplishments that are often viewed as valuable, such as legal status, academic or occupational status, and socioeconomic status. Another measurement of social adjustment is psychological status, which involves social (e.g., peer status), emotional (e.g., self-concept and others' global judgment), familial (e.g., make-up and degree of cohesion), and relation (e.g., quality of friendships and dating frequency) status.

Social performance refers to the overall quality of an individual's responses in relevant social situations. Specifically, it refers to a degree in which an individual's response meets socially valid criteria. Social performance is distinct from its hypothesised skills and supposed products. Methods of identifying relevant social tasks and associated task criteria should be socially valid and empirical.

The final component, social skills, is defined as the specific abilities or behaviours that individuals display to produce a certain social response. Proposed skills which seem to be necessary for being socially competent range from cognitive (e.g., false-belief understanding, perspective-taking, skills for processing/acquisition), emotional (e.g., affect regulation), and

behavioural (e.g., communication skills and pro-social behaviour) skills and abilities as well as motivational and expectancy sets (e.g., moral development and self-efficacy).

This hierarchical model indicates that the components build on each other. For example, it suggests that having good initial social skills may lead to good social performance and later successful adjustment. For instance, a child with appropriate social skills may often be chosen to play with and is liked to be part of group activities. Moreover, continued acceptance by peers and inclusion into peer groups may initiate, motivate and support the development of further social skills, enhance interpersonal understanding and foster feelings of social self-worth (Hartup, 1983; Parker et al., 1995). Furthermore, continued acceptance by peers and inclusion into peer groups may increase the child's social, emotional and relationship status.

Conversely, social skill deficits may lead to more long-term performance and adjustment problems. For example, a child with language difficulties may be less proficient in communicating his or her intentions, feelings, and problem-solving strategies and, therefore, be perceived as less socially competent and face repeated rejection and exclusion from peer-group activities. As a result, such a child may spend more time alone or interacting with less skilled peers, thus limiting his or her opportunities to learn age-appropriate social skills for future interactions. Links between poor peer relationships in childhood and long-term social adjustment difficulties have been reported. For example, preschool children who are rejected by their peers can be expected to experience continued social problems, poor school adjustment, greater academic difficulties, and mental health problems at a later stage (Ladd & Asher, 1985; Parker & Asher, 1987). Boivin, Hymel and Bukowski (1995) reported that peer rejection and social isolation lead to feelings of uncertainty, loneliness and anger, thus creating vulnerability to anxiety, depression and estrangement. It was also argued that rejected children tend to choose disruptive and/or destructive solutions to problems (Fabes, Gaertner, & Popp, 2005) and are more likely to keep their low social status over time (Coie & Dodge, 1983).

Even though many examples of links among social skills, social performance and social adjustment have been demonstrated, there remains a disagreement about whether social skills that are needed to meet task demands are sufficient for a successful social performance. Sometimes children choose social goals that lead to poor performance even though they possess the necessary skills or they perform inappropriately because of a lack of motivation for doing well (Gresham & Cavell, 1986; Renshaw & Asher, 1983). Depending on the environment, the use of antisocial skills, rather than pro-social skills, can sometimes be the most effective strategy to reach a goal. Cavell (1990) argued that from a pragmatic viewpoint, social skills are necessary but insufficient elements of effective social behaviour, and consequently, deficits should not be considered as the only cause of poor performance. It is unclear whether inadequate performance can be explained only by a skill deficit or whether other factors also play a role.

Therefore, to successfully evaluate children's social competence, Cavell (1990) highlighted the importance of a broad assessment that considers the tripartite model. Specifically, this means that a broad-based assessment of social adjustment, social performance in relevant situations and social skills is needed to successfully assess a child's social competence.

2.2 Children's perspective taking and false-belief understanding

Nangle et al. (2010) indicated that there is considerable consensus in the literature that one social skill that is considered to be necessary for being socially competent is making inferences about the behaviours, thoughts, beliefs and emotions of others and considering their perspective. Attributing false beliefs about oneself and others is one of the most important milestones in this skill; that is, to understand that a person might be mistaken about the reality and thus be holding a false belief. Many terms have been suggested for this ability, including 'theory of mind' (Wellman, 1990), 'mind-reading' (Apperly, 2011), 'mental state understanding' (Flavell, 2000), 'emotion understanding' (Harris, 1989) and 'social understanding' (Carpendale & Lewis, 2006). These are overlapping terms that are used interchangeably at times (Astington & Baird, 2005). Even though the term 'theory of mind' currently dominates the field, it will not be further used in the current study. Over the recent years, the assessment of the theory of mind has been greatly expanded by using new tasks, testing a greater age range of human participants and adopting methods from cognitive psychology and neuroscience. Apperly (2012), therefore, stated that there is more to theory of mind than is commonly supposed. He argued that different traditions and approaches in research on the theory of mind are committed to different views of what theory of mind is: supposing that it is a body of conceptual knowledge that is consisted in cognitive processes and that it is a social competence that can vary across individuals. Apperly (2012) argued that is it critical to distinguish between these aspects because they lead us to asking different questions that need to be addressed in different ways. Given the context, one purpose of the current study is to investigate children's ability to consider someone else's perspective and their capacity to understand false belief. In particular, the focus of the current study is on the important role that children's language abilities and conversational environments play in promoting their ability to draw such inferences and become socially competent. Following Apperly's (2012) argument, this is only

one aspect of the theory of mind; therefore, I opted against using this term. As Bloom and German (2000) further highlighted, there is more to the theory of mind than passing a false-belief task.

The understanding that other people can have a false belief has been found to be critical for children to become socially competent (De Rosnay et al., 2013; Slaughter et al., 2002). De Rosnay et al. (2013) found that false-belief understanding predicted socially competent everyday behaviour such as successful conversational interactions with peers in young school-attending children. Slaughter et al. (2002) found a significant relationship between false-belief understanding and peer acceptance in preschool children. Other studies have related false-belief understanding to more positive peer interactions (Dunn & Cutting, 1999; Dunn, Cutting, & Demetriou, 2000; Mcelwain, Hill, & Volling, 2002). Additionally, significant associations were found between false-belief understanding and understanding deception (Sodian, 1991), jokes and lies (Leekam & Prior, 1994), irony, white lies and double bluff (Happé, 1994). Furthermore, associations between false-belief understanding and the overall pragmatic language competence have been reported (Eisenmajer & Prior, 1991).

From their second year of life on, children develop an understanding of the intentional nature of human behaviour (Harris, 1989; Nelson, 2005). This involves an understanding of their own and others' mental states, the ability to draw inferences about others' mental states, intentions and perspectives as well as an understanding of deception and false belief (Hwa-Froelich, 2015). One of the first empirical investigations into the understanding of false belief was conducted by Clements and Perner (1994), who observed children's eye gaze during anticipation of an actor's return to search for a displaced object. They found that children between the ages of 2;11 and 3;7 years gave an incorrect verbal response when asked where the actor would re-appear to search for the object but looked at the correct location. The majority of older children both gave a correct verbal response and looked at the correct location. Clements and Perner (1994) argued that three-year-old children may have implicit under-

standing of belief, which could be fundamental for their explicit understanding that emerges sometime during their fifth year of life. Implicit understanding of belief is unconscious, whereas explicit understanding is conscious and abstract. Since then, several studies have documented that implicit false-belief performance is present in children between the ages of 14 and 24 months using a violation-of-expectations paradigm or similar measures of looking time to test infants' understanding of belief (Onishi & Baillargeon, 2005; Southgate, Chevallier, & Csibra, 2010; Surian, Caldi, & Sperber, 2007). Onishi and Baillargeon (2005) reported that infants as young as 15 months look longer (indicating increased processing time) when an actor looks for a displaced object in its new location rather than where they last saw it. Related results have since been independently obtained with 13-month-olds (Surian et al., 2007). Further support for the implicit understanding of false belief can be found in children's early social interactions. Children as young as two years begin to indicate new and advanced forms of social interaction, including tricks, jokes and deception (Newton, Reddy, & Bull, 2000) and blaming others for their own wrongdoings (Dunn, 1988; Wilson, Smith, & Ross, 2003). Rather than being simple behavioural practices that achieve desired outcomes and avoid undesired consequences, such behaviours appear to mirror young children's thoughtful attempts to create false beliefs about others (Newton et al., 2000).

Explicit understanding of belief has been reported to be observable in children from the age of four years onwards (Baron-Cohen, Leslie, & Frith, 1986; Gopnik & Astington, 1988; Perner, Leekam, & Wimmer, 1987; Wellman, Cross, & Watson, 2001; Wellman & Bartsch, 1988; Wimmer & Perner, 1983). This later developing system is abstract and conscious (Low, 2010) and allows children to explain verbally why someone has a false belief and how that false belief affects his or her actions. It is from four years onwards that most children are able to pass different variations of the false-belief task pioneered by Wimmer and Perner (1983). In an unexpected change-of-location false-belief task, children observe a protagonist acting with an object and then putting it in a location. In the next phase, children see

how this object is placed in another location while the protagonist is either distracted or not present. Finally, the experimenter wants to establish whether a child understands that the protagonist mistakenly believes that the object is still in the original location. There is a broad variation of how to test this understanding, for example, by asking the child where the protagonist will look for the object (Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983) or by engaging the child to help the protagonist (Buttelmann, Carpenter, & Tomasello, 2009; Southgate et al., 2010). These improvements in understanding belief seem to make four-year-olds more sophisticated social partners; false-belief performance is related to teacher ratings of social and conversational skills (De Rosnay et al., 2013; Lalonde & Chandler, 1995). A child's mastery of false-belief understanding could conceivably 'transform children's social relations' (Hughes & Leekam, 2004, p. 590) because they start to realise that people's behaviours are sometimes not what reality might dictate.

Most obvious becomes the relationship between false-belief understanding and social competence in children with autistic spectrum disorders. These children are described as having difficulties in understanding false belief and also having impairments in social and communicative functioning (Leslie, 1987).

2.3 Social competence in late talkers and children with specific language impairment

The previous two sections have introduced the main constructs of social competence and false-belief understanding. Possible definitions and developmental trajectories have been provided to establish the general framework to be used. In this section, language and its typical and atypical development is discussed. Associations between early language skills and social competence is demonstrated by summarising studies that include children with language difficulties.

Language is a complex multifaceted system that is used for social communication (Astington & Baird, 2005). Through language, people are able to express themselves and understand others. In a successful verbal interaction, people use socially determined shared rules (e.g., word meaning, pronunciation, word combinations, grammar rules, gestures, and facial expression). A distinction can be made between receptive and expressive language. Receptive language is the ability to understand input from both spoken and written language. It is more than just understanding words and gestures but also includes the ability to understand grammatical forms such as interpreting a question. Expressive language is considered as the output of language and includes spoken language. It is important to make a distinction between speech and expressive language. Speech production refers to the manner a person produces speech sounds, whereas expressive language is the ability to put thoughts, wants and beliefs into words and sentences. Children vary in their development of receptive- and expressive-language skills, but similar patterns have been described. Typically, children utter their first words between 9 and 18 months. By this age, their vocabulary can include 50 to 150 words. Around their second birthday, they can produce over 300 words and understand about 1000. In addition, they begin to put words together to form two-word sentences such as "mummy car". A year later, they use language to get things, to ask questions, to talk about past experiences, and even to pretend. Around four-and-a-half years of age, children begin to understand and use more sophisticated rules of language and begin to sound more adult-like. In school, children maintain the expansion of their use of language; they refine their grammatical skills and learn to read and write (Gleason & Ratner, 2013; Huilt & Howard, 2001).

Some children do not reach these well-established milestones and are delayed or impaired in their language development. Children who are delayed in their expressive language are called "late talkers". They are usually recognised in the age range of 18–30 months. There are a number of criteria used to identify these children. They use expressive words that are fewer than 50 (Paul, 1996; Rescorla, 1989) and/or no two-word combinations (Klee, Carson,

& Gavin, 1998), a performance that is more than one standard deviation below the mean on a standardised language assessment (Zubrick, Taylor, Rice, & Slegers, 2007) or cut-offs of the 10th, 15th and 20th percentiles for expressive vocabulary (Beckage, Smith, & Hills, 2011). Leonard (1998) defined children who score less than 1–1.5 standard deviations below the mean on one or more sub-tests of a standardised language measure, in the absence of sensory, environmental, cognitive or social emotional difficulties, as children with specific language impairment (SLI). Prevalence of SLI is reported between 3 and 7% (Norbury & Paul, 2013).

Although language skills are presumed to be one crucial aspect of a successful social interaction (Hazen & Black, 1989), the nature of the relationship between language and social competence is still unclear (Botting & Conti-Ramsden, 2008; Fujiki, Brinton, & Clarke, 2002). Most research regarding language skills and social competence has been conducted on clinical groups such as the aforementioned late talkers and children with SLI.

The interest in the social and behavioural development of children with speech and language difficulties stems mostly from the work of Baker and Cantwell (1987), who studied psychiatric outcomes for children with language difficulties in later childhood. Children with speech and language difficulties displayed more psychiatric problems compared to controls. This early study reported that children with receptive rather than expressive language difficulties were more at risk to display a psychiatric problem. However, the findings were confounded by the heterogeneity of the children involved, thus making it difficult to describe the nature of the relationship between language difficulties and social and behavioural development. Many subsequent studies have explored this relationship in more depth.

Four research groups have observed social competence in children with expressive language delay at the age of approximately two years (Carson, Klee, Lee, Williams, & Perry, 1997, 1998; Horwitz et al., 2003; Irwin, Carter, & Briggs-Gowan, 2002; Paul, Looney, & Dahm, 1991). All these studies found a close relationship between expressive language delay and limited social competence, as children with expressive language delay had significantly

lower scores on standardised socialisation scales compared to their age-matched, typically developing peers. Children at the age of 24 months with expressive language delay exhibited more symptoms of anxiety and depression, withdrawal, sleep problems and other behavioural disturbances than their typically developing peers (Carson et al., 1998). Irwin et al. (2002) found that children in the age range of 21–31 months with expressive language delay are more likely to experience depression and withdrawal and to display less social understanding and interest in play than typically developing controls. In addition, Horwitz et al. (2003) found that two-year-olds with expressive language delay are seven times more likely than typically developing children to also display low social performance in interacting with their peers.

Children with SLI as a group tend to score lower than typically developing children on a range of social skill measures, measures of social cognitive abilities as well as emotional and behavioural self-regulation (Cohen et al., 1998; Fujiki, Brinton, & Clark, 2002; Fujiki, Brinton, & Todd, 1996; Huaqing Qi & Kaiser, 2004; Lindsay & Dockrell, 2000; Lindsay, Dockrell, & Strand, 2007; McCabe & Meller, 2004; Marton, Abramoff, & Rosenzweig, 2005). Some of these children feel more lonely and less often chosen to play with by their classmates (Fujiki et al., 1996; Gertner, Rice, & Hadley, 1994); about a third of them are bullied by peers and can be targets of victimisation (Conti-Ramsden & Botting, 2004; Knox & Conti-Ramsden, 2003). Teachers report that they can have lower social skills and more behaviour problems than their peers (Fujiki, Brinton, & Todd, 1996). Children with SLI were also rated as having significantly more hyperactivity than children with typically developing language (Beitchman, Wilson, Brownlie, Walters, & Lancee, 1996; Bretherton et al., 2013; Lindsay, Dockrell, & Strand, 2007; McCabe & Meller, 2004; McCabe, 2005). Furthermore, children with SLI often have the desire to approach other children but are afraid of doing so and spend significantly less time interacting with their peers in the playground than typically developing children (Fujiki, Brinton, Isaacson, & Summers, 2001; Fujiki, Spackman, Brinton, & Hall, 2004; Hart, Fujiki, Brinton, & Hart, 2004). An increased risk of anxiety in young lan-

guage-impaired children has been reported (Nelson, Benner, & Cheney, 2005; Stanton-Chapman, Justice, Skibbe, & Grant, 2007). Children with SLI are described as displaying more internalising problem behaviours than age-matched children. Children with internalising problem behaviours have difficulty coping with negative emotions or stressful situations, so they direct their feelings inside. Because they occur on the inside, internalising behaviours are typically not visible to others. Internalised problem behaviours that have been found in children with SLI are social withdrawal, difficulty with emotional decoding, social problem solving and peer problems (Brinton & Fujiki, 1999; Cohen et al., 1998; Fujiki et al., 1996; Fujiki, Brinton, Isaacson, & Summers, 2001; Redmond & Rice, 1998; Stanton-Chapman et al., 2007). Yet children with SLI are also at increased risk of externalising difficulties. These are problem behaviours that are directed toward the external environment. Instead of expressing their negative emotions, children with externalising behaviours direct those towards other people. Externalising problem behaviours that are found in children with SLI are conduct problems and hyperactivity (Beitchman et al., 2001; Botting & Conti-Ramsden, 2000; Bretherton et al., 2013; Brownlie et al., 2004; Cohen et al., 1993; Conti-Ramsden & Botting, 2004; Ripley & Yuill, 2005). Children with SLI are less active in co-operative work groups than their typically developing peers (Brinton, Fujiki, & Higbee, 1998). In general, children with SLI are less likely to exhibit skilled pro-social behaviour (Bretherton et al., 2013a; Fujiki et al., 1999; Stevens & Bliss, 1995).

The risk of developing social and behavioural difficulties in children with SLI seems to increase across childhood (Bartak, Rutter, & Cox, 1975; Beitchman, Cohen, Konstantareas, & Tannock, 1996; Botting & Conti-Ramsden, 2000). Cantwell, Baker, Rutter and Mawhood (1989) compared boys with SLI and boys with autism with regard to their social and behavioural development. Difficulties within these fields of development were severe and persisting in the boys with autism from the age of eight years onwards. By contrast, boys with SLI did

not display social and behavioural problems at those ages, but the difficulties emerged in later childhood and worsened as they grew older (Howlin, Mawhood, & Rutter, 2000).

Longitudinal studies of children with SLI indicated that early language difficulties can later have an impact on employment opportunities, friendships, romantic relationships, and general well-being as well as an increased likelihood of involvement in antisocial behaviour (Brownlie et al., 2004; Clegg, Hollis, Mawhood, & Rutter, 2005; Records, Tomblin, & Freese, 1992; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). Young men at the age of 19 years with a history of SLI had higher rates of arrests and convictions even though they exhibited a lower level of aggression than young men without language impairment. This indicates an association between speech and language difficulties and the development of antisocial behaviour (Brownlie et al., 2004). Adults with SLI displayed a high level of social maladaptation and poor psychosocial functioning when compared to controls (Clegg et al., 2005). Seventeen men with SLI in their mid-30s were assessed for social adaption. The men displayed a higher rate of unstable employment histories with prolonged unemployment. More than half of them reported a limited range of friendships and experienced fewer romantic relationships compared to controls.

When one considers these studies on late talkers and children with SLI, the relationship between language difficulties and social competence becomes obvious. Lower language skills seem to influence the development of social skills such as pro-social behaviour and conversation skills as well as social performance. In addition, these difficulties seem to promote poorer social adjustment, especially in terms of low peer and relation status. However, when children with language difficulties are further examined, individual differences in being socially competent become apparent. Some children with language difficulties also display social problems, but others do just fine in various social contexts. They have friends and display social skills that can be considered to be good (Fujiki et al., 1999; Guralnick et al., 1996; McCabe & Meller, 2004). Durkin and Conti-Ramsden (2007) found that 54% of 14-year-old

individuals with language impairment reported a normal range of social relationships, compared to 92% of typical children at the same age. Although these differences are significant, a large number (46%) of adolescents with language impairment still reported typical social experience. This indicates that the relationship between language and social competence is not straightforward and that it is very likely that specific variables of language and additional aspects of development must further influence social competence in children with language difficulties.

2.4 Language and the development of perspective taking and false-belief understanding

As described in Section 2.2, understanding false belief is essential to becoming socially competent, but it has also been reported that language measures are related to taking someone else's perspective into account and understanding that a person might hold a false belief. Experimental support for this relationship has been found in children with typical language development (Astington & Jenkins, 1999; Ted Ruffman, Slade, Rowlandson, Rumsey, & Garnham, 2003; Slade & Ruffman, 2005; Watson, Painter, & Bornstein, 2001). Astington and Jenkins (1999) assessed 59 three-year-olds on language and false-belief understanding three times over a period of seven months. They concluded that language abilities predicted false-belief understanding, but false-belief understanding did not predict later language performance. Slade and Ruffman (2005) assessed 44 children at a mean age of three years and eight months with typical language development on four language and three false-belief tasks. The same children were re-tested six months later. They reported that language predicted later performance on false belief tasks.

Further support for a relationship between language and false-belief understanding has been found in studies including children with autism (Fisher, Happé, & Dunn, 2005; Happé, 1995; Tager-Flusberg & Joseph, 2005). Happé (1995) conducted a study that observed the

role of age and verbal ability in false-belief understanding. She reported that a higher verbal mental age was required in children with autistic spectrum disorder to pass false-belief tasks than in typically developing children. Fisher et al. (2005) also found a significant relationship between language performance and false-belief understanding when testing 44 children with autism. Specifically, grammar and vocabulary were significant predictors of false-belief understanding in children with autism.

Similar findings were reported for children with language impairment (Farrant, Fletcher, & Maybery, 2006; Holmes, 2002; Tucker, 2004). Farrant et al. (2006) reported a significantly lower score on false-belief tasks for children with SLI than for typically developing children. Nilsson and Jensen de Lopéz (2016) reviewed 17 studies including 745 children between 4 and 12 years old. They reported that children with SLI performed poorer on false-belief assessments compared with their typically developing peers.

More evidence for a relationship between language performance and false-belief understanding came from studies that observed children with visual impairment (see Siegal & Peterson (2008) for a review) and young late-signing children with hearing impairment who were born into non-signing families and, therefore, have restricted access to family conversations (Meristo, Strid, & Hjelmquist, 2016; Peterson & Siegal, 1995; Peterson, 2009). Peterson and Siegal (2000) reviewed 11 published studies that assessed more than 200 children with hearing impairment all over the world whose false-belief understanding was assessed using sign language. They reported that serious difficulties in standard false-belief tasks were consistently revealed by late-signing children with hearing impairment, whereas native signing children with hearing impairment displayed no such difficulties.

So far, studies that demonstrate a link between language performance and false-belief understanding have been summarised. Further information, which helps to improve the understanding of the relationship between language and false-belief understanding, is provided by experimental language interventions. Hale and Tager-Flusberg (2003) reported that language-

based interventions improved children's false-belief understanding. In one intervention, children were talking about story characters that held false beliefs. In a second intervention, they discussed story characters that made false claims. In both settings, the children received corrective verbal feedback if they misinterpreted what the character had said or thought. Both interventions proved very effective in assessing three-years-olds' understanding of false belief.

Considering these studies, it becomes apparent that certain aspects of language are related to false-belief understanding. Nonetheless, it is still unclear which specific elements of language are involved in children's false-belief understanding. This has been a topic of some dispute (Astington & Baird, 2005; Botting & Conti-Ramsden, 2008; Carpendale & Lewis, 2006; Milligan, Astington, & Dack, 2007). Recently, two main specific but related claims have been made about this relationship. First, it has been argued that the acquisition of words to refer to mental states (mental state talk) is crucial for children's false-belief understanding (Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003; Symons, Fossum, & Collins, 2006). Second, it has been argued that verbal interchange that children experience in communication plays a significant role in false-belief understanding (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Harris, 1996, 2005; Tomasello, 2000). Especially, communication that takes place in the context of positive joint activities (connected communication) seems to be important. From this understanding, children with autistic spectrum disorder, late-signing children with hearing impairment and children with visual impairment may all have, for different reasons, difficulties in participating in everyday communication with others. There is a possibility that this might affect their acquisition of false-belief understanding. What is not yet clear in this account, however, is whether references to mental states or communication itself is most critical. These aspects are further explored in the following two sub-sections.

2.5 Mental state talk

Mental states refer to internal psychological experiences (e.g., desires, emotions, thoughts and knowledge) that cannot be directly perceived by third persons in the same manner that physical bodies can (Moore, 2007). Mental states are defined with regard to the challenge children face when trying to link apparent actions and behaviours with mental states that cannot be observed directly. In other words, people do not have access to what others want, like or know but must infer these mental states on the basis of what they do and say. Additionally, mental states cannot be regarded as isolated entities. Rather, they need to be understood with regard to the person who is experiencing the mental state and the context in which the person has the mental experience. Barresi and Moore (1996), therefore, defined mental states in terms of intentional relations in which a mental state mediates the relation between a subject and an object. Consider the following examples: (a) Nino *thinks* that his ice-cream is cold; (b) Nino *wants* to have an ice-cream; and (c) Nino *loves* his ice-cream. In all three examples, there is a subject (Nino), who is engaged in some intentional activity (italicised verb) with an object (the ice-cream). How the relationship between the subject and the object is understood is dependent on the specific mental state term.

Given this understanding, Hall and Nagy (1987) offered an informative framework that includes three categories of mental state terms: (1) those that refer to intentions and desires (e.g., want, like, wish, and need); (2) those that encode meanings about what is experienced, whether in the form of emotions (e.g., happy, sad, afraid, and grumpy) or physiological reactions (e.g., hungry, tired, and thirsty); and (3) those that encode beliefs or cognitive states (e.g., think, know, remember, and believe).

Bartsch and Wellman (1995) found that by 18 months, children begin to produce their first words such as 'want' to refer to their own and others' desires. Furthermore, at the same age children use terms that refer to emotional states using such terms as 'happy', 'sad', and

'mad' (Bartsch & Wellman, 1995; Dunn, Bretherton, & Munn, 1987). By 28 months, children more often use terms that refer to physiological states, whereas terms that refer to cognitions and beliefs are less common (Bretherton & Beeghly, 1982). These terms (such as think, know, and guess) seem to appear more often at the age of approximately three years (Bartsch & Wellman, 1995; Shatz, Wellman, & Silber, 1983).

When parents talk to 16-month-olds in everyday situations, they use desire terms (specifically 'want') more frequently than other mental state terms (Smiley & Huttenlocher, 1989). References to cognitive states using the terms 'think' and 'know' increase with age (Beeghly, Bretherton, & Mervis, 1986; Ted Ruffman, Slade, & Crowe, 2002; Taumoepeau & Ruffman, 2006, 2008), although the proportion of desire terms to cognitive terms can vary considerably for individual children (Bartsch & Wellman, 1995). When parents refer to emotions, pleasure and distress terms are used most frequently (Brown & Dunn, 1991; Dunn et al., 1987, 1991; Smiley & Huttenlocher, 1989). Thus, before a child's second birthday, parents most often refer to children's desires and emotions but increasingly start to talk about thoughts and knowledge around 24 months.

Several studies have explored the relationship between parental and child mental state talk. It has been argued that mothers' talk about desires predicts pre-schoolers' later talk about cognition more than mothers' talk about cognition (Bartsch & Wellman, 1995; Ruffman et al., 2002). In addition, it has been reported that parental talk about cognition is related with children's later use of cognitive state terms (Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003; Ruffman et al., 2002).

It has been reported that having discussions about mental states, such as desires, emotions, thoughts and knowledge, is important for understanding others' minds and false belief (Adrian et al., 2007; Astington & Baird, 2005; Judy Dunn & Brophy, 2005; Hughes & Dunn, 1997; Jenkins et al., 2003; Racine et al., 2007; Ruffman et al., 2002; Symons et al., 2006; Turnbull, Carpendale, & Racine, 2008). In using mental state terms to explain things to young

children, parents refer to a child's desires, beliefs, and emotions (e.g., 'You *want* the car, but we left it at home'; 'You *know* what that is'; and 'Now you *feel sad*.'). Importantly, parents use the same mental state terms to talk about other people (e.g., 'Jack *wants* the car too'; 'I *think* dad will come home soon'; and 'The girl looks *happy*.'). Through these discussions, children learn to link apparent actions and behaviours with mental states that are inaccessible to direct observation (Nelson, 2005).

Experimental and observational studies found that children have a better understanding of others' mental states and false belief if the mothers more often discussed mental states with them (De Rosnay, Pons, Harris, & Morrell, 2004; Dunn et al., 1991; Ensor, Devine, Marks, & Hughes, 2014; Meins et al., 2002, 2003; Meins, Fernyhough, Arnott, Leekam, & De Rosnay, 2013; Ruffman et al., 2002; Symons, Peterson, Slaughter, Roche, & Doyle, 2005; Symons et al., 2006; Symons, 2004; Tompkins, 2015). For example, Howard, Mayeux and Naigles (2008) observed mothers and their 3–4-year-old children while they interacted in a naturalistic setting at home. They found that mothers' cognitive state vocabulary predicted children's false-belief understanding after controlling for other variables, such as children's general language and age. In other studies, mothers of pre-schoolers were observed during a book-reading interaction, and their mental state language was found to be associated with and predict their children's false-belief understanding after controlling for the children's verbal IQ and age (Adrian, Clemente, Villanueva, & Rieffe, 2005; Slaughter, Peterson, & Mackintosh, 2007). In addition, there is longitudinal support (Adrian et al., 2007; Ruffman et al., 2002) for maternal mental state talk as a developmental precursor to children's false-belief performance. Using a task in which mothers discussed 10 photographs with pre-schoolers, Ruffman et al. (2002) found that mothers' mental state talk predicted children's later false-belief understanding. However, they found that children's earlier false-belief understanding did not predict mothers' later mental state language. Furthermore, they also found that mothers' general talk,

such as descriptive or causal comments, did not predict children's later false-belief understanding.

These studies indicate that there is a unique relationship between mothers' mental state talk and children's false-belief understanding. A remaining question is whether it is maternal talk that refers to all types of mental states or specifically language involving terms that refer to cognitive mental states that is related to early false-belief understanding. Peterson and Slaughter (2003) raised the possibility that maternal cognitive mental state talk is strongly associated with children's false-belief understanding. However, other research suggests that maternal references to various mental states, such as desire, belief and emotion, are significantly correlated not only with false-belief understanding (Adrian et al., 2005; Dunn et al., 1991) but also with the understanding of emotional and other mental states (Dunn et al., 1991; Ruffman et al., 2002; Taumoepeau & Ruffman, 2006). This is an important issue because if it is the case that language that refers to cognitive mental states promotes cognitive understanding, and language that refers to emotion mental states promotes emotion understanding, it could be assumed that the specific content of the mother–child is important. Otherwise, if talk that refers to all types of mental states is crucial for the development of false-belief understanding, it could be argued that it is rather the general exchange of viewpoints that has an impact on children's false-belief understanding (Harris, 1999a; Harris, De Rosnay, & Pons, 2005; Hughes & De Rosnay, 2006). However, given the limited support for a relationship between a specific group of maternal mental state terms and children's false belief understanding, there is a need for further investigation.

Another question that needs to be further addressed is whether children's mental state talk is an indicator of their false-belief understanding. It has been proposed that a child's use of mental state words has develops the most during the third year of the child's life (Bretherton & Beeghly, 1982; Shatz et al., 1983). As described previously, this is also the age at which the ability to successfully pass false-belief tasks emerges. This concurrent emergence

supports the notion of a possible relationship. Little research has been done in this regard. It was reported that children's use of mental state words in conversations with siblings and friends and during book reading with their parents was related with their performance in different false-belief measures (Bretherton & Beeghly, 1982; Brown, Donelan-McCall, & Dunn, 1996; Hughes & Dunn, 1998; Nielsen & Dissanayake, 2000). Nielsen and Dissanayake (2000) found a correlation between 3–4-year-olds' use of mental state words during symbolic play with parents and their false-belief understanding. Additionally, these variables were also found to be related when children interacted with their friends (Hughes & Dunn, 1998).

A restriction of most studies on mental state talk and children's false-belief understanding has been a focus on solely these two aspects. It is of great interest to find out whether and how these aspects relate to a child's social competence. Observing whether early mental state talk and later false-belief understanding have an impact on children's social competence might provide further insight into the impact of language on social development.

In summary, there seems to be a unique relationship between maternal mental state talk and children's false-belief understanding, whereas little is known about the influence of children's mental state talk on their own false-belief understanding. In the next section, the focus will lay on communication and how this variable might relate to false-belief understanding.

2.6 Communication connectedness

Communication is described as an important social skill for one to be able to consider someone else's perspective and understand that the other person might hold a false belief (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Harris, 1996, 2005; Tomasello, 2000). Children learn to infer what is on someone else's mind and that they may know things

that he or she does not know primarily through communication (De Rosnay & Hughes, 2006; Harris, 1999a). Along the same lines, Tomasello (2000) argued that communication is related to false-belief understanding and perspective-taking because people are regularly reminded that others have different beliefs, desires and intentions. He stressed the importance of communication that involves misunderstandings and requests for clarification because this shows that people have different perspectives or understandings of situations. Such forms of communication are common in parent–child interactions in which parents elaborate on children's statements by representing them with their own perspective (e.g., 'I think that's funny'; 'Did that frighten you?'; 'He was just being silly.'; 'No, I would rather take the other one.'). Engaging in these types of interactions forces children to take perspective of others and compare and contrast them with their own. Through this, children start to realise that adults are more than animate agents and become aware of them as intentional and mental agents (Nelson, 1996; Tomasello, 2000).

There is empirical support for this perspective. Training studies have indicated that children perform better in false-belief tasks if they were earlier engaged in communication about mental states (Appleton & Reddy, 1996; Guajardo & Watson, 2002; Lohmann & Tomasello, 2003; Taumoepeau & Reese, 2013). Lohmann and Tomasello (2003) revealed that perspective-shifting discourse contributed to three-year-olds' improved performance of false-belief tasks. They pre-tested children in the age range of 39–46 months on false-belief understanding using standard tests. Children who failed received different types of intervention and were retested using another set of false-belief tests. The largest effect in understanding false belief was found when the children were trained in the perspective-shifting discourse about deceptive objects (e.g., a pen in the form of a flower). When these objects were given to children without communicating about them, no effect on understanding false belief was observed. Ruffman, Perner and Parkin (1999) found that pre-schoolers' false-belief understanding was predicted by their mother's efforts to motivate the children to reflect on others' feel-

ings in conflict situations. These findings support the argument that there is a relationship between communication and false-belief understanding. However, it is still unclear whether it is children's experience of engaging in a communicative act with their mothers that is important or there are particular aspects of communication that are specifically significant.

Research in this area indicates that it is especially communication that takes place in the context of positive joint activities that is linked to the development of children's false-belief understanding. Dunn et al. (1991) reported that specific aspects of communication between a mother and a child at 33 months predicted false-belief understanding at 40 months, when the communication took place in a warm emotional situation but not when it occurred in an intimidating controlling environment. Furthermore, it has been argued that the frequency of connected communication reveals the development of false-belief understanding.

Ensor and Hughes (2008) defined communication connectedness as the degree with which utterances of various speakers are semantically related to each other. Thus, the construct of connectedness provides an index of how well interlocutors are tuned in to each other's talk (Bruner, 1983). Children who engage in frequent and widespread connected communications with their friends perform well in false-belief tasks (Dunn & Cutting, 1999). Dunn and Brophy (2005) indicated that a low frequency of mother–child connected communication in "hard-to-manage" pre-schoolers was related to poor false-belief understanding, thus indicating a relationship between connectedness in communication and children's disruptive behaviour problems. Ensor and Hughes (2008) followed up 120 families in a large longitudinal study and assessed the children at two, three and four years of age. At these time points, children completed social understanding and verbal ability tests. When the children were two years old, mother–child interactions were coded for quantity, connectedness and content of mothers' and children's talk. If a mother's utterances were semantically connected to the child's prior utterances and she used a mental state reference within these connected utterances, then both aspects were independently associated with children's later false-belief

understanding. It was, therefore, argued that connected conversations provide a fertile context for children's developing false-belief understanding.

Ensor and Hughes (2008) stated that a mother's connectedness accelerated a child's social understanding just as a child's acquisition of language is enhanced by adults' sensitivity in labelling objects within the child's focus of attention (Tomasello & Barton, 1994; Tomasello & Farrar, 1986). In this case, shared focus in communication highlights similarities or differences between the child's and the parent's points of view. Furthermore, in connected communication, the child and the parent can construct a shared perspective.

Despite these valuable findings, reports of associations between communication connectedness, false-belief understanding and social competence have been relatively rare, and further research is needed.

2.7 Research questions

The previous sections of this chapter provided a summary of existing research, and probable relations were hypothesised. Despite our understanding that language does affect false-belief understanding and social competence, what remains unclear is specific elements of language that are crucial and the extent to which they are to the development of false-belief understanding and these elements' relationship to social competence.

The goal of the current study is to address these gaps by examining the relationship between mental state talk and communication connectedness at the age of two (time 1) and three-and-a-half years (time 3) and performance on false-belief understanding and social competence at the age of five years (time 4). Furthermore, the relationship between false-belief understanding and social competence is explored. The following research questions and hypotheses are presented:

Research question 1: Is the maternal or child's mental state talk or communication connectedness at times 1 and/or 3 associated with the child's performance of the false-belief task at time 4?

Hypothesis 1: Children who participate more in connected communication and hear more mental state terms perform better in a false-belief task than children who participate in less connected communication and hear fewer mental state terms.

Research question 2: Is the maternal or child's mental state talk or communication connectedness at times 1 and/or 3 associated with the child's social competence at time 4?

Hypothesis 2: Children who exhibit more connected communication and hear more mental state terms display better social skills and are socially more competent than children who participate in less connected communication and hear fewer mental state terms.

Research question 3: Is performance of the false-belief task at time 4 associated with the child's social competence at time 4?

Hypothesis 3: Children who perform better in a false-belief task are socially more competent than those who perform worse.

The first question addresses whether specific elements of language relate to false-belief understanding. Specifically, language samples will be analysed for mental state talk and communication connectedness to examine whether they affect the development of false-belief understanding. Next, to scrutinise the effect of language on social competence, question 2 examines whether early language abilities including mental state talk and communication connectedness may be important for social competence. The last question examines the argument that false-belief understanding relates to social competence. To this end, an analysis is

done of whether the child's performance of a false-belief task is related to his or her social competence.

2.8 Summary and conclusion

Up to date, there is no agreed-upon definition of social competence. Global definitions focus on the notion of effectiveness within the social context. Furthermore, comprehensive models such as the one proposed by Cavell (1990) identify critical social goals along with proposed skills and abilities. These models are helpful with regard to the assessment of social competence because they separate social skills, social performance and social adjustment. Children in need of treatment are identified by their social performance. Intervention, however, typically focuses on the skill level. Evaluations of effectiveness occur at the performance and/or adjustment levels. Therefore, assessment would ideally occur on social skills, social performance and social adjustment.

Having good social skills in the early years seems to be important for social adjustment later in life (Boivin et al., 1995; Coie & Dodge, 1983; Fabes et al., 2005). Various studies have indicated that children with low social skills were more often rejected by their peers, which had a great impact on their social adjustment even in adulthood (Ladd & Asher, 1985; Parker & Asher, 1987). Therefore, it is essential to find out more about children's social development and early skills that have an impact on later social development.

Considering others' perspective and understanding that someone can hold a false belief is one of several social skills that are required for one to be socially competent. Earlier on, children develop an implicit understanding of false belief, and from the age of four, an explicit understanding becomes apparent. An explicit understanding is abstract and conscious and allows children to explain why someone has a false belief and how that false belief affects his or her actions. Since this ability seems to be crucial in the development of social compe-

tence, it is of great interest to further investigate the relationship between false-belief understanding and social competence.

The findings of longitudinal studies on children with language difficulties have indicated that language problems can be related to problems in social competence, including social adjustment issues later in life. The main argument put forward is that language is a core competence in the development of social skills, in social performance and in being socially well adjusted. Further research is required in to determine aspects of language that are necessary for one to be socially competent. It has been argued that attributing a false belief to others seems to be a linking ability between specific language skills and social competence. Two main language measures seem to be related to the ability to understand that someone is holding a false belief: mental state talk and the connectedness in the communication between a mother and a child.

In other words, an environment in which connected communication including mental state terms is prevalent seems to support false-belief understanding in young children. Therefore, in considering the role of language in false-belief understanding, a distinction needs to be made between children's language abilities and the language environment of the communicative exchange in which children are involved. The social context affects children's language abilities, which seem to affect their environment, in terms of the kinds of semantic input and communication they receive. Considering this, it is surprising that these particular links between language, false-belief understanding and social competence in children have not been studied in more detail. In other words, specific language assessments may reflect the extent to which children's false-belief understanding hinges on their language abilities and how this influences their social competence. Specific research questions that relate to these topics were formulated.

3 Methods

The previous chapter provided information concerning assessments of social competence and introduced a probable relationship between language, false-belief understanding and social competence. The main argument put forward is that language abilities and false-belief understanding are important for becoming socially competent. Specific research questions and hypotheses were stated.

This chapter describes the methods used to address the research questions. Assessment tools were chosen with regard to developmental stages and were based on the construct definitions provided. Structurally, this chapter consists of four main sections with relevant subsections. In the first two sections recruitment processes and participants are introduced. The third section and its sub-sections provide further information about how these participants were assessed and which measurements were used. Procedures are described in section four.

3.1 Study design

Ethical approval to conduct the current study was gained from the Human Ethics Committee at the University of Canterbury.

The families who were participating in the current study were drawn from the longitudinal study of New Zealand children "Learning to Talk" (Klee, Stokes, & Moran, 2015). This broader project examined three measures in the search for better predictors of children's language outcomes; verbal short-term memory, short-term vocabulary growth and parents' concern about their child's speech and language development. Children were assessed at three time points on a battery of assessments. Additional information about this study can be found in the Marsden report (Klee, Stokes, & Moran, 2015).

Participants were recruited through a university research database, doctors' offices, local special education providers, Plunket nurses (the local preschool public health service) and early childhood education centres. The initial study sample at time 1, (hereafter, T1) included 168 children (96 boys and 72 girls) living in and around Christchurch. The toddlers were aged between 24-31 months (*M*= 26.8, *SD*= 1.8), with no report of any significant medical history, any diagnosis known to affect speech, hearing or language development and English as their first language.

At time 2 (T2) parents of 163 children participated. At this time children ranged in age from 27-36 months (*M*= 30.3, *SD*= 1.95). Since the data from this time point is not relevant for the current study, T2 will not be further described.

At time 3 (T3) 160 families returned to participate in the first follow-up study, demonstrating an impressive commitment to the study. The children ranged in age from 42-50 months (*M*= 45.5, *SD*= 1.9), with 91 boys and 69 girls. The mean length of time between the initial assessment and the first follow-up assessment was 18 months.

At time 4 (T4) 67 monolingual English speaking pre-schoolers and their mothers living in the Canterbury region in New Zealand are involved. Participants of T4 are described in detail in the following section.

3.2 Participants

In 2015 families were invited for the second follow-up study (T4). Since time for the current study was limited only families who could be seen from January to November 2015 were included. Contact was attempted with 135 families. Seven families were not contactable because their email addresses and telephone numbers were no longer valid. Twenty-nine families did not respond to the invitation sent out via email. Five families declined to partici-

pate in the second follow-up study as they had moved from the Christchurch region. One family couldn't take part because of health issues, and one family was simply not keen on further participation. This left 93 families who visited the Child Language Centre again at T4 and participated in the relevant assessments.

The current study included only those children for whom transcripts of language samples were available for ages 24-30 (T1) and 42-48 months (T3). Nine participants had to be excluded because a language sample was missing. Language samples of 17 participants included more people than just the mother and the child and were therefore excluded as well. Having more people in the room clearly changes the communication environment. It is argued that a one to one communication has a different dynamic than a setting with three to five people.

The participants for the current study were 67 children ranged in age from 59-67 months (M= 63.3, SD= 1.80), with 37 boys and 30 girls. The majority of children in the sample attended pre-school education day-care at T1 (49, 73%) and all of them at T3 (67, 100%). Children who attended pre-school education day-care at T1 averaged 12.3 hours per week at their day-care centre. Children who attended pre-school education day-care at T3 averaged 18.6 hours per week. Over half of the children in the sample were male (37, 55%). A large portion of children in the sample were either the first (30, 45%) or second born child in their family (26, 39%). The majority of families participating had two children at T3 (40, 60%).

Frequencies and percentages for salient demographic characteristics are reported in Table 2. These information were gained with a parent questionnaire (PQ) at T1 and T3 which was completed by the mother when the children were 24-30 months of age and again when they were 42-50 months (see Appendix B). Some of the variables were not repeatedly measured since they would still be the same over time as for example birth order. Hearing was measured at T4 when the children were 59-67 months old using a otoacoustic emissions

screen (OAE, described in 3.3.2). Results of the hearing screening are also presented in Table 2.

Table 2
Summary of child characteristics

Variable	n	% of sample
Attends pre-school education day-care at T1		
Yes	49 (Average hours/week: 12.3)	73
No	18	27
Attends pre-school education day-care at T3		
Yes	67 (Average hours/week: 18.6)	100
No	0	0
Child's gender		
Female	30	45
Male	37	55
Birth order		
1	30	45
2	26	39
3	10	15
4	1	1
Number of children in family		
1	11	17
2	40	60
3	14	21
4	1	1
5	1	1
Hearing (OAE screen at 2000, 2500, 3200 and 4000hz at 50dB):		
"Pass" one ear and "refer" for the other	12	18
"Pass" both ears	49	73
"Refer" both ears	1	1.5
"Pass" one ear and no data for the other	4	6
No results for both ears	1	1.5

Note. Total Sample (N = 67). Due to rounding error, percentages may not add up to 100; OAE= Otoacoustic Emissions

The education level of the sample was based on the mothers who completed all the parent questionnaires at T1 and were combined into categories used by Statistics New Zealand (StatisticsNZ, 2016). In comparison with the educational attainment data from the most recent national census population of females aged 15-44 years in New Zealand the education level of mothers in this sample was much higher. As can be seen in Table 3 a higher percentage of mothers are holding university degrees and a lower percentage have no or few qualifications than in the general population. This is not unlike the situation in many other studies of children's language, but it does mean that the group does not represent the general population. Consequently, the study's finding might not be generalisable to the general population.

Table 3

Education profile of mothers in the study compared to 15-44 year old females in the population

Education level	n	Sample %	Population[a] %
No qualification	0	0	12.7
Some secondary education [b]	6	9	24.6
Secondary education certificates and diplomas [c]	12	17.9	35.5
University degrees [d]	49	73.13	27.1

Note. [a] Source: Statistics New Zealand, customised data received 26 January 2016 [b] Includes Level 1-2 Certificates. [c] Includes Level 3-4 Certificates and Level 5-6 Diplomas. [d] Includes undergraduate and postgraduate degrees and graduate and postgraduate certificates and diplomas. Adapted from Early factors in childhood communication disorders: final project report (p. 7), by T. Klee, S. Stokes and C. Moran, 2015, Wellington: Marsden Fund of the Royal Society of New Zealand. Adapted with permission.

3.3 Measures

Children completed a protocol of assessments at T1, T3 and T4 during their two visits to the Child Language Centre (Appendix C) while the parents filled out several questionnaires. In the following only assessments that are relevant for the current study are described. An overview of relevant tasks for all time points is provided in Table 4. At T1 and T3 data were collected through spontaneous language samples, the Receptive One Word Picture Test

(ROWPVT, Martin & Brownell, 2011) and the parent questionnaire. Additionally, at T1 parents filled out the New Zealand English adaption of the MacArthur Bates Communicative Development Inventory (Elaine Reese & Read, 2000). At T4 children were assessed on a nonverbal false belief task and on the Clinical Evaluation of Language Fundamentals - Preschool, second edition (CELF-P2, Wiig et al., 2004) to measure their general language abilities. Children also participated on the Raven's Coloured Progressive Matrices (CPM, Raven, 1986) to assess their intellectual capacity. Children's hearing ability was screened using an otoacoustic emissions (OAE) test. The parents filled out three questionnaires to provide demographic information but also to describe their children's social competence. All these assessments are described in detail in the following sub-sections. Testing was conducted in a quiet room located in the Child Language Centre. The scores forms for the non-standardised measures are included in Appendix D.

Table 4
Child and mother measures at T1, T3 and T4

	Time 1 (24-30 months)	Time 3 (42-48 months)	Time 4 (59-67 months)
Child	Language Sample	Language Sample	False belief understanding task
	ROWPVT	ROWPVT	CELF-P2
			CPM
			Hearing Screen
Mother	Language Sample	Language Sample	SDQ
	Parent Questionnaire	Parent Questionnaire	SRS-2
	CDI		Parent Questionnaire

Note. CELF-P2= Clinical Evaluation of Language Fundamentals - Preschool, Second Edition (Wiig, Secord, & Semel, 2004). CDI= MacArthur Bates Communicative Development Inventory: Words & Sentences, New Zealand English Adaptation (Reese & Read, 2000). CPM= Coloured Progressive Matrices (Raven, 1986). SDQ= Strengths and Difficulties Questionnaire (Goodman, 1997). SRS-2= Social Responsiveness Scale-Second Edition (Constantino, 2012). ROWPVT= Receptive One Word Picture Test (Martin & Browell, 2011).

3.3.1 Demographic information

Parent questionnaire

This questionnaire was developed in order to gather information about demographic variables and parent concerns about their child's development. Parents were also asked to report about any health problem the child might have and whether any medication or therapy has been prescribed. This questionnaire was used at each time but was slightly revised over the years to avoid asking the same questions.

3.3.2 Hearing and intellectual capacity

Hearing screening

All children were assessed using an Otoacoustic Emissions (OAE) screening in order to determine cochlear status. Responses to sound were measured by inserting a small probe into the child's ear canal. OAE screening was done at 2000, 2500, 3200 and 4000 Hz at 50 dB.

Raven's Coloured Progressive Matrices (CPM)

The CPM (Raven, 1986) has commonly been used to distinguish between degrees of intellectual maturity by quantifying a child's ability to form comparisons and to reason by analogy (Raven & Court, 1998). It was specifically created for children aged between 5 and 11 years of age including 36 items divided into three sets of 12 (A, Ab and B). The items are brightly coloured illustrations printed in a book to attract and maintain children's attention. Within each set, items are ordered in terms of increasing difficulty. Sets also vary in difficulty, with set B enclosing the most challenging items. For each item the children were shown a big pattern with a missing piece. Children were asked to point to one of six smaller pieces

below which would complete the pattern above. The child's answer was recorded on a scoring form which provided scores for each set and as a total.

The CPM has been regarded as a culturally fair measure of intellectual functioning for both children and adults (Carlson & Jensen, 1981). In normative studies good reliability, test-retest reliability and high internal consistency and split-half reliability were reported (Cotton et al., 2005).

3.3.3 False-belief understanding

False belief tasks try to determine a child's ability to understand the contents of another person's mind without giving the child explicit access to, or explicit statements regarding, the other person's perspective.

Bloom and German (2000) questioned the validity of the widely used standard false-belief tests, like the "unexpected change of location" task explained in chapter 2, because additional task demands like executive skills and processing of linguistic information conceal conceptual understanding. In most standard false-belief tasks children are asked a direct question about how the mistaken agent will act. When children are asked this test question they have to shift from merely observing the test scene to participating in a conversation about it. Their own perspective on the scene naturally becomes prominent and must be inhibited to allow them to adopt the agent's perspective. In addition children need to understand the test question and select a response. In other words, young children may often fail standard false-belief tasks because simultaneously executing false false-belief-representation, response-selection, and response-inhibition processes overwhelms their limited resources (Baillargeon, Scott, & He, 2010; De Bruin & Newen, 2012).

Nonverbal false-belief tasks on the other hand do not demand linguistic skills and the child is observing and acting instead of answering a question. Therefore, the number of addi-

tional processes is drastically reduced. In a nonverbal design, language either is not used or is mostly additional to what is mainly a nonlinguistic mode of interaction and presentation.

The competitive nonverbal false-belief task

In order to minimise additional task demands a competitive nonverbal false-belief task designed by Krachun, Carpenter, Call and Tomasello (2009) was used in this study.

For this task a table (100 x 60cm) with a sliding platform in the middle and a plexiglas panel with arm holes on each side was used. An opaque screen was put up to block the child's view when needed. Furthermore, colourful stickers and two small identical boxes were used.

In two warm up trials the child was introduced to the general procedure and the competitive context was established. The experimenter (myself) put the two boxes next to each other onto the sliding platform. She told the child that they were going to play a game in which the child could try to win a sticker which is hidden in one of the boxes. The child was also told that she needs to be careful because the competitor wants to win the sticker as well. While both the child and the competitor were watching the experimenter hid the sticker in one box. The experimenter then slid the platform towards the competitor, who reached with effort but unsuccessfully for the box with the sticker inside. The platform was then slid over to the child who was able to reach for the box and this way win the first sticker. To establish the competitive context, the competitor was able to reach the box and win the sticker in a second trial. The competitor acted disappointed when the child won the sticker and pleased when she did. She often made competitive comments such as "This time I will win the sticker!"

After this warm up, a pre-test was given to verify that children could use the competitor's reach as a cue to the sticker's location. In these trials, before the experimenter hid the sticker in a box, she positioned an opaque screen to block the child's view of the boxes. The competitor could still see the boxes and the children were made aware of this fact. The child

could see the competitor's face over the screen and they observed how the competitor watched how the experimenter hid the sticker. The competitor was watching the hiding with clear interest, leaning forward, and saying things such as "aha" to show that she paid attention. She looked straight ahead during the hiding so the child could not use her gaze to infer where the sticker was being hidden. The experimenter then removed the screen so that the child could see both boxes again. The experimenter slid the platform towards the competitor who reached unsuccessfully for the box with the sticker in it. The experimenter then slid the box towards the child who could choose and reach a box. When children understood that the competitor knew in which box the sticker was because she saw it being hidden, they will choose the same box as she did. The children had to pass three trials in a row before the false belief was assessed.

In the false-belief trials the experimenter was also blocking the child's view of the boxes with the screen and hid the sticker while the competitor was observing. The experimenter removed the screen and the competitor immediately turned around and looked in the opposite direction. She gave some excuse for doing so like for example to store her sticker or to look out the window. In this moment the experimenter got the child's attention and switched the position of the boxes without telling the child in which box the sticker is. During this act the experimenter was smiling mischievously and glanced occasionally at the competitor's back to make sure she didn't see the switch. The competitor was clearly not attending to the experimenter's actions, muttering to herself and being highly absorbed in her task. The experimenter signalled the competitor when she was finished by asking her whether she was ready to pick a box. The competitor then returned to her position facing the child again. The experimenter slid the platform first in the direction of the competitor who reached for the empty box with effort but unsuccessfully. The platform was slid to the side of the child while the competitor was still reaching for the box. Children who recognised the competitor's false belief should choose the box the competitor was not reaching for. Children who chose the

correct box were allowed to keep the sticker; otherwise the experimenter slid the platform back to the competitor who took the sticker. The competitor showed obvious surprise when the location of the sticker was revealed. Even though the task was nonverbal, the experimenter and the competitor chatted naturally with each other and with the child throughout. They were carful not to refer to the competitor's belief states.

Location of the sticker was randomly determined with the restriction that the sticker could not be hidden in the same box for more than two consecutive trials.

The main measure was whether or not children chose the correct box. Choice was defined as the box children were touching or trying to open by the time the experimenter finished sliding the platform over to them. Children had to pass at least 3 out of 4 false-belief trials in order to pass the false-belief understanding task.

3.3.4 Social competence

In the past, children were mostly assessed on how they performed on tasks using appropriate social skills as a way of drawing conclusions about social competence. According to the tripartite model proposed by Cavell (1990), introduced in chapter 2.1, it seems to be inadequate to only assess specific social skills like perspective taking, to predict the quality of a child's social competence. Cavell (1990) suggests that researchers and practitioners incorporate assessments of not only specific behavioural skills across different types of social situations but also indexes of social adjustment such as peer acceptance, loneliness and self-esteem. Therefore, two parent questionnaires were used additionally to retrieve more information about the children's social performance and social adjustment.

Strengths and Difficulties Questionnaire (SDQ)

The SDQ (Goodman, 1997) is a widely used well-established behavioural screening questionnaire appropriate for 3-16 year olds. For this study the SDQ version for 4 to 10 year olds was used. Parents completed this one page questionnaire for assessing the psychological adjustment of their children. The SDQ asks about 25 characteristics, including competencies or strengths in addition to assessing problems. It is using a three point Likert-scale, ranging through 'not true', 'somewhat true' and 'certainly true' to indicate how far each characteristic applies to their child. The 25 items are divided between five scales of five items each, generating scores for emotional symptoms (e.g., "Many worries or often seems worried"), conduct problems (e.g., "Generally well behaved, usually does what adults request"), hyperactivity (e.g., "Restless, overactive, cannot stay still for long"), peer problems (e.g., "Has at least one good friend") and prosocial behaviour (e.g., "Helpful if someone is hurt, upset or feeling ill"). All except prosocial behaviour are summed to generate a total difficulties score, indicating the severity and the content of the psychosocial problems. The prosocial scale indicates the amount of prosocial characteristics a child shows (Goodman, 1997). Screening cut-offs for categorical scores (abnormal, borderline and normal) are provided. The SDQ shows strong psychometric properties and correlations with other measures of child psychopathology were high (see Stone, Otten, Engels, Vermulst, & Janssens, 2010 for a review). The SDQ has been normed from a large sample including 10,438 children in the United Kingdom.

Social Responsiveness Scale - Second edition (SRS-2)

The SRS-2 (Constantino, 2012) is a measure that identifies social impairment associated with autism spectrum disorder (ASD) and quantifies its severity in an age range from 2.5 to 99 years. In this study the SRS-2 version for 4-18 year olds was used. Parents were asked to rate symptoms that they have noticed over time at home and fill out a form consisting of 65

items. Five subscales are provided: Social Awareness (e.g., "Is aware of what others are thinking or feeling"), Social Cognition (e.g., "Doesn't recognise when others are trying to take advantage of him or her"), Social Communication (e.g., "Avoids eye contact or has unusual eye contact"), Social Motivation (e.g., "Would rather be alone than with others") and Autistic Mannerisms (e.g., "Has an unusually narrow range of interests"). The subscales corresponding to the two symptom domains Social Communication and Restricted Interest and Repetitive Behaviour. Each item is scored on a 4 point Likert-scale, ranging through 'not true', 'sometimes true', 'often true' and 'almost always true'. Upon completion of all items raw total and subscale scores are calculated for the specific gender. SRS-2 total raw scores range from 0 to 95, with higher scores indicating increased social impairment. Cronbach's alpha scores indicate that the overall SRS scale has good internal consistency (a = .94 in males; a = .93 in females, parent rated) (Constantino & Gruber, 2005). Norms are provided for each form based on a sample of 1906 individuals.

3.3.5 Linguistic abilities

Clinical Evaluation of Language Fundamentals - Preschool, second edition (CELF-P2)

The CELF-P2 (Wiig et al., 2004) evaluates a broad range of language skills in preschool children age 3-6 years. This test includes a variety of subtests that provide in-depth assessment of a child's language skills. The subtests include concepts and following directions, word structure, expressive vocabulary, recalling sentences, sentences structure, basic concepts, recalling sentences in context, word classes and phonological awareness. Together they are used to derive four index scores: expressive and receptive language, language content and language structure. The CELF-P2 also provides a total language score.

Norms were derived from 800 children from wide-ranging geographic locations, age, gender, race and education of primary caregiver living in the United States of America. Internal consistency reliability was reported as .73-.96 and test-retest reliability for subtests as .77-.92 and as .91-.94 for composite scores. Concurrent validity was reported to be moderate to high for composite scores and for subtests. Sensitivity of the Core Language Score was reported as .85; the specificity as .82 (Brassard & Boehm, 2007).

MacArthur Bates Communicative Development Inventory: Words & Sentences (CDI), New Zealand English adaptation

The CDI: Words and Sentences (Fenson et al., 1993) is a well-established and widely-used parent report measure of expressive vocabulary and grammatical development for children aged 16 to 30 months. Reese and Read (2000) adapted the CDI for use with children in New Zealand due to differences between New Zealand and American English. Forty-one words in the vocabulary section were changed by substituting the equivalent word used in New Zealand (e.g., stroller - pushchair, diaper - nappy). Parents were asked to indicate whether their child produced any of the 680 words listed by checking the words on the form. These words are organised into 22 semantic categories (e.g., actions, body parts, animals, food and drink, clothing, etc) (see Appendix E). The CDI provides a range of scores on different aspects of expressive language development, however the only measure used in the current study was total words produced. The CDI has high test-retest reliability, good concurrent and predictive validity (Buehler, Klee, Stokes, & Gibson, 2016; Fenson et al., 1993; Reese & Read, 2000). Norms were derived from a large sample of 2156 children from wide-ranging sociodemographic backgrounds living in the United States of America. New Zealand norms were not available at the time of writing.

Receptive One Word Picture Vocabulary Test (Fourth edition) (ROWPVT-4)

The ROWPVT-4 (Martin & Brownell, 2011) is a measure of receptive vocabulary designed for participants of an wide age range from 2 through to 80+ years. The test consists of 190 items presented in a developmental sequence that reflects the concepts with which people currently have experience through home, school or media. Children were asked to point to one out of four coloured pictures which matched the word spoken by the examiner. The test began based on the chronological age of the children and was discontinued when the ceiling was reached. Because this test was developed for American children, "cookies" was changed to "biscuits" and "mailman" to "postman" in accordance with New Zealand English vocabulary. Since "baseball" is not a common sport in New Zealand it was changed to "rugby". This test provides both raw scores and standard scores.

Internal consistency coefficient alphas range from .95 to .98 across age groups. Test-retest (average of 20 days) reliability for the entire sample was reported from .87 to .93 (Brassard & Boehm, 2007). Concurrent validity was reported to be moderate in the manual (Martin & Brownell, 2011). The ROWPVT-4 was normed from a large sample of 2,327 individuals from 32 states in the United States of America.

3.3.6 Language samples

Spontaneous play-based language samples of the children and their mothers were obtained at T1 and T3. These interactions were filmed and transcribed using SALT (Miller & Chapman, 2012). All the transcriptions were done by a research assistant and a PhD candidate (myself) both trained in sample segmentation and coding.

Interjudge agreement using language samples from T1 and T3 was examined using a point-by-point agreement calculation. 10% of the language samples which were transcribed by the research assistant were transcribed again. A percentage of agreement was obtained in a

word by word, utterance segmentation and mental state terms comparison. The general criteria for utterance segmentation were taken from Fletcher and Garman (1988), Garman (1989) and Johnson (1986). Additionally, 'yes' and 'no' and their various representations were transcribed as separate utterances unless intonation indicated that it was part of the utterance (e.g., 'no mummy'). Utterances which were separated by a brief pause or hesitation but were grammatically related to the previous utterance were transcribed as one ('I'll have a cupcake and dad can have the lettuce (Pause) and the cucumber'). Utterances including a tag question were transcribed as one utterance (e.g., 'that's where we put the pots isn't it?').

The following formula was used to assess each of these variables:

$$\text{Percentage of agreement} = \frac{\text{Number of agreements}}{\text{Number of agreements + disagreements}} \text{ X } 100$$

In this formula, the "number of agreements" used were defined in terms of the variable of interest. At T1 interjudge word by word agreement was 88.59%, utterance segmentation agreement was 96.55% and mental state term agreement was 92.25%. At T3 interjudge word by word agreement was 91.63%, utterance segmentation agreement was 98.24% and mental state term agreement was 92.03%. Table 5 summarises the range of each agreement across participants.

Table 5

Summary of interjudge agreement

	Participant	Word by Word Agreement	Utterance Segmentation Agreement	Mental State Term Agreement
Time 1	P017	84.78%	94.87%	83.35%
	P037	85.22%	95.73%	94.29%
	P049	89.77%	95.73%	93.35%
	P056	88.42%	97.94%	90.24%
	P063	94.77%	98.95%	100%
	Mean	88.59%	96.55%	92.25%
Time 3	P015	95.39%	98.71%	93.10%
	P034	95.26%	97.64%	95.12%
	P046	94.19%	99.39%	72.22%
	P048	94.91%	98.28%	100%
	P079	90.45%	98.13%	94.74%
	P080	79.56%	97.28%	97.02%
	Mean	91.63%	98.24%	92.03%

Child and maternal mental state talk

The transcripts were coded using SALT (Miller & Chapman, 2012) for all children's and mothers' utterances containing mental state terms. Each category was then expressed as a proportion of the 20 minutes observation, such as a proportion of total number of different words uttered by the speaker or of total number of uttered turns.

Mental state terms included all nouns, verbs, adjectives or adverbs describing one of four categories of mental states: physiological, emotional, desire, and cognitive. Physiological state words were defined as references to internal states of body and included words such as 'hot' and 'sleepy'. Emotional terms were defined as references to affective states including words like 'happy' and 'sad'. Words such as 'want' and 'need' were categorised as general references to desire. Cognitive state terms were defined as referring to thoughts, memories, reasoning, knowledge or other forms of cognitive mental activity, such as verbs like 'think', 'remember' and 'know'. These were coded along with nouns (e.g., 'idea', 'dream'), adjectives

(e.g., 'clever') and other terms. A detailed summary of the terms included in the different coding categories is shown in Table 6.

The general criteria for coding were taken from Bartsch and Wellman (1995) and Ruffman et al. (2002). In line with Bartsch and Wellman (1995) utterances including mental state terms were examined to determine if the speaker genuinely referred to a mental state, rather than just using the term in a conversational fashion. For example, 'think' terms that principally could mean 'yes' or 'no' (e.g., 'I think so', 'I don't think so'), and used for turn taking (e.g., 'what do you think?') were not coded as referring to mental states. Similarly, 'know' terms used to redirect the listener's attention (e.g., 'know what?') or for soliciting a response from a conversational partner in order to keep talk going (e.g., 'do you know what I did yesterday?') were coded as conversational rather than genuine uses. Furthermore, not coded were 'I don't know' and 'I know' responses which did not elaborate on what was unknown and only contained these three words. Their use could possibly just mean 'I can't answer' (Bartsch & Wellman, 1995; Shatz et al., 1983). References such as 'I don't know what that is' were included since knowledge about a particular object was described by the speaker.

'Just pretend' or 'It's just pretend' without further explanation were not coded since it could be just used to prevent a child from a specific behaviour like taking toys in his mouth or describe an object rather than a mental state. Utterances like 'I pretend it's vegemite', 'We can pretend it's bread' or 'Like the pretend table' on the other hand are reflecting a mental state and were therefore coded. When coding for desire terms Bartsch and Wellmans' (1995) criteria were also followed. Not counted as genuine mental utterances were terms used for social convention (e.g., 'I don't care') and for objectless statements for desire (e.g., 'I wanna'). Context was used to determine whether an utterance including the term 'like' was truly intended to refer to a desire like 'I want that' or to refer to a state of enjoyment. An example for a desire reference using 'like' is 'I would like a cup of tea' whereas 'I like playing with these toys' would be considered as a reference to a state of enjoyment.

Utterances that exactly and immediately repeated one's own or the other person's mental state utterance were not included in the analysis. Further excluded were all mental state terms that were mentioned in memorised songs or rhymes, such as 'Happy Birthday'. If utterances were unintelligible except for the mental state term, they were excluded because it was unclear whether the child or the mother is referring to a genuine mental state.

Inter-rater reliability using the coded transcripts were examined. Seven randomly chosen transcripts of the 67 at T1 and T3 were re-coded by a research assistant. Inter-rater agreement for mental state terms said by the child was 86.26% at T1 and 93.1% at T3. Inter-rater agreement for mental state terms produced by the mother were 90.25% at T1 and 90.36% at T3.

Table 6

Coding examples of mental state words taken from the transcripts

Category	Mental State Terms	Examples
Physiological	sleep, asleep, wake up, awake, died/dead, all better, okay, toilet references, hot, broken	"Is the baby asleep?" "She is dead." "Do you need to poo?"
Emotion	happy, pleased, not pleased, annoyed, hurtful, bored, not happy, unhappy, feel [feel bad], sad, upset, fed up, miserable, cross, grumpy, angry, mad, scared, frightened, afraid, worried, shocked, shy, surprised, pleased, enjoy, excited, fun, interested, frustrated, missed, disgusted, okay [feel okay], good [feel good], better [feel better], disappointed, mad, cry, relax, like, love, proud	"The boy is really happy" "She is too excited." "He does look grumpy." "This is fun." "I love chocolate!" "I like this teddy bear."
Desire	want, hope, wish, like, don't like, love, dream, prefer, keen on, need, hate, fancy,	"I want this car." "He wants to go to the farm." "He would like some grass." "I need that baby."
Cognition	think, know, believe, expect, wonder, remember, guess, dream, forget, mean [I mean that], real, understand, remind, realise, have in mind, hard [difficult], pretend, make believe, bet, forget, sure, understand, concentrate, assure, distract, figure, idea, ignore, imagine, interest, learn, recognise, trust, decide, clever	"She is thinking hard" "I think that's a kitchen" "I don't know if I can open this" "How do you know it's his"? "He expects her to cry" "I pretend this is vegemite."

Child and maternal communication connectedness

The same transcripts were coded for communication connectedness using a system introduced by Dunn and colleagues (e.g., Dunn & Cutting, 1999) and refined by Ensor and Hughes (2008). Adopting procedures from the Ensor and Hughes (2008) study, each transcript was divided into conversational turns. A turn was defined as utterances of one speaker bounded by another speaker's utterances (Shatz & Gelman, 1973) or a significant pause of five seconds or more. Each conversational turn of the mother and the child was assigned to one of the following four codes:

1. **Connected**: Speaker's utterance is semantically related to the other speaker's previous verbal turn.

2. **Initiation**: Speaker initiates a new topic that is both unrelated to the other speaker's previous turn and successful in eliciting a semantically related response from the other speaker.

3. **Failed**: Speaker's turn is directed to the other speaker but fails to prompt a semantically related response.

4. **Unclear**: Speaker's utterance was inaudible or unintelligible and therefore not able to assign to a code.

Each category was then expressed as a proportion of the 20 minutes observation, such as a proportion of speaker turns.

Table 7 shows a conversational extract, coded for quantity and quality. The child's first and second turn were coded as initiation because the child initiated new topics and the mother produced a semantically related response. Accordingly, the mother's first two turns were coded as connected. The child's third turn is considered as connected because he obviously responded to the mother's question. The child's fourth turn was coded as failed because the mother did not reply to the child's question but initiated a new question. Since the child did reply to this new initiation the mother's fourth turn was coded as initiation and the child's fifth turn as connected. The child's sixth turn is considered as an initiation because it followed

a pause of more than five seconds. The mother's fifth turn includes a related response and is therefore coded as connected.

Table 7
Coding example of conversational extract

Turn Number	Utterances	Quality (of turn)
1	C what 's that stream?	Initiation
1	M {ah} the stream?	Connected
	M {oh} it 's just a stream.	
	M it 's coming under a bridge.	
	M it's just a stream that 's going past I think.	
2	C what 's that?	Initiation
2	M what 's what?	Connected
	M {oh} what does it look like to you?	
3	C kitchen.	Connected
3	M yeah.	Connected
	M it 's something like a kitchen.	
4	C what 's that green thing?	Failed
4	M do you need to go to the toilet?	Initiation
5	C no.	Connected
	C don't need to.	
	(Pause of 7 seconds)	
6	C a banana!	Initiation
5	M yes.	Connected
	M it is a banana.	

Note. C= child; M= mother

A 'trumping system' (Ensor & Hughes, 2008) was applied to the four coding variables of communication behaviour, so that when a conversational turn could be coded in two categories, certain categories superseded others. The trumping rule was developed on the grounds that in previous research the maternal use of connected terms towards their children was high-

lighted to be significant. Therefore, it was important to code all connected turns and hence these turns superseded all other categories. Thus, if a turn could be coded as either connected or failed it was always coded as connected. For example, if the beginning of a turn was clearly connected to the previous one and followed by an utterance that could be considered as failed the turn was still coded as connected:

M would you like some tea [initiation].
C no [connected].
C you want some?
M look at that!

A trumping system was also used such that turns could be categorised as either failed, unclear or initiation were always coded as initiation. For example if utterances in a turn are unintelligible followed by a clear initiation than the turn was coded as initiation:

M what does the horse do?
C X (unintelligible).
C the cow is in the stable [initiation].
M the cow is locked in [connected]?

Table 8 and 9 provide additional criteria for the coding process which are illustrated with examples.

Inter-rater reliability coding was assessed by two independent researches. Seven randomly chosen transcripts of the 67 at each T1 and T3 were coded simultaneously. Inter-rater agreement for turns uttered by the child was 91.55% at T1 and 95.53% at T3. Inter-rater agreement for turns produced by the mother were 95.53% at T1 and 89.81% at T3.

Table 8
Coding criteria and examples of connected turns taken from the transcripts

Criteria Turns were always considered as connected when…	Example
…they were semantically related.	C I have a cup of tea. M you do have a cup of tea [connected]. M what is the cow doing?

	C she is eating.
…they consisted of a clarifying term like “hm?”, “pardon?”, "eh?", “huh?”, "yeah?", "really?". This could stand for “What was that?/What did you say?”.	M what ‘s the baby gonna do on the toilet? C wee [connected]. M hm [connected]? C wee [connected]. C X [unclear]. M pardon [connected]? C milk [connected].
…they were a reaction of a call.	C mum? M yeah [connected].
…they were addressed to the other person in order to thank them.	C there you go. M thank you [connected].
…they were answering a question.	M do you want a piece of bread? C no [connected]. C I hurt my head.
…they were repetitions or extensions.	C no. M no [connected]. C boy. M the boy [connected].
…they were semantically related even after a longer break.	M do you wanna see these animal/s? : :05 C what animal/s [connected].
…they include praise following a verbally statement but not for a general action.	C found him. M good one [connected]. C I did it! M well done [connected]. C the pot. C the [failed]> M good girl [failed]. M clever.

…they provide a feedback to an utterance with a prompt.	M sit on the~ C chair [connected].
…the child said or asked for something the mother told him/her to do.	M go and ask Dora. C Dora want cake [connected] M do you wanna see if Dora wants some tea? C tea [connected]?
…they confirmed the previous uttered turn.	M cup of tea [initiation]? C mhm [connected]. M alright [connected]. M does Boots have milk [initiation]? C yep [connected]. M ok [connected]. C another car [initiation]. C this car. M cool [connected].
...they included a ‘yes’ or ‘no’ reaction even if the previous turn was unclear or unintelligible.	M that 's a good idea. C X [unclear]. M yeah [connected].
…they were clearly relating to a previous turn even though they are not semantically related.	C help [initiation]. M I don't think that wee man fits on there sweetheart [connected]. C and that one not go open like this. M hang on [connected]. M {oh} that way.

Table 9

General coding criteria and examples of turns taken from the transcripts

Criteria	Examples
The first turn in a transcript was always considered as an initiation if a related response was following or failed if there was no related response following.	M what is this [initiation]? C a cow [connected]. C there is a car [failed]. M blow your nose.
If a turn got abandoned or interrupted it was still coded.	M look! M there is a frog in the bus. C a frog in> [connected]. M and there is a kitchen [initiation]. C teddy mummy [initiation]. M anyth* [unclear]> C teddy [initiation].
Overlaps were coded.	M we need to stay in here sweetheart. C <get coffee> [failed]. M <come back in here> {IA}. M right. M do you wanna <help me make it> [failed]? C <this> coffee [initiation]. C (um) yeah.
The turn following after a pause longer than 5 seconds was considered as a new turn and got coded accordingly.	M does the bus make any sounds [failed]? ; :05 M did you see the cow [initiation]? C yeah [connected].
Playing sounds or routinized language were only coded if they acted as a response or as an initiation but not if they were just playing sounds in between utterances.	M what do we sing when it ‘s your birthday? C {sings birthday song} [connected]. M how does the cow make [initiation]? C {moo} [connected].

	C {quack} [initiation]. M yeah [connected]. M a duck.
Other sounds which were not communicative were not coded and treated like pauses.	C open this [failed]. M {oh}. C open it [initiation]. M alright [connected].
Some turns were not clear to interpret and were therefore coded as unclear.	M what else could you have in your sandwich? M tomato? C you can't have them [unclear]. M tomato on toast [unclear]? C all over there [unclear].
'Look!' was coded as initiation or as connected if there was an explanation following on what was looked at. If it was said without further information it was coded as unclear.	C I want this. C look [initiation]! M it 's a chopping board [connected]. M Look [unclear]! C I need car.

3.4 Procedures

Time 1

Previous to their first visit to the Child Language Centre at the University of Canterbury parents received a booklet containing general information regarding the study and a consent form, along with a parent questionnaire and a copy of the New Zealand version of the CDI. Parents were asked to carefully read the information and either send or bring the documents completed to the first assessment.

The initial assessment required two visits to the Child Language Centre where children completed a protocol of 13 assessments in a quiet room usually with a parent present. Most of the tasks at this time were not relevant for the current study except the parent questionnaire, the CDI, the ROWPVT and the language sample described in the previous section.

Spontaneous play-based language samples of the children and their mothers were obtained at T1. Participants spent around 20 minutes in a quiet room at the Child Language Centre and played together with a set of toys provided. The same instructions were given to all participants shortly before starting the recording. Mothers were told to play with their child as they would at home and that there was no need to get the child to say specific words or to do specific things. These interactions were filmed and audio recorded. The video cameras were wall mounted and had pan/tilt motion and zoom capabilities. Beyerdynamic boundary microphones were set into the ceiling in the centre of the clinic rooms and were used for the audio recording. These language samples were transcribed starting when the examiner left the room and closed the door. Transcriptions were done using the Systematic Analysis of Language Transcription software (SALT; Miller & Chapman, 2012).

After the first session the child could choose a book out of three. After the second session the parent was given the $20 voucher for the mall and a $10-20 petrol voucher to thank them for participating. If there were any concerns about their child's development, these were discussed at this point and referrals were suggested.

Time 3

The same participants were invited to take part in the first follow-up study at T3 consisting of two sessions. Procedure of T3 was very similar to T1. Target reassessment dates were set 18 months after the date on the child's CDI questionnaires filled out by their parents at T2. Parents were contacted two to three weeks before this date to ask if they would further participate in a follow-up study.

As at T1 parents signed the consent form and completed the parent questionnaire. The children were assessed on a battery of several assessments. For the current study only the language sample and the ROWPVT was of importance. They were gained using the same procedure as at T1.

Children again received a book and parents a $20 voucher at a local shopping mall and a $10 petrol voucher. If there were any concerns about their child's development, these were discussed at this point and referrals were suggested.

Time 4

All families who participated previously in the first follow-up study (T3) were contacted by either mail or email. Parents were invited for further participation and received an information sheet about what the study involved (Appendix F). Parents who were interested in participating in the second follow-up study contacted the research team to schedule two appointments. The mean length of time between the first session of the first follow-up study and the first session of the second follow-up study was 18 months.

Parents brought their children to the Child Language Centre for two 1.5 hour sessions approximately 10 days apart (range = 1 day to 5 weeks). Each session lasted from 30 to 90 minutes depending on the number of tasks in which the child was willing to participate. Signed parental consent was gained for all participants (Appendix G). The parents (usually the mother) filled out the questionnaires during the first session while most of the relevant tasks for the current study were assessed in the second appointment. The nonverbal false belief task was often assessed at the beginning of the second session since children were very motivated and opened up a lot during this task. Some children were quite shy since they had not met the research team before. The nonverbal task allowed them to get to know them in a playful and fun way. Normally children were ready for other tasks after this start.

All sessions were video and audio recorded. Children again received a book and parents a $20 voucher at a local shopping mall and a $10 petrol voucher. If there were any concerns about their child's development, these were discussed at this point and referrals were made.

4 Results

In the previous chapter participants, measurements and procedures used to address the stated research questions were described.

This chapter reports on the statistical analyses that were conducted in order to answer these research questions. The results are broken down into five sections. First, descriptive statistics for all mother and child variables measured at T1 (24-30 months), T3 (42-48 months) and T4 (59-67 months) are provided. Second, data transformations and outliers are described. Third, correlation analysis are introduced. Fourth, specific results addressing the main research questions are summarized. Finally, secondary analyses which address further questions related to the main research questions are summarized.

4.1 Descriptive statistics

Mother and child variables at time 1 and time 3

In total 67 language samples of child-mother interactions were analysed at T1 and T3. A turn was defined as utterances of one speaker bounded by another speaker's utterances (Shatz & Gelman, 1973) or a significant pause of five seconds or more. The mean number of mother turns at T1 was 134.13 (*SD*= 134.13) and 135.33 (*SD*= 39.19) at T3. The mean number of children's turns was 126.02 (*SD*= 39.52) at T1 and 134.73 (*SD*= 39.78) at T3. To help control for verbosity maternal and child turns were analysed as a proportion of their total turns

respectively. For example, for communication connectedness the number of turns that were related to previous turns was divided by the total number of turns the mother or the child produced during the spontaneous play situation at T1 and T3. Turns were considered as related when they included terms which are in the same semantic field, when they were based on the same topic, when one speaker was answering a question of the other or when they included a clarifying term. Additional examples of related terms can be find in Chapter 3. In addition, maternal and child use of mental state words were analysed as a proportion of number of completed words. Completed words were counted using SALT (Miller & Chapman, 2012). They were defined as complete and intelligible words, meaning that incomplete and unintelligible words were excluded from the analysis. The mean number of mother completed words at T1 was 1101.17 (*SD*= 347.33) and 1065.61 (*SD*= 417.98) at T3. The mean number of children completed words at T1 was 380.18 (*SD*= 217.98) and 811.09 (*SD*= 310.07) at T3. For mental state words the number of references to a category of mental state as well as the total reference to mental states was divided by the number of total completed words by the mother and the child at T1 and T3. Table 10 provides descriptive statistics for communication connectedness and Table 11 for maternal and child use of mental state words during their spontaneous play at T1 and T3.

Table 10

Descriptive statistics for measures of communication connectedness at T1 and T3

	Measure	M	SD	Range
Mothers T1	Number of turns	134.13	33.53	50-222
	Connected turns	71.93 (0.53)	29.19	5-138
Children T1	Number of turns	126.02	39.52	10-222
	Connected turns	59.2 (0.45)	28.45	3-144
Mothers T3	Number of turns	135.33	39.19	42-237
	Connected turns	77.15 (0.58)	25.99	14-127
Children T3	Number of turns	134.73	39.78	28-247
	Connected turns	68.22 (0.49)	29.45	10-163

Note. Proportions are shown in parentheses. N= 67.

Table 11

Descriptive statistics for measures of mental state words at T1 and T3

	Measure	M	SD	Range
Mothers T1	Number of completed words	1101.17	347.33	471-2510
(n=67)	Physiological reference	3.63 (0.00)	3.63	0-23
	Desire reference	12.70 (0.01)	6.86	3-33
	Cognitive reference	11.34 (0.01)	8.27	0-48
	Emotion reference	1.99 (0.00)	2.39	0-14
	Total Mental State words	29.66 (0.03)	13.49	7-93
Children T1	Number of completed words	380.18	217.98	12-1095
(n=67)	Physiological reference	1.84 (0.01)	2.64	0-12
	Desire reference	2.09 (0.00)	3.36	0-18
	Cognitive reference	0.37 (0.00)	0.85	0-5
	Emotion reference	0.72 (0.00)	1.49	0-9
	Total Mental State words	5.01 (0.01)	5.41	0-23
Mothers T3	Number of completed words	1065.61	417.98	213-2093
(n=67)	Physiological reference	3.45 (0.00)	3.07	0-15
	Desire reference	10.82 (0.01)	6.33	0-25
	Cognitive reference	15.72 (0.01)	9.94	0-53
	Emotion reference	3.19 (0.00)	3.14	0-16
	Total Mental State words	33.18 (0.03)	16.28	1-88
Children T3	Number of completed words	811.09	310.07	218-1620
(n=67)	Physiological reference	3.22 (3.99)	3.49	0-15
	Desire reference	8.82 (0.01)	6.66	0-31
	Cognitive reference	3.82 (0.00)	4.15	0-18
	Emotion reference	1.97 (0.00)	3.26	0-19
	Total Mental State words	17.84 (0.02)	12.26	0-63

Note. Proportions are shown in parentheses.

Expressive vocabulary was assessed with the New Zealand adaption of the parental questionnaire CDI at T1. The measure used in the current study was total words produced. The mean number of words produced by children at T1 was 349 (*SD*= 182.20). Receptive vocabulary was assessed with the ROWPVT at T1 and T3. Children were asked to point to one out of four coloured pictures which matched the word spoken by the examiner. The mean number of correct words matched to a picture was 32.40 (*SD*= 10.17) at T1 and 61.18 (*SD*= 12.08) at T3. Descriptive statistics for children's expressive vocabulary at T1 and their receptive vocabulary at T1 and T3 are presented in Table 12.

Table 12

Descriptive statistics for measures of expressive and receptive vocabulary at T1 and T3

	Measure	M	SD	Range
CDI T1	Expressive vocabulary	349.39	182.20	11-638
ROWPVT T1	Receptive vocabulary	32.40	10.17	5-53
ROWPVT T3	Receptive vocabulary	61.18	12.08	36-91

Note. CDI= MacArthur Bates Communicative Development Inventory: Words & Sentences (CDI), New Zealand English adaptation (Fenson et al., 1993), ROWPVT= Receptive One Word Picture Vocabulary Test (Martin & Brownell, 2011)

Mother and child variables at time 4

At T4 30 children passed the nonverbal false belief task (45%), and 37 children did not pass the task (55%). Table 13 provides descriptive statistics for children's social competence measured by the Strength and Difficulty Questionnaire (SDQ) and the Social Responsiveness Scale (SRS-2) at T4. One mother didn't complete the SRS-2.

Table 13

Descriptive statistics for measures of children's social competence at T4

PQ	Measure	M	SD	Range
SDQ (n=67)	Emotional Symptoms	1.36	1.57	0-7
	Conduct Problems	1.05	1.33	0-5
	Hyperactivity	2.57	2.13	0-9
	Peer Problems	0.82	1.29	0-6
	Prosocial Behaviour	8.39	1.71	4-10
	Externalising	3.62	3.16	0-13
	Internalising	2.18	2.29	0-9
	Total Difficulties	5.80	4.63	0-20
SRS-2 (n=66)	Social Awareness	5.01	2.47	0-10
	Social Cognition	3.79	3.53	0-14
	Social Communication	7.27	5.72	0-25
	Social Motivation	4.85	4.24	0-18
	Restricted Interests and Repetitive Behavior	2.58	3.03	0-14
	Social Communication and Interaction	20.88	12.97	0-59
	SRS-2 Total Raw Scores	23.76	15.16	1-73
	SRS-2 Total T Score	46.80	6.09	38-66

Note. PQ= Parent Quesionnaire, SDQ= Strength and Difficulty Questionnaire, SRS-2= Social Responsiveness Scale - Second Edition.

General language characteristics are based on scores of the CELF-P2 assessed at T4 and are presented in Table 14. The mean standard score of core language abilities for the children in this study was 113.61 (SD = 14.64). The majority of children (35, 52%) received an core language score above the defined average range (86-114 scores) while 28 (42%) of children were within the average range. Only 4 children (6%) performed in a range below average. The mean expressive language score was 111.91 (SD = 15.36). The majority of children (33, 50%) reached a score within the average range, while 4 children (6%) performed below and 29 (44%) above average. Mean score of the receptive language was 109.96 (SD = 14.37). Most of the children (34, 51%) achieved scores within the average range (86-114), 3 children (4%) performed within the low development range and 30 (45%) performed above the average range.

Table 14

Descriptive statistics for measures of child language assessed with the CELF-P2 at T4

Measure	*M*	*SD*	*Range*
Expressive Language Index standard score	111.91	15.36	66-142
Receptive Language Index standard score	109.96	14.37	76-136
Language Content Index standard score	114.97	16.62	72-145
Language Structure Index standard score	110.49	14.11	69-134
Core Language Score standard score	113.61	14.64	77-142

Note. n= 67 for standard scores of Receptive Language Index, Language Content Index and Core Language. For one child there is no data on the Expressive Language Index and on the Language Structure Index. Therefore, for these two measures n= 66. CELF-P2= Clinical Evaluation of Language Fundamentals - Preschool, second edition (Wiig et al., 2004).

General intellectual capacity of the sample, composed of 67 children, was assessed via administration of the Raven Coloured Progressive Matrices (CPM). CPM consists of 36 items in three sets of 12. The mean of the number of correct items of total 36 was 19.63 (SD = 3.77). Compared to normative data from Australia (Raven & Court, 1998) this score indicates a group performance at the 90-percentile rank. The majority of children (31, 47%) had a score in the intellectually superior range whereas 17 children (25%) performed above average. Fur-

ther 25% of the children reached a score within the average range while two children (3%) performed below average. These results indicate that the children as a group displayed very high general intelligence.

4.2 Transformation and outliers

Prior to data analysis the dataset was examined for distribution of the variables and outliers. Because the distributions for the connectedness and mental state words variables were skewed, log transformations were conducted (Stevens, 2009); however, the distributions were still skewed and the assumption of normality was violated following transformation (see Appendix H). Stevens (2009) posited that regression analysis may be robust to violations of normality with a sufficiently large sample size. Additionally, values for the transformed proportional data (i.e., connectedness and mental state words measures for mother and child) were negative. Because the assumption of normality was violated and the values of the transformed proportional data were negative, inferences based on the results of the statistical analysis need to be drawn with caution.

To assess for outliers, standardized scores for the transformed variables were calculated. Stevens (2009) defined univariate outliers as values greater than ± 3.29 standard deviations from the mean. Univariate outliers were examined and one value was removed from each of the following measures: child connectedness at T1, mother connectedness at T1, mother mental state talk at T1, and mother mental state talk at T3. Variable names are defined in appendix I. Stevens (2009) posited that researchers should consider the cause of the outlier (e.g., data entry issues) when considering if outliers should be removed or retained. An additional consideration is the impact of the outliers on the results of the analysis. To assess the potential influence of removal of the outliers, the means of the variables with and without the

outlying values were assessed. The researcher determined that removal of the outliers did not have a significant effect on the means and standard deviations (Appendix J).

4.3 Correlation analyses

Correlational analyses were conducted to examine the relationships between the use of mental state words and communication connectedness measures at T1 and T3, social competence measures at T4, and performance on the false belief task at T4. I opted against Bonferroni adjustments to set a more stringent significance level for multiple comparisons because of the subsequent loss of power in comparison to using a per test significance threshold (Benjamini & Hochberg, 1995). Field (2009) argues that there is always a trade-off and while it is important that multiple comparison procedures control the Type I error rate this should be the case without a substantial loss in power. Because this was an exploratory study and not a confirmatory study I decided against rejecting differences between means that are meaningful by taking the increase in the Type I error rate into account. Additionally, many of the methods for controlling for family-wise error rates are developed for analysis using normally distributed variables (Benjamini & Hochberg, 1995). Several variables within the current study are not normally distributed. The results of the analysis are presented in Table 15.

Analysis revealed significant correlations between mental state words, communication connectedness, performance on the false belief task and the social competence measures (SRS-2, SDQ) at T4. Therefore, these variables were included in regression analysis to assess how much of the variance in the outcome measures was accounted for by the predictor variables.

Table 15

Results for the correlations between connectedness, mental state words measures, social competence, false belief task, CDI, and ROWPVT

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Child Connected T1	-												
2. Child Connected T3	.146	-											
3. Mother Connected T1	.640**	-.026	-										
4. Mother Connected T3	.344**	-.003	.615**	-									
5. Child Mental State Words T1	-.028	-.077	.259	.067	-								
6. Child Mental State Words T3	-.059	.227	.001	-.083	.165	-							
7. Mother Mental State Words T1	-.025	-.189	.002	.130	.339*	.041	-						
8. Mother Mental State Words T3	.055	.270*	-.015	.038	.144	.253*	.154	-					
9. SDQ T4	-.236	-.050	-.423**	-.205	-.358**	-.011	-.118	-.158	-				
10. SRS-2 T4	-.279*	-.089	-.476**	-.283*	-.343*	-.158	-.076	-.258*	.828**	-			
11. False Belief Task T4	-.123	.085	-.138	-.158	-.035	.262*	.033	.170	.036	.013	-		
12. CDI T1	.463**	.119	.623**	.435**	.034	.072	.110	.126	-.391**	-.492**	-.107	-	
13. ROWPVT T1	.507**	.189	.590**	.396**	.081	-.052	.001	.187	-.335**	-.412**	-.173	.683**	-
14. ROWPVT T3	.357**	.065	.428**	.255*	-.089	-.038	-.035	.048	-.260*	-.343**	-.064	.488**	.588**

Note. * p < .05; ** p < .01

4.4 Main data analyses

Research Question 1

Is the maternal or child's mental state talk or communication connectedness at times 1 and/or 3 associated with the child's performance of the false-belief task at time 4?

Time 1. A binary logistic regression analysis was conducted to determine whether child connectedness at T1, mother connectedness at T1, child mental state words at T1, and mother mental state words at T1 had a significant effect on the odds of the child passing the false belief task. The reference category for the false belief task at T4 was 0 (not passing). The overall model was not significant, $\chi^2(4) = 3.11$, $p = .539$, suggesting that child connectedness at T1, mother connectedness at T1, child mental state words at T1, and mother mental state words at T1 were not associated with the odds of passing the false belief task at T4. Since the overall model was not significant, the individual predictors were not examined further. Table 16 summarizes the results of the regression model.

Table 16

Logistic regression results with performance on false belief task (T4), connectedness (T1), and mental state words (T1)

Variable	Exp(B)	B	SE	$\chi 2$	p
Child connectedness at T1	1.15	0.14	2.84	0.30	.961
Mother connectedness at T1	0.01	-4.79	3.03	5.95	.114
Child mental state words at T1	1.10	0.10	0.93	0.51	.917
Mother mental state words at T1	0.82	-0.20	2.75	0.40	.941

Time 3. A binary logistic regression was conducted to determine whether mother connectedness at T3, child mental state words at T3, mother mental state words at T3, and child connectedness at T3 had a significant effect on the odds of the child performing the false belief

task at T4. The reference category for false belief task at T4 was 0. The overall model was not significant, $\chi^2(4) = 5.52$, $p = .238$, suggesting that mother connectedness at T3, child mental state words at T3, mother mental state words at T3, and child connectedness at T3 did not have a significant effect on the odds of passing the false belief task at T4. Since the overall model was not significant, the individual predictors were not examined further. Table 17 summarizes the results of the regression model.

Table 17

Logistic regression results with connectedness (T3) and mental state words (T3) predicting performance on false belief task (T4)

Variable	Exp(B)	B	SE	$\chi 2$	p
Mother connectedness at T3	0.13	-2.05	2.39	3.00	.392
Child mental state words at T3	9.47	2.25	1.29	6.73	.081
Mother mental state words at T3	5.49	1.70	2.09	2.85	.415
Child connectedness at T3	0.83	-0.18	2.68	0.37	.946

Research Question 2

Is the maternal or child's mental state talk or communication connectedness at times 1 and/or 3 associated with the child's social competence at time 4?

Association between T1 measurements and Social Responsiveness Scale (Second edition; SRS-2) at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between child connectedness at T1, mother connectedness at T1, child mental state words at T1, and mother mental state words at T1 and SRS-2 at T4. Normally, the order that variables are added to a hierarchical model is determined by the degree to which their influence on the outcome variable has been established in literature. Since there is hardly any literature addressing the influence of communication connectedness and

mental state talk on social outcome the order was based on the previous correlation analysis. A stronger correlation was found between communication connectedness measures and scores of SRS-2 than between mental state talk measures and scores of SRS-2. Therefore, communication connectedness was added to the model first. This is also the case in all the following hierarchical analysis. The analysis was conducted in two steps or models; model 1 consisted of connectedness measures at T1, while model 2 consisted of both connectedness measures and mental state talk. The assumption of normality was assessed by plotting the quantiles of the model residuals against the quantiles of a Chi-square distribution, also called a Q-Q scatterplot. For the assumption of normality to be met, the quantiles of the residuals must not strongly deviate from the theoretical quantiles. Strong deviations could indicate that the parameter estimates are unreliable (Stevens, 2009). The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values. The assumption is met if the points appear randomly distributed with a mean of zero and no apparent curvature (Stevens, 2009). The data satisfied both the assumptions of normality and homoscedasticity. Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors. High VIFs indicate increased effects of multicollinearity in the model. VIFs greater than 6 are cause for concern, whereas a VIFs of 10 should be considered the maximum upper limit (Stevens, 2009). All predictors in the regression model have VIFs less than 10, thus the assumption was met. Table 18 presents the VIFs for each predictor in the model.

The hierarchical linear regression analysis was conducted to reveal how much variance in SRS-2 scores at T4 was accounted for by connectedness and mental state talk measures at Time 1. Maternal and child measures were both included in the model for predicting SRS-2 scores in order to further explore the question whether children's mental state talk additionally might be an indicator of their social competence. Table 18 summarizes the model estimates for the analysis with connectedness scores by themselves (model 1) and connectedness scores

with mental state talk scores (model 2). The analysis indicated that connectedness scores alone accounted for 12% of the variance in SRS-2 scores, $F(2,49) = 4.50$, $p = .016$. When the mental state talk measures were added, they accounted to 5% additional variance. The total model accounted for 17% of the variance in SRS-2 scores, $F(4,47) = 3.63$, $p = .012$. Because the models were significant, the individual predictors were assessed further. The predictors were investigated in model 1 since model 2 was not a significant improvement over model 1 ($R^2 = .12$ for Step 1, $\Delta R^2 = .05$ for Step 2 (p = 1.39)). In model 1, mother connectedness at T1 was the only statistically significant predictor, $B = -37.50$, $t = -2.63$, $p = .022$. This result indicates that for every one unit increase in the number of maternal utterances which were connected to their child's previous remark there was a 37.50 unit decrease in SRS-2 score. Even though the second model was not a significant improvement, it is noteworthy that child mental state talk approached significance ($B = -10.36$, $t = -1.90$, $p = .063$), however, it did not meet the .05 alpha level for the analysis.

Table 18

Results of the hierarchical multiple linear regression with connectedness (T1) and mental state words (T1) predicting SRS-2 (T4)

		VIF	*B*	SE	β	t	p	R^2	ΔR^2
Model 1	Child Connected T1	1.10	-17.01	15.97	-0.15	-1.07	.292	.12	.12
	Mother Connected T1	1.10	-37.50	15.87	-0.33	-2.36	.022		
Model 2	Child Connected T1	1.13	-20.90	15.75	-0.18	-1.33	.191	.17	.05
	Mother Connected T1	1.26	-25.15	16.52	-0.22	-1.52	.135		
	Child Mental State Talk T1	1.20	-10.36	5.45	-0.27	-1.90	.063		
	Mother Mental State Talk T1	1.22	-7.79	13.96	-0.08	-0.56	.579		

Note. Model 1: $F(2, 49) = 4.50$, $p = .016$. Model 2: $F(4, 47) = 3.63$, $p = .012$.

Association between T1 measurements and the Strength and Difficulties Questionnaires (SDQ) scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between child connectedness at T1, mother connectedness at T1, child mental state words at T1, and mother mental state words at T1 and SDQ at T4. For the hierarchical analysis, connectedness measures for child and mother at T1 were entered in model 1. The mental state talk measures for child and mother at T1 were entered in model 2. The assumption of normality was assessed by a Q-Q scatterplot and was met. The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values and was met. No multicollinearity was detected as all predictors in the regression model have VIFs less than 10. Table 19 presents the VIFs for each predictor in the model.

The hierarchical linear regression analysis was conducted to reveal how much variance in SDQ scores was accounted for by connectedness and mental state talk measures. Table 19 summarizes the model estimates for the analysis with connectedness scores by themselves (model 1) and connectedness scores with mental state talk scores (model 2). The analyses indicated that connectedness scores accounted for 21% of the variance in SDQ scores without including mental state talk measures, $F(2,50) = 7.82$, $p = .001$. Upon addition of the mental state talk measures, the model accounted for 26% of the variance in SDQ scores when mental state talk measures were included, $F(4,48) = 5.58$, $p = .001$. Because the models were significant, the individual predictors were assessed further. The predictors were investigated in model 1 since model 2 was not a significant improvement over model 1 ($R^2 = .12$ for Step 1, $\Delta R^2 = .05$ for Step 2 (p = 1.39)). In model 1 mother connectedness at T1 was a statistically significant predictor, $B = -14.41$, $t = -3.09$, $p = .003$. This result indicates that for every one unit increase in the number of maternal utterances which were connected to their child's previous remark there was a 14.41 unit decrease in SDQ score. In model 2, is noteworthy that

child mental state talk approached significance (B = -3.11, t = -2.00, p = .052), however, it did not meet the .05 alpha level for the analysis.

Table 19

Results of hierarchical multiple linear regression with connectedness (T1) and mental state words (T1) predicting SDQ (T4)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	Child Connected T1	1.09	-6.87	4.67	-.190	-1.47	.148	.21	.21
	Mother Connected T1	1.09	-14.41	4.67	-.398	-3.09	.003		
Model 2	Child Connected T1	1.12	-7.75	4.57	-.214	-1.70	.096	.26	.05
	Mother Connected T1	1.24	-10.77	4.82	-.297	-2.24	.030		
	Child Mental State Words T1	1.19	-3.11	1.56	-.259	-2.00	.052		
	Mother Mental State Words T1	1.22	-2.56	4.10	-.082	-0.62	.536		

Note. Model 1: $F(2, 52) = 7.82$, $p = .001$, $R^2 = .21$. Model 2: $F(4, 48) = 5.58$, $p = .001$, $R^2 = .26$.

Association between T3 measurements and SRS-2 scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between mother connectedness at T3, child mental state words at T3, mother mental state words at T3, and child connectedness at T3and SRS-2 at T4. The assumption of normality was assessed through a Q-Q scatterplot and was met. The assumption of homoscedasticity was assessed through a scatterplot and was met. All predictors in the regression model have VIFs less than 10, thus no multicollinearity was found. Table 20 presents the VIFs for each predictor in the model.

The hierarchical linear regression analysis was conducted to reveal how much variance in SRS-2 scores was accounted for by connectedness and mental state talk measures at T3. Table 20 summarizes the model estimates for the analysis with connectedness scores at T3 by themselves (model 1) and connectedness scores with mental state talk scores at T3 (model 2). The analyses indicated that connectedness scores accounted for 7% of the variance in SRS-2 scores without including mental state talk measures, $F(2,62) = 3.47$, $p = .037$. Upon addition of the mental state talk measures, the model accounted for 12% of the variance in SRS-2

scores when mental state talk measures were included, $F(4,60) = 3.10$, $p = .022$. Because the models were significant, the individual predictors were assessed further. The predictors were investigated in model 1 since model 2 was not a significant improvement over model 1 ($R^2 = .12$ for Step 1, $\Delta R^2 = .05$ for Step 2 ($p = 1.68$)). In model 1, mother connectedness at T3 was a statistically significant predictor, $B = -41.00$, $t = -2.53$, $p = .014$. This result indicates that for every one unit increase in the number of maternal utterances which were connected to their child's previous remark there was a 41.00 unit decrease in SRS-2 score.

Table 20

Results of the hierarchical multiple linear regression for predicting SRS-2 (T4) from connectedness (T3), and mental state words (T3)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	Child Connected T3	1.00	-11.10	17.84	-0.08	-0.62	.536	.07	.07
	Mother Connected T3	1.00	-41.00	16.21	-0.31	-2.53	.014		
Model 2	Child Connected T3	1.12	2.07	18.37	0.01	0.11	.911	.12	.05
	Mother Connected T3	1.02	-41.95	15.93	-0.31	-2.63	.011		
	Child Mental State Talk T3	1.12	-9.06	8.49	-0.13	-1.07	.290		
	Mother Mental State Talk T3	1.14	-19.61	11.48	-0.21	-1.71	.093		

Note. Model 1: $F(2, 62) = 3.47$, $p = .037$, $R^2 = .07$. Model 2: $F(4, 60) = 3.10$, $p = .022$, $R^2 = .12$.

Association between T3 measurements and SDQ scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between mother connectedness at T3, child mental state words at T3, mother mental state words at T3, and child connectedness at T3 and SDQ at T4. Model 1 of the regression analysis consisted of the connectedness measures at T3. Model 2 of the regression analysis consisted of the connectedness measures and mental state talk measures at T3. The assumption of homoscedasticity was assessed through a scatterplot and was met. All predictors in the regression model have VIFs less than 10; as such, no multicollinearity is present. Table 21 presents the VIFs for each predictor in the model.

The results of the hierarchical multiple linear regression for model 1 were not significant, $F(2,63) = 2.00$, $p = .144$, $R^2 = 0.03$, indicating mother connectedness and child connectedness at T3 did not explain a significant proportion of variation in SDQ at T4. Results of the hierarchical multiple linear regression for model 2 were not significant, $F(4,61) = 1.35$, $p = .261$, $R^2 = 0.02$, indicating that connectedness and mental state talk measures at T3 did not explain a significant proportion of variation in SDQ at T4. Since the overall model was not significant, the individual predictors were not examined further. Table 21 summarizes the results of the regression model.

Table 21

Results for hierarchical multiple linear regression for predicting SDQ (T4) from connectedness (T3), and mental state words (T3)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	Child Connected T3	1.00	-1.56	5.57	-0.03	-0.28	.781	.03	.03
	Mother Connected T3	1.00	-9.92	5.05	-0.24	-1.97	.054		
Model 2	Child Connected T3	1.12	.292	5.90	0.01	0.05	.961	.02	-.01
	Mother Connected T3	1.01	-9.75	5.10	-0.24	-1.91	.060		
	Child Mental State Talk T3	1.11	0.15	2.71	0.01	0.05	.957		
	Mother Mental State Talk T3	1.13	-4.35	3.66	-0.16	-1.19	.239		

Note. Model 1: $F(2,63) = 2.00$, $p = .144$, $R^2 = 0.03$. Model 2: $F(4,61) = 1.35$, $p = .261$, $R^2 = 0.02$.

Research Question 3

Is performance of the false-belief task at time 4 associated with the child's social competence at time 4?

To assess the relationship between performance on the false belief task at T4 and child's social competence, Spearman correlation analyses were conducted. Results indicated that there were no statistically significant relationships between the false belief task and SDQ ($r(67) = .04$), or between the false belief task and SRS-2 ($r(66) = .07$).

4.5 Summary of main data analyses

Mother communication connectedness was found to be a significant predictor of scores of both questionnaires. Mother connectedness for T1 and T3 predicted how mothers scored their children's social competence on the SRS-2 at T4. For the SDQ it was only mother communication connectedness at T1 which significantly predicted children's scores on this questionnaire at T4. These results will be further discussed in the following chapter.

4.6 Secondary analyses

The main question in this thesis was whether specific aspects of language are linked to social competence through perspective taking and awareness of others' false belief. Mental state talk and communication connectedness have been identified to be related to false-belief understanding in children. Therefore, in order to answer my main question these two aspects of language were considered. Mother communication connectedness was found to be a significant predictor of scores of questionnaires assessing the children's social competence. This indicated that there is relation between specific aspects of language and social competence. Nevertheless, the amount of variance explained by communication connectedness and mental state talk was modest and therefore other variables must have been involved in the children's social development. In order to explore the relationship between specific aspects of language and social competence in more depth further analyses were considered.

Children with poor receptive or expressive language are at higher risk of displaying behaviour problems than their typically developing peers (e.g., Bretherton et al., 2013; Horwitz et al., 2003; Irwin, Carter, & Briggs-Gowan, 2002). Therefore, it is likely that these aspects of language further influenced the social development of children in the current study.

Indeed, correlation analysis of the current study, identified significant correlations between the CDI at T1 which assessed expressive vocabulary, the ROWPVT at T1 and T3 which assessed receptive vocabulary and the scores for both parental questionnaires (SDQ and SRS-2) at T4 indicating a relationship between the children's expressive and receptive vocabulary at T1 and T3 and their social competence at T4. Therefore, in addition to the stated research question it was of interest to determine whether expressive and receptive vocabulary measured with the CDI and the ROWPVT accounted for further variance in social competence.

Association between T1 additional measurements and SRS-2 scores at T4

As reported, it was found that children with language impairment often displayed difficulties in their social competence. This indicates a relationship between language abilities and social competence. Therefore, the previous regression analysis was repeated by adding CDI and ROWPVT scores in the model first in order to control for expressive and receptive vocabulary. A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between CDI at T1, ROWPVT at T1, child connectedness at T1, mother connectedness at T1, child mental state words at T1, mother mental state words at T1 and SRS-2 at T4. Model 1 of the analysis comprised CDI and ROWPVT scores at T1. Model 2 of the analysis comprised CDI and ROWPVT scores and connectedness at T1. Model 3 of the analysis comprised CDI, ROWPVT, connectedness and mental state talk at T1. The assumption of normality was assessed by a Q-Q scatterplot and was met. The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values and was met. All predictors in the regression model have VIFs less than 10, so the assumption of absence of multicollinearity was met. Table 22 presents the VIFs for each predictor in the model.

The results of the hierarchical linear regression model were significant in model 1, $F(2,49) = 7.02$, $p = .002$, $R^2 = 0.22$, indicating that approximately 22% of the variance in

SRS-2 was accounted for by CDI and ROWPVT scores at T1. In model 2, $F(4,47) = 4.04$, $p = .007$, $R^2 = 0.26$, indicating that approximately 26% of the variance in SRS-2 was explainable by CDI, ROWPVT and connectedness at T1. The results were also significant in model 3, $F(6,45) = 4.18$, $p = .002$, $R^2 = 0.36$, indicating that approximately 36% of the variance in SRS-2 was accounted for by the model. Because the models were significant, the individual predictors were assessed further. Model 3 was a significant improvement over model 1 and model 2 and was therefore used for the examination of individual predictors ($R^2 = .26$ for Step 2, $\Delta R^2 = .36$ for Step 3 ($p = .04$)). Results of the regression are included in Table 22. CDI at T1 was a statistically significant predictor, $B = -0.04$, $t = -2.67$, $p = .011$. This result indicates that for every one unit increase in child expressive vocabulary, there was a 0.04 unit decrease in SRS-2. Child's mental state talk at T1 was also a statistically significant predictor, $B = -11.68$, $t = -2.28$, $p = .028$.

Table 22

Results for hierarchical multiple linear regression for predicting SRS-2 (T4) from CDI (T1), ROWVPT (T1), connectedness (T1) and mental state words (T1)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	CDI scores T1	1.60	-0.04	0.01	-0.45	-2.82	.007	.22	.22
	ROWPVT Score T1	1.60	-0.05	0.22	-0.04	-0.22	.825		
Model 2	CDI scores T1	1.64	-0.04	0.01	-0.40	-2.37	.022	.26	.04
	ROWPVT Score T1	1.62	-0.07	0.23	0.54	0.32	.754		
	Child Connected T1	1.14	-15.24	15.74	-0.13	-0.97	.338		
	Mother Connected T1	1.15	-16.73	18.19	-0.15	-0.92	.363		
Model 3	CDI scores T1	1.80	-0.04	0.01	-0.43	-2.67	.011	.36	.10
	ROWPVT Score T1	1.93	0.03	0.23	0.02	0.14	.886		
	Child Connected T1	1.20	-18.67	15.23	-0.16	-1.23	.227		
	Mother Connected T1	1.84	0.70	18.72	0.06	0.04	.970		
	Child Mental State Talk T1	1.21	-11.68	5.13	-0.30	-2.28	.028		
	Mother Mental State Talk T1	1.28	-9.21	13.38	-0.09	-0.69	.495		

Note. Model 1: $F(2,49) = 7.02$, $p = .002$, $R^2 = 0.22$. Model 2: $F(4,47) = 4.04$, $p = .007$, $R^2 = 0.26$. Model 3: $F(6,45) = 4.18$, $p = .002$, $R^2 = 0.36$.

Association between T1 additional measurements and SDQ scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between CDI at T1, ROWPVT at T1, child connectedness at T1, mother connectedness at T1, child mental state words at T1, mother mental state words at T1 and SDQ at T4. The predictor variables were entered hierarchically, with model 1 consisting of CDI and ROWPVT scores. Model 2 consisted of CDI, ROWPVT and connectedness measures. Model 3 consisted of CDI, ROWPVT, connectedness and mental state talk measures. The assumption of normality was examined through a Q-Q scatterplot and was met. Strong deviations could indicate that the parameter estimates are unreliable. The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values and was met. The assumption of absence of multicollinearity was met, as all predictors in the regression model have VIFs less than 10. Table 23 presents the VIFs for each predictor in the model.

The results of the hierarchical linear regression model were significant in model 1, $F(2,50) = 5.23$, $p = .009$, $R^2 = 0.17$, indicating that approximately 17% of the variance in SDQ was explainable by CDI and ROWPVT scores at T1. In model 2, $F(4,48) = 4.50$, $p = .004$, $R^2 = 0.27$, indicating that approximately 27% of the variance in SDQ was explainable by CDI, ROWPVT and connectedness measures at T1. The results were also significant in model 3, $F(6,46) = 4.43$, $p = .001$, $R^2 = 0.37$, indicating that approximately 37% of the variance in SDQ was accounted for by the model.

Results of the regression are included in Table 23. Model 3 was a significant improvement over model 1 and model 2 and was therefore used for the examination of individual predictors ($R^2 = .27$ for Step 2, $\Delta R^2 = .37$ for Step 3 ($p = .04$)). In model 3, child mental state talk was a statistically significant predictor, $B = -3.44$, $t = -2.22$, $p = .031$. This results indicates that for every one unit increase in child mental state talk, there was a 3.44 unit de-

crease in SDQ scores. Mother connectedness approached significance (*B* = -10.70, *t* = -1.92, *p* = .061), however, it did not meet the .05 alpha level for the analysis.

Table 23

Results for hierarchical multiple linear regression for predicting SDQ (T4) from CDI (T1), ROWPVT (T1), connectedness (T1) and mental state words (T1)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	CDI Score T1	1.57	-0.01	0.00	-0.34	-2.10	.041	.17	.17
	ROWPVT Score T1	1.57	-0.05	0.07	-0.11	-0.71	.481		
Model 2	CDI Score T1	1.60	-0.01	0.00	-0.26	-1.44	.156	.27	.10
	ROWPVT Score T1	1.59	-0.02	0.07	-0.04	0.26	.798		
	Child Connected T1	1.14	-6.74	4.81	-0.19	-1.40	.168		
	Mother Connected T1	1.16	-10.70	5.58	-0.30	-1.92	.061		
Model 3	CDI Score T1	1.79	-0.01	0.00	-0.28	-1.76	.085	. 37	.10
	ROWPVT Score T1	1.90	0.01	0.07	0.03	0.17	.869		
	Child Connected T1	1.20	-7.51	4.66	-0.21	-1.61	.114		
	Mother Connected T1	1.83	-5.68	5.74	-0.16	-0.99	.328		
	Child Mental State Talk T1	1.21	-3.44	1.55	-0.29	-2.22	.031		
	Mother Mental State Talk T1	1.28	-2.75	4.13	-0.09	-0.67	.509		

Note. Model 1: $F(2,50) = 5.23$, $p = .009$, $R^2 = 0.17$. Model 2: $F(4,48) = 4.50$, $p = .004$, $R^2 = 0.27$. Model 3: $F(6,46) = 4.43$, $p = .001$, $R^2 = 0.37$.

Association between T3 additional measurements and SRS-2 scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between ROWPVT at T3, child connectedness at T3, mother connectedness at T3, child mental state words at T3, mother mental state words at T3 and SRS-2 at T4. Model 1 of the analysis consisted of ROWPVT scores. Model 2 of the analysis consisted of ROWPVT, and connectedness measures. Model 3 of the analysis consisted of ROWPVT, connectedness and mental state talk measures. The assumption of normality was assessed by plotting a Q-Q scatterplot and was met. The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values and was met. All predictors in the regression model have VIFs less than 10, which indicates absence of multi-collinearity. Table 24 presents the VIFs for each predictor in the model.

Results of the regression are included in Table 24. The results of the hierarchical linear regression for model 1 were significant, F(1,63) = 8.62, p = .005, R^2 = 0.12, indicating that approximately 12% of the variance in SRS-2 at T4 is explainable by ROWPVT scores at T3. The results show that model 2 was significant, $F(3,61) = 4.48$, $p = .007$, $R^2 = 0.18$, indicating that approximately 18% of the variance in SRS-2 at T4 is explainable by ROWPVT scores and connectedness measures. Model 3 was also significant, F(5,59) = 3.96, p = .004, R^2 = 0.25, indicating that approximately 25% of the variance in SRS-2 at T4 is explainable by ROWPVT scores, connectedness and mental state talk measures at T3. The predictors were investigated in model 1 since model 2 and model 3 were not a significant improvement over model 1 (R^2 = .12 for Step 1, ΔR^2 = .06 for Step 2 (p = .12), ΔR^2 = .07 for Step 3 (p = .07)). In model 1, ROWPVT scores at T3 was a statistically significant predictor, $B = -0.44$, $t = -2.94$, $p = .01$. This result indicates that for every one unit increase in the number of maternal utterances which were connected to their child's previous remark there was a 0.44 unit decrease in SRS-2 score.

Table 24

Results for hierarchical multiple linear regression for predicting SRS-2 (T4) from ROWPVT (T3), connectedness (T3) and mental state words (T3)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	ROWPVT T3	1.00	-0.44	0.15	-0.35	-2.94	.005	.12	.12
Model 2	ROWPVT T3	1.01	-0.44	0.15	-0.34	-2.93	.005	.18	.06
	Child Connected T3	1.08	-7.62	17.23	-0.05	-0.44	.660		
	Mother Connected T3	1.08	-18.56	10.99	-0.20	-1.69	.044		
Model 3	ROWPVT T3	1.06	-0.37	0.15	-0.29	-2.51	.015	.25	.07
	Child Connected T3	1.12	5.62	17.67	0.04	0.32	.752		
	Mother Connected T3	1.06	-34.08	15.59	-0.25	-2.19	.033		
	Child Mental State Talk T3	1.13	-10.46	8.15	-0.15	-1.28	.205		
	Mother Mental State Talk T3	1.14	-18.11	11.02	-0.20	-1.64	.106		

Note. Model 1: F(1,63) = 8.62, p = .005, R^2 = 0.12. Model 2: $F(3,61) = 4.48$, $p = .007$, $R^2 = 0.18$. Model 3: F(5,59) = 3.96, p = .004, R^2 = 0.25

Association between T3 additional measurements and SDQ scores at T4

A hierarchical multiple linear regression analysis was conducted to assess whether a significant relationship existed between ROWPVT at T3, child connectedness at T3, mother connectedness at T3, child mental state words at T3, mother mental state words at T3 and SDQ at T4. Model 1 of the analysis consisted of ROWPVT scores. Model 2 of the analysis consisted of ROWPVT and connectedness measures. Model 3 of the analysis consisted of ROWPVT, connectedness and mental state talk measures The assumption of normality was assessed by plotting a Q-Q scatterplot and was met. The assumption of homoscedasticity was assessed by plotting the model residuals against the predicted model values and was met. All predictors in the regression model have VIFs less than 10, which indicates absence of multi-collinearity. Table 25 presents the VIFs for each predictor in the model.

The results of the hierarchical linear regression for model 1 were significant, $F(1,64) = 4.99$, $p = .03$, $R^2 = 0.07$, indicating that approximately 7% of the variance in SDQ at T4 is explainable by ROWPVT scores at T3. The results indicate that model 2 was not significant, $F(3,62) = 2.49$, $p = .07$, $R^2 = 0.11$, indicating that approximately 11% of the variance in SDQ at T4 is explainable by ROWPVT, child connectedness at T3 and mother connectedness at T3. Results of model 3 were also not significant, $F(5,60) = 1.76$, $p = .13$, $R^2 = 0.13$, indicating that approximately 13% of the variance in SDQ at T4 is explainable by ROWPVT, connectedness and mental state words measures at T3. The predictors were investigated in model 1 since model 2 and model 3 were not a significant improvement over model 1 ($R^2 = .07$ for Step 1, $\Delta R^2 = .04$ for Step 2 ($p = 0.30$), $\Delta R^2 = .13$ for Step 3 ($p = 0.50$)). In model 1, ROWPVT scores significantly predicted SRS-2 at T4, $B = -0.27$, $t = -2.23$, $p = .03$. This result indicates that for every one unit increase in the number of the child's receptive vocabulary there was a 0.27 unit decrease in SDQ at T4. Results of the multiple linear regression are included in Table 25.

Table 25

Results for hierarchical multiple linear regression for predicting SDQ (T4) from ROWPVT (T3), connectedness (T3) and mental state words (T3)

		VIF	B	SE	β	t	p	R^2	ΔR^2
Model 1	ROWPVT T3	1.00	-0.10	0.05	-0.27	-2.23	.03	.07	.07
Model 2	ROWPVT T3	1.00	-0.09	0.05	-0.23	-1.82	.07	.11	.04
	Child Connected T3	1.07	-0.82	5.48	0.02	-0.15	.88		
	Mother Connected T3	1.07	-7.88	5.08	-0.19	-1.55	.13		
Model 3	ROWPVT T3	1.06	-0.09	0.05	-0.22	-1.79	.08	.13	.03
	Child Connected T3	1.12	1.04	5.81	0.02	0.18	.86		
	Mother Connected T3	1.06	-7.78	5.13	-0.19	-1.52	.13		
	Child Mental State Talk T3	1.11	-0.06	2.66	0.00	-0.02	.98		
	Mother Mental State Talk T3	1.13	-4.16	3.59	-0.15	-1.16	.25		

Note. Model 1: $F(1,64) = 4.99$, $p = .03$, $R^2 = 0.07$. Model *2:* $F(3,62) = 2.49$, $p = .07$, $R^2 = 0.11$. Model 3: $F(5,60) = 1.76$, $p = .13$, $R^2 = 0.13$

4.7 Summary of secondary analyses

Secondary analysis were conducted in order to find out whether receptive and expressive language skills accounted for further variance in social competence scores. By adding the CDI but not the ROWPVT scores to the model first, a much stronger model for the prediction of SRS-2 was created. CDI at the age of 24 to 31 months was a significant predictor of the social outcome of children at the age of 5 years measured with the SRS-2. This seems to indicate that expressive vocabulary has a strong link to social outcome. Additionally, child mental state talk at the age of 24 to 31 months was a significant predictor for scores of both measurements of social competence at the age of 5 years - SDQ and SRS-2. Surprisingly, mother connectedness was no longer a significant predictor of social outcome. These results will be further discussed in the next chapter.

5 Discussion

In this chapter, the results are discussed, and the current study is placed within the larger research framework. First, an overview of the study is provided to provide the aim of the current study and how it is addressed. Furthermore, the current study's results are discussed in detail and in relation to the existing literature, followed by an assessment of the strengths and weaknesses of the current study, implications for clinical practice and suggestions for future research. Finally, the chapter ends with conclusions on how the current study's aim has been fulfilled.

5.1 Overview of the study

The main aim of the current study is to assess the relationship between language and children's social competence. The overarching hypothesis is that children's ability to produce and hear mental state words and be connected in communication with their mothers at time 1 (T1) and time 3 (T3) is linked to the children's social competence at time 4 (T4) through the social skill of perspective taking and the ability to understand that other people might hold a false belief. Three research questions have been asked to explore this hypothesis. In the first research question, it was examined whether mental state talk and communication connectedness measured at children's age of 24–31 months and at 41–49 months improved predictive models for false-belief understanding at 5 years of age in this cohort. In the second research question, we explored whether the aspects of mental state talk and communication connectedness predicted social competence of five-year olds. The third research question addressed the relationship between children's false-belief understanding and their social competence at the age of 5 years. The overall pattern of the data in the current study was considered to find evi-

dence of the influence between expressive language, including mental state words and maternal communication connectedness, and social competence in children who are in the age range of 2–5 years, while acknowledging that no firm conclusion could be drawn about the role of false-belief understanding on social competence in the current study. A discussion of the results is presented in the following section.

5.2 The predictive relationship between mental state talk, communication connectedness and children's later false-belief understanding

In the current study, mental state talk and communication connectedness were not associated with children's performance of the false-belief task later in their development (T1: $\chi^2(4) = 3.11$, $p = .539$; T3: $\chi^2(4) = 5.52$, $p = .238$). These findings contradict the results of previous studies, which reported that talk about mental states, including emotions, desires, thoughts and knowledge, is related to the development of false-belief understanding (Adrian et al., 2005; Ensor et al., 2014; Howard, Mayeux, & Naigles, 2008; Hughes & Dunn, 1997; Symons et al., 2006; Turnbull et al., 2008).

There are several possible explanations for these unexpected findings. First, it is feasible that the task chosen to assess false-belief understanding in the current study was not appropriate enough for various reasons. The nonverbal, competitive task used in the present study was designed by Krachun et al. (2009). The rationale to assess children on this specific task was based on the consideration that it was a valid measure of one's ability to take another person's perspective and understand that the other person might be holding a false belief. Krachun et al. (2009) reported that in their study, 70% (14) of the five-year-old typically developing children passed this nonverbal and competitive task with the passing criterion at three or more trials correct out of four. They found that as a group, children performed comparable in

the Sally-Anne test, which is a standard verbal change-of-location task often used to assess false-belief understanding in children. This indicated that the nonverbal, competitive false-belief task was a valid assessment. Additionally, this task was chosen because children did not require specific linguistic skills to pass, and they were observing and acting out instead of answering questions. This was of great importance since language was one of the predictor variables. Finally, Krachun et al. (2009) assessed this task on a group of 20 typically developing children aged between 54 to 61 months old (mean = 58 months). The mean age of our group of children was 63.3 months, so there was a very close match between the children in the current study and the children assessed by Krachun et al. (2009), with our children being a bit older. It might be reasonable to think that older children would pass the task more easily because they are further developed in false-belief understanding. Nonetheless, in the present study, more than half of the children (55%, 37) failed this competitive, nonverbal false-belief task. It could be that children did not pass this task because they had not developed an understanding of false belief at that time or this task did not appropriately assess false belief understanding in the children who participate in the present study. So far, this task has not been replicated in another study; therefore, no information about performance across different participants has been found. Additionally, there is also a possibility that children did not pass this task for other reasons. It is plausible that some of the children were distracted by the competitive context. This context might have made it difficult for children to make careful choices because they wanted to act quickly and effectively to win the sticker a competitor missed. Children were often very excited about their prospect of winning a sticker; thus, making thoughtful responses was rather difficult. In a similar task by Peterson, Slaughter, Peterson and Premack (2013), children did well in a competitive setting when they first had to choose an adult before the actual act of winning a prize. In this task, 33 (66%) of four-year-old, typically developing children passed two trials following the given procedures. A child and the experimenter hid a sticker, while two adults (Dot and Midge) were watching. Dot was leaving

the room while Midge witnessed how the experimenter was putting the prize in another box. Midge also left the room, and once both were back, the child was asked to choose an adult (Dot or Midge) to open a box. Children were aware of the fact that if the adult found the prize, they would go empty-handed. To receive the prize, children had to understand that Dot was holding a false belief and was consequently less likely to open the correct box and that choosing her would increase their own chance of winning. In the current study, children had to first reconsider the scene they had observed and think about who had or had not witnessed the change instead of immediately acting out by themselves. It might be the case that taking a moment to choose an adult is less disruptive to understanding the resulting belief state of others than immediately acting out by themselves. Thus, even though the competitive nature of the false-belief task used in the current study was intended to make the test easier and more interesting for the children, it may have hindered their performance.

The second possibility for this contradiction between our findings and those of previous research could lie in the fact that only one false-belief task was administered in the current study, while several false-belief tasks were assessed in the cited studies. The rationale for using only one task was that combination of false-belief tasks is quite time-consuming and since the current study was part of a broader study, time was limited. It was also important to consider that task batteries can include measures that assess other aspects that do not address a specific research question, and several standard and non-standard measures are relevant for different developmental stages. Therefore, for the current study, only one task was selected. This was not the case in the cited studies in which the relationship between maternal mental state talk and children's false-belief understanding was found. For example, Ensor et al. (2014) assessed 105 children (mean age = 5.93 years) on five false-belief tasks. When the children were younger (mean age = 2.36 years), interactions with their mothers were filmed at their homes during a meal preparation or while they were having dinner together. Mother's references to cognition, desires and feelings were coded and analysed. It was reported that

frequencies of mothers' cognitive references during interactions with their 2-year-olds predicted individual differences in children's performance of these five-false belief tasks. Howard et al. (2008) tested false-belief understanding in 63 three- and four-year-old children on an unexpected content task and on a change of location task. Furthermore, mothers' references to mental states in naturalistic interaction with their children were coded and analysed. It was found that maternal mental references predicted children's false-belief performance. Symons et al. (2006) even used 11 tasks to assess false-belief understanding in 43 children (mean age= 69.2 months). The same children were observed in a spontaneous play setting with their mothers earlier in development (mean age = 24.7 months). The mother's mental state language was coded and was found to be significantly related to their children's later understanding of false belief. According to these studies, it could be the case that assessing several false-belief tasks might provide a more robust collective than a single task measure to assess a relationship between maternal mental state talk and children's false-belief understanding. Furthermore, it was reported that children can perform inconsistently across different false-belief tasks, even across standard tests (Charman & Campbell, 1997). Such discrepancies in performance are likely due to individual differences in false-belief understanding across various task types. It is thus possible that the children in the current study were not able to pass the false-belief task in the change-of-location paradigm but were able to pass a false-belief task in other paradigms, such as change of content. Therefore, for future studies in which associations between language and false-belief understanding are examined, one recommendation would be to focus on a careful selection of tasks for assessing children's false-belief understanding. This selection should include tasks that have been used on large representative samples, have been examined for reliability and are suitable for young children at the same development stage.

The third possible reason for a contradiction may be found in the manner in which maternal mental state talk was assessed. The current study and the study by Symons et al.

(2006) assessed mother–child interactions in a spontaneous setting, whereas other studies used specific picture books to observe mother's references to mental states. For example, Adrian et al. (2005) assessed mothers' references to mental states while the mothers were reading a book with their children. Thirty-four children with a mean age of 4;10 years participated with their mothers. Those children were also assessed on a false-belief task and the authors reported that the frequency of cognitive and emotional terms correlated positively with the children's false-belief understanding. Turnbull et al. (2008) found an association between the frequency of mothers' mental state references and their children's false-belief understanding using a picture-book task. In this study, 70 children with a mean age of 53 months participated with their mothers. The stories in the books used in both studies had a presentation of events with obvious mentalist content such as false belief, trickery, and lies in common. It is likely that these contrasting settings differentially encouraged participation in social interaction (De Rosnay & Hughes, 2006) and influenced the type of discourse. For example, Hoff-Ginsberg (1991) found that maternal vocabulary was richer during book reading than toy playing. Thus, these picture books could have encouraged the extent to which mothers referred to mental states.

The findings also contradict the results of two studies that reported that the frequency of connected communication between mothers and their children is associated with false-belief understanding (Dunn & Cutting, 1999; Ensor & Hughes, 2008). Ensor and Hughes (2008) examined communication between mothers and their children in a spontaneous play setting. Participants were 120 mother–child pairs who took part in a longitudinal study across three time points. During the first assessment, children's mean age was 2.38 years; during the second, 3.45 years; and during the last, 4.19 years. In the first setting, maternal communication connectedness was assessed and analysed. Children's false-belief understanding was tested at all three time points through several false-belief tasks. A significant correlation between mothers' connected turns and children's false-belief performance was reported across

all time points ($p < .01$). It could be that the same methodological issues in the previous section might be responsible for these contradicting findings. It seems reasonable that assessing several false-belie tasks might provide a more robust outcome than a single task measure in detecting a relationship between communication connectedness and children's false-belief understanding.

Dunn and Cutting (1999) observed 128 children (mean age = 4.16 years) while they were playing with friends in a spontaneous play setting. The children were further assessed on seven false-belief tasks, and it was found that children who were less connected in communication with their friends were the ones who scored lower on false-belief tasks. This study differed in two main aspects from the current study. First, in the current study mother–child communication were assessed, whereas Dunn and Cutting (1999) measured communication between friends. Second, Dunn and Cutting (1999) used far more tasks to assess false-belief understanding. Moreover, the number of tasks used to assess false belief could be important, but it is also probable that communication between friends is structured differently from that between a mother and her child. Siblings and friends are also reported to have an impact on a child's development. Children with more siblings have been found to pass tasks that assess earlier false-belief understanding (McAlister & Peterson, 2007; Perner, Ruffman, & Leekam, 1994; Ruffman, Perner, Naito, Parkin, & Clements, 1998). Furthermore, findings from the Pennsylvania Study of Social Understanding (Dunn, 1999) indicated that children spontaneously referred more often to mental states when they talked to their siblings rather than their mothers.

In summary, in contrast to previous research, it was not found that mental state talk and communication connectedness were related to false-belief understanding. It is likely that methodological issues were responsible for these contradictory findings.

5.3 The predictive relationship between mental state talk, communication connectedness and children's later social competence that was measured through the SRS-2

As reported in the literature review, previous research found that a high frequency of mental state talk and communication connectedness had an impact on children's false-belief understanding (Adrian et al., 2005; Cutting & Dunn, 1999; Ensor et al., 2014; Ensor & Hughes, 2008; Howard et al., 2008; Hughes & Dunn, 1997; Symons et al., 2006; Turnbull et al., 2008). Moreover, it was reported that false-belief understanding was linked to social competence (De Rosnay et al., 2013; Slaughter et al., 2002). De Rosnay et al. (2013) reported that children who performed well in false-belief tasks also displayed high social skills in everyday conversations that require taking others' perspective into account. Since all these factors seem to be indirectly related with each other, the rationale for including a regression analysis to assess a relationship among mental state talk, communication connectedness and social competence was based on the hypothesis that the described language measurements might also be directly related to social competence. Additionally, analysis revealed a significant correlation between the SRS-2 questionnaire and children's mental state talk ($r = -0.34$), the mother's mental state talk ($r = -0.26$), the child's connectedness ($r = -0.28$) and the mother's connectedness ($r = -0.28$).

In the present study, communication connectedness and mental state talk at the age of 24–31 months (T1) accounted for 17% of the variance in social competence that was assessed through the SRS-2 at the age of 5 years. At the age of 42–48 months (T3), the model accounted for 12% of the variance. Specifically, the manner in which the mothers' talk was connected to their children's talk contributed to predicting the children's SRS-2 scores. We should note that the amount of variance explained by communication connectedness is modest, as it indicates that other factors might be involved, such as language and other aspects of children's history of social interaction including sibling interaction and family talk (e.g., Dunn et al.

(1991)). The relationship between maternal connectedness and children's social competence seemed to be stable, with the mother's connected talk at both assessment time points predicting their children's social competence (T1: $p = .022$; T3: $p = .011$).

To the best of our knowledge, this is the first study to address associations between early connectedness in communication between mothers and children and children's later social competence. The findings indicate that a mother's connectedness in communication with her child is one factor of the child's later social competence. Specifically, it was found that the more a mother was tuned into her child's talk at 24–31 months and 41–49 months of age, the fewer social difficulties she reported on the SRS-2 when her child was 5 years old.

Some support for our findings of a relationship between the parent–child interaction style and aspects of a child's social competence can be found in a study that was conducted by Black and Logan (1995). They analysed similar communication aspects in 43 children (ages 24–60 months) and their parents. Parents whose children were rejected by their peers were found to differ in their communication style compared to those children were popular. Parents whose children were rejected used more irrelevant turns, concurrent turns and those that failed to give the children time to respond following a request. Additionally, this failure to leave time for a response was observed in combination with more requests than those made by parents of popular children. Parents of rejected children were also more likely to respond contingently or not at all to their children's request. By contrast, parents of popular children were more likely to use a style of turn taking in which alternation of turns included relevant exchanges of information. These parents used shorter turns and provided room for their children to initiate topics. These findings on a relationship between the parent–child interaction style and aspects of a child's social competence have to be interpreted with care because the results are correlations. The possibility that the rejected children in this study may also display other behavioural problems that influence their acceptance by peers such as language difficulties cannot be ruled out. It has been proposed that children with emotional and behavioural difficulties are

likely to have language-development deficits (Benner, Nelson, & Epstein, 2002; Nelson, Benner, Neill, & Stage, 2006). Therefore, there is a possibility that these children display less language abilities, which influence their parents' communication style. Accordingly, it has been argued that a child's difficulties in language development affects his or her parents, who consequently provide less than ideal input as a direct result of their effort to compensate for their toddler's deficits (Tannock & Girolametto, 1992; Whitehurst et al., 1988). A feasible explanation for the relationship between communication connectedness and social competence could be that children gain insight into their mother's mind in a shared moment of focus. Recall that maternal connected turns are semantically related comments associated to a child's previous utterance. Therefore, a connected utterance a mother produces is relevant to the child's current focus of attention. It could be argued that this shared conversational focus enhances a child's social understanding because in these connected moments, the child and the mother build up a shared perspective. Thus, the child gets an insight into the mind and the knowledge of the mother. The child might experience that the mother has a different perspective or understanding of the situation. Through this insight and the understanding that the mother knows things he or she does not know, a child learns to take others' perspective, which is argued to be an important factor in one becoming socially competent. This aligns with a statement from Ensor and Hughes (2008) who proposed that the mothers' connectedness is accelerating a child's social understanding just as a child's acquisition of language is enhanced by adults' sensitivity in labelling objects within the child's focus of attention.

No association has been found between the use of the mother's mental state words and children's SRS-2 scores in the current study (T1: p = .579; T3: p = .093). In other words, it was not found that a mother who referred more to mental states also reported fewer social difficulties for her child on the SRS-2. It might be the case that maternal mental state talk had no effect on the child's social competence per se, or the effect was not strong enough to be detected. Surprisingly, children's use of mental state words approached significance (T1: p =

.063) in being a predictor of SRS-2 scores. Even if the result was not significant, it indicates a trend for a relationship between the child's production of mental state words and social competence. A correlation was found between the child's mental state talk at T1 and both parental questionnaires that assessed social competence at T4. This is consistent with studies that reported that children's use of mental state terms in conversation was correlated with social measures (Brown et al., 1996; Brown & Dunn, 1991).

5.4 The predictive relationship between mental state talk, communication connectedness and children's later social competence measured with the SDQ

In the current study, two parental questionnaires are used to assess children's social competence. While the SRS-2 is an instrument that consists of more items, the SDQ was used for additional screening. Nonetheless, being different measures, the SRS-2 and the SDQ tap into different behaviours at the item level. The SRS-2 is designed to identify children with social impairments and, therefore, its items measure various aspects of social awareness, social cognition, social communication, social motivation and autistic mannerisms. The items on the SDQ tap into aspects of children's emotions, conduct problems, hyperactivity, peer problems and pro-social behaviour. The rationale for including two measurements of social development was to consider Cavell's (1990) tripartite model and assess a broad spectrum of social competence-containing information about social skills, social performance and social adjustment. Furthermore, in the current study, correlations between the SDQ, the mother's connectedness at T1 ($r = -0.42$) and child mental state words at T1 ($r = -0.36$) were found. Therefore, a hierarchical linear regression analysis was conducted to reveal how much unique variance in SDQ scores was accounted for by connectedness and mental state talk measures.

Communication connectedness scores accounted for 21% of the variance in SDQ scores and upon addition of the mental state talk measures, the hierarchical regression model accounted for 26% of the variance in SDQ scores. Additionally, it was the mother's connectedness to their children's talk at the age of 24−31 months that predicted children's social outcomes at the age of 5 years. In contrast to the results that addressed the SRS-2 scores, there was no significant relationship found between maternal communication connectedness and SDQ scores at the age of 42−48 months but they approached significance (p =.054).

Maternal mental state talk was not found to be a significant predictor of SDQ scores at any time point. In other words, it was not found that when a mother referred more to mental states, she also reported fewer social difficulties for her child on the SDQ. In addition, it might be the case that maternal mental state talk had no effect on the child's social competence per se, or the effect was not strong enough to be detected. Children's use of mental state words at T1 approached significance in being a predictor of SDQ scores (p = .052), thus indicating that there is a trend between the child's production of mental state words and her or his social competence reported by the mother on the SDQ.

In summary, findings from both parental questionnaires were very similar, indicating that both questionnaires assessed the same construct even though they differed on a more specific level. Maternal connectedness was found to be a significant predictor of scores of both questionnaires, whereas child mental state talk approached significance.

5.5 The relationship between performance of the false belief task and the child's social competence

In the current study, no significant relationship between children's performance of the false-belief task and social outcome from both SRS-2 scores ($r(66) = .07$) and SDQ scores ($r(67) = .04$) was found. These findings are not in line with previous studies that reported that false-belief understanding predicts later social outcome in children (De Rosnay et al., 2013; Slaughter et al., 2002).

This contradiction may have several reasons. First, as described in the preceding section, the reason for this contradiction may lie within the task used to assess false-belief understanding (see section 5.2 for a discussion). Second, it is possible that a combination of several tasks that assess different aspects of false-belief understanding could have provided a different picture. De Rosnay et al., (2013) used 10 tasks to assess false-belief understanding in children, whereas Slaughter et al, (2002) assessed children on two tasks. Both of these research groups found a correlation between false-belief understanding and social competence.

Third, another possible explanation could be found in the lack of a definition of social competence. As discussed in Section 2.1, some researchers measure a set of social skills rather than assess social competence in a broader fashion, as Cavell (1990) suggested. According to Cavell, an assessment of social competence should include measures of social skills, social performance and social adjustment. De Rosnay et al. (2013) assessed successful conversational interactions of children (M= 78·8 months) with peers, which can be considered to be social skills. Slaughter et al. (2002) evaluated peer acceptance among pre-school children, which is an index of the children's social adjustment. In the current study, two parent questionnaires (SRS-2 and SDQ) were used to assess not only social skills across different types of social situations but also indexes of social adjustment such as peer acceptance, loneliness and self-esteem. This way, a broader spectrum of social competence was assessed. It is

very likely that these different levels of assessment can lead to different results. Looking at the previous studies discussed, one could hypothesise that false-belief understanding is related to more specific elements of social competence rather than to social competence in a broader context. Further research is warranted.

Fourth, the children in the previous studies were slightly older than the children in the current study. It is, therefore, possible that false-belief understanding is related to social competence later in development. In fact, Slaughter et al. (2002) found that false-belief understanding was the best predictor only for children above the age of five years. Definitely, more studies are required to draw a clearer picture of this relationship.

In summary, in contradiction with previous research, it was not found that false-belief understanding in children was related to social competence. It is likely that defining and methodological issues were responsible for these contradictory findings.

5.6 Additional factors that predict social competence

Secondary analyses were conducted to determine whether receptive and expressive language skills further accounted for the variance in social competence. The rationale for adding these measurements was the modest amount of variance between the effects of communication connectedness and mental state talk on social competence, which indicated that other variables were likely to be involved in children's social development. Furthermore, it was based on the findings in previous studies that demonstrated that children with poor receptive and expressive language were at a higher risk of behaviour difficulties (Bretherton et al., 2013a; Horwitz et al., 2003; Irwin et al., 2002). Therefore, in addition to the research questions posed at the beginning of the study, it was of interest to find out whether expressive and

receptive vocabulary measured through the CDI assessed at T1 and through the ROWPVT assessed at T1 and T3 accounted for further variance in social competence.

The predictive relation between expressive and receptive vocabulary, mental state talk, communication connectedness and children's later social competence measured through the SRS-2

A hierarchical linear regression analysis was conducted to reveal how much variance in SRS-2 scores were accounted for by CDI and ROWPVT scores, mental state talk and connectedness measures. As reported in Section 2.3, children with language impairment also often display difficulties in their social competence, indicating a relationship between language abilities and social competence. Therefore, CDI and ROWPVT scores were first added to the existing hierarchical linear regression model. The expressive and receptive language scores, communication connectedness and mental state talk at T1 accounted for 36% of the variance in SRS-2 scores at T4. By adding the CDI and the ROWPVT scores to the model, a much stronger model for the prediction of SRS-2 scores at T4 was created. There was a .19 increase in R^2, which is attributable to the addition of CDI and ROWPVT scores. CDI scores but not the ROWPVT scores at the age of 24 to 31 months were significant predictors (p = .011) of the children's social outcome (measured through SRS-2 scores) at the age of 5 years. In other words, the more words a child expressed at two years of age, the fewer social difficulties they displayed at the age of five years, according to their mothers. Children's early ability to successfully express themselves to others may help in developing aspects of social competence. These results add to a growing body of evidence that indicates a robust correlation between children's expressive vocabulary and their social development (Carson et al., 1998; Carson, Klee, Perry, Donaghy, & Muskina, 1997; Horwitz et al., 2003; Irwin et al., 2002; Paul et al., 1991).

In addition, adding CDI scores assessed at T1 increased the predicting strength of child mental state talk of SRS-2 scores, as they moved from approaching significance to significance (p = .028). The more a child produced words to refer to mental states, the fewer social difficulties the child displayed, as reported by the mothers on the SRS-2. These findings add new evidence that children's ability to refer to mental states has a link to their broader social competence. Similar results have been reported by Brown et al. (1996) and Hughes, Fujisawa, Ensor, Lecce, and Marfleet (2006). Brown et al. (1996) observed 38–47-month-old children in spontaneous interactions with their mothers, siblings and best friends at home. The interactions were analysed and coded for the use of mental state terms by all speakers. Individual differences in the frequency of mental state talk in sibling and friend dyads were correlated with measures of co-operative and conflictual interaction, friendship quality and child characteristics. It was reported that mental state talk in the child–friend and child–sibling dyads was correlated with positive, co-operative interactions between children. Hughes et al. (2006) observed 111 two-year-olds playing with a sibling at home. Children's talk about mental states and the quality of the children's play with their siblings were analysed. A significant relationship was found between the children's use of mental state words and the quality of their play with siblings. While these results support the argument of a relationship between children's mental state talk and their social competence, our study provides new evidence that the same relationship can also be found when mental state talk is measured in a mother–child free–play interaction. Furthermore, the results presented by Brown et al. (1996) and Hughes et al., (2006) focus on correlations, whereas the current study provides a regression analysis that shows that there is a link between children's use of mental state words at the age of 24 to 31 months and their social competence at 5 years.

A feasible explanation for this relation might be that children who address mental states more often do so because they are more aware of them, and they display a more profound understanding of the mind and emotions. In line with this argument, Brown et al.,

(1996) reported that children's use of mental state terms was linked to their understanding of false belief. Additionally, Garner, Jones, Gaddy, and Rennie (1997) indicated that children's references to emotions were strongly linked with their own emotional perspective-taking. This understanding of mental states displayed in the children's use of mental state words was argued to be essential for everyday social interaction (Hughes & Dunn, 1998).

Furthermore, De Rosnay and Hughes (2006) stressed that children's spontaneous reference to mental states may reflect an eagerness to engage with the mental and emotional lives of others. This is further reflected in a reported developmental shift in children between four and five years of age with a significant increase over time in the proportion of words that refer to mental states of others rather than children's own mental states (Hughes & Dunn, 1998). This shift in development indicates that children become more aware and interested in mental states of others. This ability may result in a more nuanced understanding of others, which may play out in their relationships and the friendships they cultivate. This is in line with studies that reported a close relationship between children's mental state talk and their co-operative interaction with friends and siblings (Brown et al., 1996; Hughes et al., 2006).

Surprisingly, mothers' connectedness was no longer a significant predictor of social outcome when CDI scores were added to the predicting model. This indicates that the child's expressive vocabulary including words that refer to mental states was a stronger predictor of their social competence. It could be hypothesised that the manner in which a child uses language to interact with others is a stronger indicator of their social competence than the way a mother's connectedness when she communicates to her child.

The predictive relations among expressive and receptive vocabulary, mental state talk, communication connectedness and children's later social competence measured through the SDQ

Similar to the results reported in the previous section, adding expressive and receptive vocabulary scores to the existing model increased the strength of the model, thus indicating that approximately 37% of the variance in SDQ scores was then explainable by CDI and ROWPVT scores, connectedness and mental state talk at T1. There was a .11 increase in R^2, which is attributable to the addition of CDI and ROWPVT scores. As it has been seen with the SRS-2 scores, adding the CDI scores to the hierarchical regression model resulted in the child's mental state talk at T1 also becoming a significant predictor (p = .031) of social competence. Maternal connectedness was no longer a significant predictor. These results support the previously discussed argument.

5.7 Limitations of the current research

The limitations of the current study must be recognised. The first limitation concerns the size of the sample. Even though having data from a 3-year longitudinal study, including spontaneous language samples of 67 children and their mothers, is itself an important achievement, having a larger sample size would have increased the statistical significance of the results. This increase would have allowed for the addition of other variables such as gender, socio-economic status or age to the predicting model, and additional relationships would have been detected. For example, Stokes and Klee (2009) reported that age, sex and socio-economic status in two-year-olds were associated with expressive vocabulary. The longitudinal study from which the data for the current study were drawn was ongoing, and it would have been possible to assess more children on the false-belief tasks. The decision to stop the

assessment was mainly due to time limitations and the unavailability of the person who acted as the competitor in the false-belief task. Replacing the competitor would have changed the setting, and even if this change would have been subtle, it could have had an impact on the children's performance.

The second limitation concerns that the sample included mothers with a higher education level than what is found in the general population of New Zealand (see Chapter 3.2). Additionally, the majority of families were from middle-class to upper middle-class backgrounds. This is of concern because significant relations were found between the mother's mental state talk and their level of education (Meins et al., 2003; Ruffman, Slade, Devitt, & Crowe, 2006). Additionally, Cutting and Dunn (1999) and Dunn et al. (1991) reported that higher socio-economic status promoted false-belief understanding. This situation is not unlike the one in many other studies on children's language, but it does mean that the group does not reflect the whole range of backgrounds found in the general population. Consequently, the study's finding might not be generalisable to a wider population. A more comprehensive study would ensure that the sample also includes mothers with a lower education level and those from more diverse socio-economic backgrounds.

As described in Section 4.1, children as a group displayed high language and intellectual abilities, which also do not reflect the general population. A more comprehensive study would include children on a broader spectrum of language and cognitive abilities. It could be assumed that in a group of children with lower language abilities, the differences in social competence would be greater since language was reported to be a significant predictor.

A further area of limitation concerns the measurement of the children's false-belief understanding. In the current study, only one task was used to measure false-belief understanding. Alternatively, assessing children on a combination of carefully selected assessments that measure false-belief understanding could provide more confidence about having comprehensive and age-appropriate measures of false-belief understanding. This selection should

include tasks that have been used on large representative samples have been examined for reliability and are suitable for young children at the same development stage.

Another limitation of this study is that only communication between mothers and their children was included. I focused on this because of the obvious influence mothers have on their children's development, which is described in the research literature. Nonetheless, fathers and siblings are also reported to have an influence on a child's development. Children with more siblings are found to pass false-belief understanding tasks earlier (McAlister & Peterson, 2007; Perner et al., 1994; Ruffman et al., 1998). Furthermore, findings from the Pennsylvania Study of Social Understanding (Dunn, 1999) indicated that children spontaneously referred more often to mental states when they talked to siblings rather than to mothers. Therefore, for future studies, one recommendation is to include language samples with additional caregivers and, in particular, siblings who undoubtedly also influence a child's development.

5.8 Strength of the current research

In the present study, spontaneous language samples were assessed. In contrast to tasks in which the parents are asked to describe photographs or pictures, a spontaneous language sample provides a more accurate and valid measure of mothers' and children's language. Although the work load involved in the current study was significantly greater than analysing more standardised language assessments, it is one of the major strengths of this research, which is that data concerning language and communication stem from a nearly naturalistic observation.

Another strength of the current study is that a measure of children's mental state vocabulary was included. To date, we know very little about the relationship between children's

ability to mentalise their false-belief understanding and their social competence. The current study, therefore, adds important findings to our understanding of these aspects.

5.9 Implications for clinical practice

One of the main questions that have been addressed in the current study was how language and communication are related to social competence. The current study has identified that children's expressive vocabulary, including mental state terms and mothers' interactional styles, partially predicts children's social competence. Therefore, these findings have practical implications for healthcare professionals who work with children and families. First, given that difficulties in these domains may be risk factors for social problems, early identification is critical, and these aspects could be included in a broader assessment. Additionally, since children's early ability to successfully express themselves to others and maternal connectedness may help in developing aspects of social competence, intervention programs that are supposed to enhance positive social competence are likely to be more effective when expressive language and maternal connectedness are also targeted.

5.10 Future research

The current study has addressed the relationship between language and social competence over time in very young children. Several possibilities for additional research have been stated throughout this chapter. Additionally, a future research project that assesses children with language impairment through similar tasks could add new valuable information. Since a child's expressive vocabulary, including mental state words and maternal communication

connectedness, are found to be important for her or him to be socially competent, it could be hypothesised that the social difficulties observed in children with language impairment might partially stem from their difficulties within these domains. Specifically, research could assess whether the low language abilities of children with language difficulties affect their language input and range of communication opportunities. It was reported that mothers of children with language impairment were less responsive to their children's utterances than mothers of children with typically developing language skills (Bishop, Chan, Adams, Hartley, & Weir, 2000; Hoffer & Bliss, 1990).

Since talking about mental states and communication connectedness seems to improve social competence, a controlled randomised intervention study could be performed. Such a study could consist of a group of mother–child pairs who engage in activities at home that animates children to talk about mental states and requires mothers to talk in a connected manner with their children for a prolonged period of time (e.g., three months). At the end of the intervention, children's improvement in social competence could be measured by either standardised tasks or questionnaires. Meanwhile, the group could be compared to another group of mother–child dyads who engaged in a control task for the same period. This approach would help in determining whether talking about mental states and communication connectedness have a causal effect on children's social competence.

5.11 Conclusion

The aim of the current study was to examine whether maternal or child's mental state talk and/or communication connectedness is linked to social competence through the social skill of perspective-taking and the ability to understand that other people might hold a false

belief. Exploring variation in children's language skills and their conversational environment can provide indications of how typically developing children come to be socially competent.

In the current study, mothers' connected communication played a role in their children's social development. This is the first time that these aspects of mothers' verbal interaction style have been assessed in relation with children's social competence. It was found that mothers who more often refer to their children's utterances and who reformulated, elaborated or answered to them in an appropriate manner described their children as socially more advanced later in development compared to mothers who were less connected in communication with their children. However, mothers' connectedness in communication with their children was no longer a significant predictor once the children's expressive and receptive language abilities were added to the model.

Children's language abilities, including their production of mental state terms at two years of age, were stronger predictors of their social competence at the age of five years. Specifically, children's expressive vocabulary at the age of 24 to 31 months was a significant predictor of their social competence at the age of 5 years. These findings add to a growing body of evidence that indicates that language is related to social competence through a child's ability of being able to successfully express themselves with words. What has been unknown so far is that children's ability to express words that refer to mental states also plays a predicting role in their social development. It was found that children who produced more words to refer to their own and others' mental states such as emotions, desires and cognition were reported to have fewer social difficulties later in development than children who made less references to mental states. These findings indicate that children who refer more frequently to mental states might also be more aware of them and, therefore, display a more profound understanding of others' mind and emotions. The ability to refer to mental states might help children to interact more effectively in the social world.

Contrary to previous research, mental state talk and communication connectedness were not related to false-belief understanding, nor did I find support in the argument that children who understand false-belief are socially more competent. In both cases, it is likely that methodological issues were responsible for these contradictory findings.

In conclusion, the current study has made a positive contribution to the knowledge that the process of becoming socially competent encompasses having words to express oneself effectively. It also adds new findings that indicate that using words that refer to mental states is important for the development of children's social competence. However, the role of the ability to take someone else's perspective and understand that a person might be holding a false belief within these associations remains elusive.

Appendix A: Summary of predictive models relating to Chapter 2

Author	Participants	Predictor variables	Outcome variables	R^2
Adrian, Clemente, Villanueva, & Rieffe (2005)	n = 34 age: M = 4.10 years	mothers' mental state language (frequency and types)	children's false belief understanding	.13
Adrian, Clemente, & Villanueva (2007)	T1 n = 41 age: M = 4.7 years T2 n= 37 age: M = 5.9 years	mothers' use of mental state words	children's false belief understanding	.08
Astington & Jenkins (1999)	T1 n = 59 age: M = 3.4 years T3 n = 59 age: M = 4.1 years	age, general language abilities	false belief understanding	.53
Boivin, Hymel & Bukowski (1995)	n = 774 M = 10.10 years	withdrawal, social preference and victimisation	loneliness depressed mood	.129 .283
Brownlie et al. (2004)	T1 n = 284 age: M = 5.6 years T2 n = 244 age = 12 - 13 years T3 n = 258 age: M = 18.10 years	language impairment	young adult's delinquency young adult's aggression	.093 .069
De Rosnay, Fink, Begeer, Slaughter, & Peterson (2013)	n = 129 age: M = 6.7 years	false belief understanding	socially competent every-day behaviour like successful conversational interactions with peers	-.22
Dunn, Brown, Slomkowski, Tesla, & Youngblade (1991)	n = 50 T1 age: M = 33 months T2 age: M = 40 months	Family discourse about feelings	children's false belief understanding	.04
Ensor and Hughes (2008)	T1 n= 120 age: M = 2.38 years T2 age: M = 3.45 years T3 age: 4.19 years	Maternal education, number of mother's and child's turns, mother and child connectedness, mother and child mental state references	children's false belief understanding	.50
Howard, Mayeux & Naigles (2008)	n = 60 Group 1: n= 16 age: M = 3.7 years Group 2: n = 16 age: M = 3.5 years Group 3: n = 16 age: M = 4.5 years Group 4: n = 12 age: M = 4.4 years	age, auditory comprehension of language, maternal cognitive mental states	children's false belief understanding	.47
Jenkins, Turrell, Kogushi, Lollis, &	T1 n = 40 age: M = 4.4 years	family members cognitive talk	child's cognitive talk	.09

Ross (2003)	age younger siblings: M = 2.4 years T2 n= 37 age: M = 6.3 years age younger siblings: M = 4.4 years			
Racine, Carpendale, & Turnbull (2007)	n = 78 age: M = 4.5 years	child belief emotion talk	children's false understanding	belief.05
Slade & Ruffmann (2005)	n = 44 age: M =3.8 years	general language abilities	children's false understanding	belief.10
Ruffman, Slade, & Crowe (2002)	T1 (age: M = 3.01) T2 (age: M = 3.41) T3 (age: M = 4.04)	mothers' use of mental state words T1	children's false understanding T2	belief.05
			children's false understanding T3	belief .06
		mothers' use of mental state words T2	children's false understanding T3	belief 0.11
Turnbull, Carpendale, & Racine (2008)	n = 70 age: M = 4.5 years	talk about aspects of the false-belief component	children's false understanding	belief.09
Watson, Painter & Bornstein (2001)	T1 n = age: M = 24 T2 n = age: M = 48	general language ability T1	children's false understanding T2	belief.22

Note. Authors of studies were ordered alphabetically. R^2 reported here is given for the predictive variables after removing other variables from the models. Only studies which provided R^2 were included in this overview.

Appendix B: Parental questionnaire at T1

Parent Questionnaire

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Please complete this questionnaire and the *Communicative Development Inventory: Words and Sentences* and return both in the enclosed envelope. If you'd rather talk to us over the phone instead of filling out written questionnaires, just let us know!

1. Child's name: _____

2. Child's birth date: Day _____ Month _____ Year 20_____

3. Child's gender: Male _____ Female _____

4. Child's birth order: 1st _____ 2nd _____ 3rd _____ 4th or more _____

5. Child's birth weight: _____ grams (*or* _____lbs _____oz)

6. Was this child born a twin? No _____ Yes _____

7. Was this child born prematurely? No _____ Yes _____
   ↳ If yes, by how many weeks? _____

8. Has this child ever had any major health problems?
   No _____ Yes _____
   ↳ If yes, what are they? _____

9. Number of children in family, *including* this child: _____

10. In which country was this child born?
    ☐ New Zealand
    ☐ other; please indicate where: _____
    ↳ If other, how long has this child lived in New Zealand? _____

11. Which ethnic group does this child belong to? Tick the one or ones which apply.
    ☐ New Zealand European
    ☐ Māori
    ☐ Samoan
    ☐ Cook Island Maori
    ☐ Tongan
    ☐ Niuean
    ☐ Chinese
    ☐ Indian
    ☐ other such as Dutch, Japanese, Tokelauan; please state: _____

12. What is this child's main language? _____

13. Are any other languages spoken in the child's home?
    No _____ Yes _____
    ↳ If yes, which ones? _____

Please continue on the next page.

14. Is this child in day care or an early childhood education programme or cared for regularly by anyone else?
No _____ Yes _____
↳ If yes, how many hours per week on average? _____

15. Do you have any concerns about this child's ability to hear? Yes ___ No ___

16. Do you have any concerns about this child's language development? Yes ___ No ___

17. Do you have any concerns about this child's ability to communicate? Yes ___ No ___

18. If you answered "Yes" to any of the last 3 questions, say why you are concerned:

_____

_____

_____

19. Would you like us to get in touch with you to discuss your concerns? Yes ___ No ___

☐ Contact me on my home phone at: _____

☐ Contact me on my cell phone at: _____

☐ Contact me by email post at: _____

20. Has anyone in the child's family had speech, language or learning problems (for example, the child's mother, father, brothers, sisters or grandparents)?
No _____ Yes _____
↳ If yes, who were they? _____

The next set of questions is about you.

21. Your name: _____

22. What is your relationship to the child named on page 1? _____

23. In which country were you born?
☐ New Zealand
☐ Australia
☐ England
☐ China (People's Republic of)
☐ India
☐ South Africa
☐ Samoa
☐ Cook Islands
☐ other; please indicate which: _____

Please continue on the next page.

24. If you live in New Zealand but were not born here, answer this question:
When did you first arrive to live in New Zealand?
Month (if known) _____ Year _____

25. Which ethnic group do you belong to? Tick the one or ones which apply to you.
☐ New Zealand European
☐ Māori
☐ Samoan
☐ Cook Island Maori
☐ Tongan
☐ Niuean
☐ Chinese
☐ Indian
☐ other such as Dutch, Japanese, Tokelauan; please state: _____

26. What is your highest secondary school qualification?
☐ None
☐ NZ School Certificate in one or more subjects *or*
National Certificate level 1 *or*
NCEA level 1
☐ NZ Sixth Form Certificate in one or more subjects *or*
National Certificate level 2 *or*
NZ UE before 1986 in one of more subjects *or*
NCEA level 2
☐ NZ Higher School Certificate *or*
Higher Leaving Certificate *or*
NZ University Bursary / Scholarship *or*
National Certificate Level 3 *or*
NCEA 3 *or*
NZ Scholarship
☐ other secondary school qualification gained in NZ
☐ other secondary school qualification gained overseas

27. Apart from secondary school qualifications, do you have another completed qualification?
No _____ Yes _____
↳ If yes, what is it? _____

28. What is your occupation? _____

29. Today's date is: Day _____ Month _____ Year 20_____

Thank you for your time and effort.

Please return this questionnaire and the *Communicative Development Inventory: Words and Sentences* in the enclosed envelope to:

The Child Language Centre
Department of Communication Disorders
University of Canterbury
Private Bag 4800
Christchurch 8140

Appendix C: Overview sheets of T4

TIME 4

Participant number:_____ DOB:_____ Age at S1:_____ Age at S2:_____

Examiner:_____

Session 1 _____ Session 2_____

Task	Completed (Session 1 / 2)	Order in session	Scored / Entered	Comments
Time 4 Session 1				
CELF-P2				
TENR				
DEAP				
PIPA				
ROWPVT				
Book given to child				
Parent Questionnaire, PEDS, SDQ and SRS-2 given to parent				
Time 4 Session 2				
Parent Questionnaire, PEDS, SDQ and SRS-2 received back				
EEG				
Bus Story Test				
ToM Task				
Raven's Coloured Progressive Matrices				
Audiological Screening				
Voucher given to parent				
Post Time 4				
Summary of individual results requested?				
Summary of individual results sent				
Summary of study requested / sent				

Comments:

Appendix D: Score forms for the non-standardised measures

Participant 001

Theory of Mind – Data sheets for false belief task

Right/Left randomizing: 1

Date	*Name*	*Date of birth*	*Age*

Familiarisation

Trial	*Side*	*Choice*
1.1	right	
1.2	left	
1.3	right	
1.4	left	
1.5	right	
1.6	left	
1.7	left	

Test trials

Trial	*Side*	*Choice*
2.1	left	
2.2	right	
2.3	right	
2.4	left	

Appendix E: New Zealand version of the MacArthur Bates Communicative Development Inventory: Words and Sentences (CDI)

Child's Name _____ Sex _____

Birthdate _____ Age _____* Today's Date _____

** Please check your child is aged 2-2.5 years old at the time you fill in this questionnaire*

The MacArthur-Bates Communicative Development Inventory: Words & Sentences

New Zealand English Adaptation

PART 1 – WORDS CHILDREN USE

A. VOCABULARY CHECKLIST

Children understand many more words than they say. We are particularly interested in the words your child SAYS. Please go through the list and mark the words you have heard your child use. If your child uses a different pronunciation of a word (for example, "raffe" instead of "giraffe" or "sketti" for "spaghetti"), mark the word anyway. Remember that this is a "catalogue" of all the words that are used by many different children. Don't worry if your child only knows a few of these right now.

1. SOUND EFFECTS AND ANIMAL SOUNDS (12)

baa baa	○	meow	○	uh oh	○
choo choo	○	moo	○	vroom	○
cockadoodledoo	○	ouch	○	woof woof	○
grr	○	quack quack	○	yum yum	○

2. ANIMALS (Real or Toy) (42)

alligator	○	duck	○	owl	○
animal	○	elephant	○	penguin	○
ant	○	fish	○	pig	○
bear	○	frog	○	pony	○
bee	○	giraffe	○	possum	○
bird	○	goose	○	puppy	○
bunny	○	hen	○	rooster	○
butterfly	○	horse	○	sheep	○
cat	○	insect	○	teddybear	○
chicken	○	lamb	○	tiger	○
cow	○	lion	○	turkey	○
deer	○	monkey	○	turtle	○
dog	○	moose	○	wolf	○
donkey	○	mouse	○	zebra	○

3. VEHICLES (Real or Toy) (14)					
aeroplane	○	fire engine	○	tractor	○
bike	○	helicopter	○	train	○
boat	○	motor bike	○	tricycle	○
bus	○	pushchair*	○	truck	○
car	○	sled	○		

*or word used in your family: please add to Section F.

4. TOYS (18)					
ball	○	chalk	○	pencil	○
balloon	○	crayon	○	play dough	○
bat	○	doll	○	present	○
block	○	game	○	puzzle	○
book	○	glue	○	story	○
bubbles	○	pen	○	toy	○

5. FOOD AND DRINK (68)					
apple	○	fizzy drink	○	peas	○
banana	○	food	○	pizza	○
beans	○	gherkin	○	popcorn	○
biscuit	○	grapes	○	potato	○
bread	○	green beans	○	potato chip	○
butter	○	hamburger	○	pretzel	○
cake	○	ice	○	pudding	○
carrots	○	ice block	○	pumpkin	○
cereal	○	ice cream	○	raisin	○
cheerios	○	jam	○	salt	○
cheese	○	jelly	○	sandwich	○
chewing gum	○	juice	○	sauce	○
chicken	○	lollies	○	soup	○
chips	○	lollipop	○	spaghetti	○
chocolate	○	meat	○	strawberry	○
coffee	○	melon	○	toast	○
coke	○	milk	○	tomato sauce	○
corn	○	muffin	○	tuna	○
cracker	○	noodles	○	vanilla	○
doughnut	○	nuts	○	vitamins	○
drink	○	orange	○	water	○
egg	○	pancake	○	yogurt	○
fish	○	peanut butter	○		

6. CLOTHING (27)					
beads	○	jacket	○	shorts	○
belt	○	jeans	○	slipper	○
bib	○	jersey	○	sneaker	○
boots	○	nappy	○	snowsuit	○
button	○	necklace	○	sock	○
coat	○	pyjamas	○	tights	○
dress	○	scarf	○	trousers	○
gloves	○	shirt	○	underpants	○
hat	○	shoe	○	zip	○

7. BODY PARTS (27)					
ankle	○	feet	○	nose	○
arm	○	finger	○	penis*	○
belly button	○	hair	○	shoulder	○
buttocks/bottom/bum*	○	hand	○	sore	○
cheek	○	head	○	tooth	○
chin	○	knee	○	toe	○
ear	○	leg	○	tongue	○
eye	○	lips	○	tummy	○
face	○	mouth	○	vagina*	○

*or word used in your family: please add to Section F.

8. SMALL HOUSEHOLD ITEMS (49)					
basket	○	glasses	○	purse	○
blanket	○	hammer	○	radio	○
bottle	○	jar	○	rubbish	○
box	○	keys	○	scissors	○
bowl	○	knife	○	serviette	○
broom	○	lamp	○	soap	○
brush	○	light	○	spoon	○
bucket	○	medicine	○	tape	○
camera	○	money	○	telephone	○
clock	○	mop	○	tin	○
coin	○	nail	○	tissue	○
comb	○	paper	○	toothbrush	○
cup	○	picture	○	towel	○
dish	○	pillow	○	tray	○
fork	○	plant	○	vacuum cleaner*	○
glass	○	plate	○	walker	○
				watch	○

*or word used in your family: please add to Section F.

9. FURNITURE AND ROOMS (33)					
bath	○	dryer	○	room	○
bathroom	○	fridge	○	shower	○
bed	○	garage	○	sink	○
bedroom	○	high chair	○	sofa	○
bench	○	kitchen	○	stairs	○
cellar	○	living room	○	stove	○
chair	○	oven	○	table	○
cot	○	playpen	○	TV	○
couch	○	porch	○	wardrobe	○
door	○	potty	○	washing machine	○
drawer	○	rocking chair	○	window	○

10. OUTSIDE THINGS (31)					
backyard	○	pool	○	star	○
cloud	○	rain	○	stick	○
flag	○	rock	○	stone	○
flower	○	roof	○	street	○
footpath	○	sandpit	○	sun	○
garden	○	sky	○	swing	○
grass	○	slide	○	tree	○
hose	○	snow	○	water	○
ladder	○	snowman	○	wind	○
lawn mower	○	spade	○		
moon	○	sprinkler	○		

11. PLACES TO GO (22)

beach ○	home ○	playground ○
camping ○	house ○	school ○
church* ○	movie ○	shop ○
circus ○	outside ○	work ○
country ○	park ○	yard ○
downtown ○	party ○	zoo ○
farm ○	petrol station ○	
forest ○	picnic ○	

*or word used in your family: please add to Section F.

12. PEOPLE (29)

aunt/auntie ○	daddy* ○	mummy* ○
baby ○	doctor ○	nurse ○
babysitter ○	fireman ○	people ○
babysitter's name ○	friend ○	person ○
boy ○	girl ○	pet's name ○
brother ○	grandma* ○	police ○
child ○	grandpa* ○	sister ○
child's own name ○	lady ○	teacher ○
clown ○	mailman ○	uncle ○
cowboy ○	man ○	

*or word used in your family: please add to Section F.

13. GAMES AND ROUTINES (24)

bath ○	hi ○	please ○
breakfast ○	hello ○	shh/shush/hush ○
bye ○	lunch ○	shopping ○
call (on the phone) ○	nap ○	snack ○
dinner/tea ○	night night ○	thank you ○
give me five! ○	no ○	this little piggy ○
gonna get you! ○	patty cake ○	turn around ○
go potty ○	peekaboo ○	yes ○

14. ACTION WORDS (103)

bite ○	drive ○	hug ○	read ○	swim ○
blow ○	drop ○	hurry ○	ride ○	swing ○
break ○	dry ○	jump ○	rip ○	take ○
bring ○	dump ○	kick ○	run ○	talk ○
build ○	eat ○	kiss ○	say ○	taste ○
bump ○	fall ○	knock ○	see ○	tear ○
buy ○	feed ○	lick ○	shake ○	think ○
carry ○	find ○	like ○	share ○	throw ○
catch ○	finish ○	listen ○	show ○	tickle ○
chase ○	fit ○	look ○	sing ○	touch ○
clap ○	fix ○	love ○	sit ○	wait ○
clean ○	get ○	make ○	skate ○	wake ○
climb ○	give ○	open ○	sleep ○	walk ○
close ○	go ○	paint ○	slide ○	wash ○
cook ○	hate ○	pick ○	smile ○	watch ○
cover ○	have ○	play ○	spill ○	wipe ○
cry ○	hear ○	pour ○	splash ○	wish ○
cut ○	help ○	pretend ○	stand ○	work ○
dance ○	hide ○	pull ○	stay ○	write ○
draw ○	hit ○	push ○	stop ○	
drink ○	hold ○	put ○	sweep ○	

15. DESCRIPTIVE WORDS (63)

allgone ○	full ○	orange ○
asleep ○	gentle ○	poor ○
awake ○	good ○	pretty ○
bad ○	green ○	quiet ○
better ○	happy ○	red ○
big ○	hard ○	sad ○
black ○	heavy ○	scared ○
blue ○	high ○	sick ○
broken ○	hot ○	sleepy ○
brown ○	hungry ○	slow ○
careful ○	hurt ○	soft ○
clean ○	last ○	sticky ○
cold ○	little ○	stuck ○
cute ○	long ○	thirsty ○
dark ○	loud ○	tiny ○
dirty ○	mad ○	tired ○
dry ○	naughty ○	wet ○
empty ○	new ○	white ○
fast ○	nice ○	windy ○
fine ○	noisy ○	yellow ○
first ○	old ○	yucky ○

16. WORDS ABOUT TIME (12)

after ○	morning ○	today ○
before ○	night ○	tomorrow ○
day ○	now ○	tonight ○
later ○	time ○	yesterday ○

17. PRONOUNS (25)

he ○	me ○	their ○	we ○
her ○	mine ○	them ○	you ○
hers ○	my ○	these ○	your ○
him ○	myself ○	they ○	yourself ○
his ○	our ○	this ○	
I ○	she ○	those ○	
it ○	that ○	us ○	

18. QUESTION WORDS (7)

how ○	when ○	which ○	why ○
what ○	where ○	who ○	

19. PREPOSITIONS AND LOCATIONS (26)

about ○	down ○	on top of ○
above ○	for ○	out ○
around ○	here ○	over ○
at ○	inside/in ○	there ○
away ○	into ○	to ○
back ○	next to ○	under ○
behind ○	of ○	up ○
beside ○	off ○	with ○
by ○	on ○	

20. QUANTIFIERS AND ARTICLES (17)

a ○	each ○	other ○
all ○	every ○	same ○
a lot ○	more ○	some ○
an ○	much ○	the ○
another ○	none ○	too ○
any ○	not ○	

21. HELPING VERBS (21)					
am	○	does	○	need/ need to	○
are	○	don't	○	try/ try to	○
be	○	gonna/ going to	○	wanna/ want to	○
can	○	gotta/ got to	○	was	○
could	○	hafta/ have to	○	were	○
did/ did ya	○	is	○	will	○
do	○	lemme/ let me	○	would	○

22. CONNECTING WORDS (6)					
and	○	but	○	so	○
because	○	if	○	then	○

B. HOW CHILDREN USE WORDS	Not Yet	Sometimes	Often
1. Does your child ever talk about past events or people who are not present? For example, a child who saw a parade last week might later say parade, clown or band.	○	○	○
2. Does your child ever talk about something that's going to happen in the future, for example, saying "choo choo" or "aeroplane" before you leave the house for a trip, or saying "swing" when you are going to the park?	○	○	○
3. Does your child talk about objects that are not present such as asking about a missing or absent toy, referring to a pet out of view, or asking about someone not present?	○	○	○
4. Does your child understand if you ask for something that is not in the room, for example, by going to the bedroom to get a teddy bear when you say "where's the bear?"	○	○	○
5. Does your child ever pick up or point to an object and name an absent person to whom the object belongs? For example, a child might point to mummy's shoe and say "mummy".	○	○	○

PART II – SENTENCES AND GRAMMAR

A. WORD ENDINGS/PART I	Not Yet	Sometimes	Often
1. To talk about more than one thing, we add an 's' to many words. Examples include cars (for more than one car), shoes, dogs and keys. Has your child begun to do this?	○	○	○
2. To talk about ownership, we add an "s", for example, Daddy's key, cat's dish and baby's bottle. Has your child begun to do this?	○	○	○
3. To talk about activities, we sometimes add "ing" to verbs. Examples include looking, running and crying. Has your child begun to do this?	○	○	○
4. To talk about things that happened in the past, we often add "ed" to the verb. Examples include kissed, opened and pushed. Has your child begun to do this?	○	○	○

B. WORD FORMS

Following are some other words children learn. Please mark any of these words that your child uses.

NOUNS					
children	○	men	○	teeth	○
feet	○	mice	○		

VERBS					
ate	○	fell	○	made	○
blew	○	flew	○	ran	○
bought	○	got	○	sat	○
broke	○	had	○	saw	○
came	○	heard	○	took	○
drank	○	held	○	went	○
drove	○	lost	○		

C. WORD ENDINGS/PART 2

Young children often place the wrong endings on words. For example, a child might say "Auntie goed home". Mistakes like this are often a sign of progress in language. In the following lists, please mark all the mistakes of this kind you have heard your child say recently.

NOUNS

blockses	○	mans	○	sockses	○
childrens	○	mens	○	teeths	○
childs	○	mices	○	toeses	○
feets	○	mouses	○	tooths	○
foots	○	shoeses	○		

VERBS

ated	○	comed	○	goed	○	ranned	○
blewed	○	doed	○	gotted	○	runned	○
blowed	○	dranked	○	haved	○	seed	○
bringed	○	drinked	○	heared	○	satted	○
buyed	○	eated	○	holded	○	sitted	○
breaked	○	falled	○	losed	○	taked	○
broked	○	flied	○	losted	○	wented	○
camed	○	getted	○	maked	○		

HAS YOUR CHILD BEGUN TO COMBINE WORDS YET, SUCH AS "NOTHER CRACKER", OR "DOGGIE BITE"?

○ Not Yet ○ Sometimes ○ Often

IF YOU ANSWERED NOT YET, PLEASE STOP HERE. IF YOU ANSWERED SOMETIMES OR OFTEN, PLEASE CONTINUE.

D. EXAMPLES: Please list three of the longest sentences you have heard your child say recently.

1. _____
2. _____
3. _____

E. COMPLEXITY

In each of the following pairs, please mark the one that sounds MOST like the way your child talks right now. If your child is saying sentences even longer or more complicated than the two provided, just pick the second one.

1. Two shoe. ○ Two shoes. ○	14. That my truck. ○ That's my truck. ○	27. Turn on light. ○ Turn on the light so I can see. ○
2. Two foot. ○ Two feet. ○	15. Baby crying. ○ Baby is crying. ○	28. I want that. ○ I want that one you got. ○
3. Daddy car. ○ Daddy's car. ○	16. You fix it? ○ Can you fix it? ○	29. Want biscuits. ○ Want biscuits and milk. ○
4. (Talking about something happening right now.) Cat sleep. ○ Cat sleeping. ○	17. Read me story, Mummy. ○ Read me a story, Mummy. ○	30. Biscuit Mummy. ○ Biscuit for Mummy. ○
5. (Talking about something happening right now.) I make tower. ○ I making tower. ○	18. No wash dolly. ○ Don't wash dolly. ○	31. Baby want eat. ○ Baby want to eat. ○
6. (Talking about something that already happened.) I fall down. ○ I fell down. ○	19. Want more juice. ○ Want juice in there. ○	32. Lookit me! ○ Lookin me dancing! ○
7. More biscuit! ○ More biscuits! ○	20. There a cat. ○ There's a cat. ○	33. Lookit! ○ Lookit what I got! ○
8. These my tooth. ○ These my teeth. ○	21. Go bye-bye. ○ Wanna go bye-bye. ○	34. Where's my dolly? ○ Where's my dolly name Sam? ○
9. Baby blanket. ○ Baby's blanket. ○	22. Where Mummy go? ○ Where did Mummy go? ○	35. We made this. ○ Me and Paul made this. ○
10. (Talking about something that already happened.) Doggie kiss me. ○ Doggie kissed me. ○	23. Coffee hot. ○ That coffee hot. ○	36. I sing song. ○ I sing song for you. ○
11. (Talking about something that already happened.) Daddy pick me up. ○ Daddy picked me up. ○	24. I no do it. ○ I can't do it. ○	37. Baby crying. ○ Baby crying cuz she's sad. ○
12. (Talking about something that already happened.) Doggie go away. ○ Doggie went away. ○	25. I like read stories. ○ I like to read stories. ○	
13. Doggie table. ○ Doggie on table. ○	26. Don't read book. ○ Don't want you read that book. ○	

F. OTHER COMMENTS/ other words your child says:

THANK YOU FOR COMPLETING THIS.

Appendix F: Information sheet parents T4

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Learning to Talk

Information for parents/whānau

An invitation to participate in part 3 of the research project

The research team: Professor Thomas Klee, Professor Stephanie Stokes; Hamimah Ahmat, Daniela Buehler & Doreen Hansmann (PhD students)

Address: Child Language Centre | Te Reo o te Tamaiti
7 Creyke Road, Ilam, Christchurch 8041
Phone: for Hamimah, call 364 2987 ext. 7161
for Daniela or Doreen, call 364 2987 ext. 8193
Email: ChildLanguageCentre@canterbury.ac.nz
Website: www.cmds.canterbury.ac.nz/clc/

Kia ora! Hello!

You and your child took part in the **Learning to Talk** research project when they were 2 and again when they were coming up to age 4. A total of 168 families participated at age 2 and 155 returned at age 4 – a great success! We would now like to invite you and your child back for two more visits – if you are interested – now that your child is 5 years old. This will give us the opportunity to track children's language development for a full 3 years and give us further insight into how children's speech and language develops. During these two visits, we will assess your child's language, hearing and memory skills and engage your child in a task that will measure their brain activity. We hope you will consider participating in this next phase of the research project.

Before you decide if you want to participate, please take time to read this leaflet. It's important you know why the research is being done and what it will involve. Feel free to ask us if there is anything you are not sure about or would like more information about. We'd be happy to answer any questions you have. Our contact details are on the front page.

What is the purpose of the project?

Children vary in how quickly they develop speech and language skills. Some start off slowly and then catch up with others their age, while others have persisting difficulties throughout childhood. The purpose of this study is to help us figure out what we should look out for in 2- and 3- year olds in order to better understand long-term developmental outcomes. This will help inform parents and professionals about when to be concerned about their child's speech and language abilities.

What is involved?

We would like to see your child for an assessment at the Child Language Centre about 18 months after your last visit. Since your child may now be in school, we can arrange visits after school or on Saturday – at your convenience.

What will happen to my child if we take part?

You will need to make two visits to the Child Language Centre, at 7 Creyke Road in Ilam, with your child. The visits will be scheduled a week or two apart and will probably last about 1.5 hours each, or slightly longer.

During your visits, your child will be seen by several speech and language therapists who are working on their PhD. Daniela, Doreen and Hamimah will do some short tasks with your child to assess their speech and language skills. Your child's hearing will be tested with an instrument which is placed in your child's ear briefly. This doesn't hurt and only

takes a few minutes. This will all be video-recorded. If your child is unhappy and wants to stop or take a break at any time, this is okay. You will be there with them all the time to see what is happening. We will also ask you to complete three, short written questionnaires at home and mail them back to us in a postage-free envelope.

What are the benefits for us?

Your child will receive another free book as a token of our appreciation. You will receive a $20 Westfield voucher and a $10 petrol or taxi voucher after your 2nd visit. We think your child will enjoy coming to see us, as everything we do is fun and child friendly. You will find it interesting to see where your child is at with their talking.

If you have any concerns about your child's speech, you can talk about them with us. We can send you the results from the assessments if you want them. There aren't any risks to you or your child as a result of participating in this study.

What if I change my mind?

You can pull out of the project at any time and you don't have to say why.

What will happen to the results of the project?

We will write up the results and share them with people who work with children across the world. Doreen, Hamimah and Daniela will also write up their part of the project as a doctoral thesis, which will be available through the University of Canterbury library.

Will my child's name be made public?

No, your child's name won't appear in any publications. Your names and contact details will be noted at the start, but then every child will be given a number, so only the researchers will know which child has which results. The information we have on your child will be kept in secure locked cabinets and secure computer files. Only people working on the project will have access to this information. Videos taken may be used for teaching purposes or at conferences only if you give permission.

Other information:

The project has been reviewed and approved by the University of Canterbury Human Ethics Committee (Dr Lindsey MacDonald, Committee Chair; Lynda Griffioen, Secretary, phone 364 2987 ext. 45588, email human-ethics@canterbury.ac.nz)

Appendix G: Parental consent form

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Consent Form

Learning to Talk research study (Age 5)

You may cross out any of the following statements you do not agree with:

1. I have read and understood the information given to me about the research project named above. I have had a chance to ask questions and have had them answered. I understand that my child's and my participation in this project are voluntary and that we are free to withdraw at any time without giving a reason. I understand that the sessions will be video and audio recorded. I understand that the information you collect from us will remain confidential and will be securely stored at the university. I understand that any presentations or publications resulting from this project will not refer to us by name. I understand that this project has been reviewed ***and approved*** by the University of Canterbury Human Ethics Committee. On this basis, my child (named below) and I agree to participate in this research project.

2. I agree to also let the researchers use the audio-video recording for **teaching purposes** at the university with the understanding that you will not refer to us by name.

3. I agree to also let the researchers use the audio-video recording at **research conferences** with the understanding that you will not refer to us by name.

MY CHILD'S NAME (please print): .....

MY NAME (please print): .....

My Signature: .....

Date: .....

I may be contacted by:

- ❑ Email _____
- ❑ Cell phone _____
- ❑ Landline _____
- ❑ Post _____
_____

❑ I would like you to send me a brief summary of your findings when the study is complete.

Main Researcher: Professor Thomas Klee, Email: ChildLanguageCentre@canterbury.ac.nz, Phone: 03 364 2987 ext. 8501

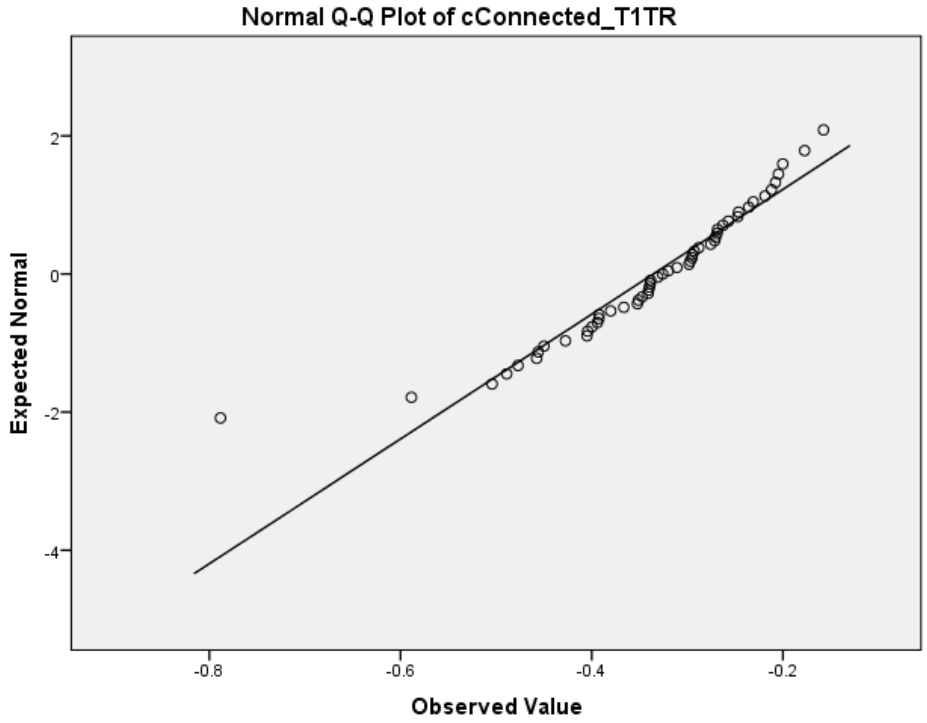
University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. **www.canterbury.ac.nz**

Appendix H: Plots transformed data

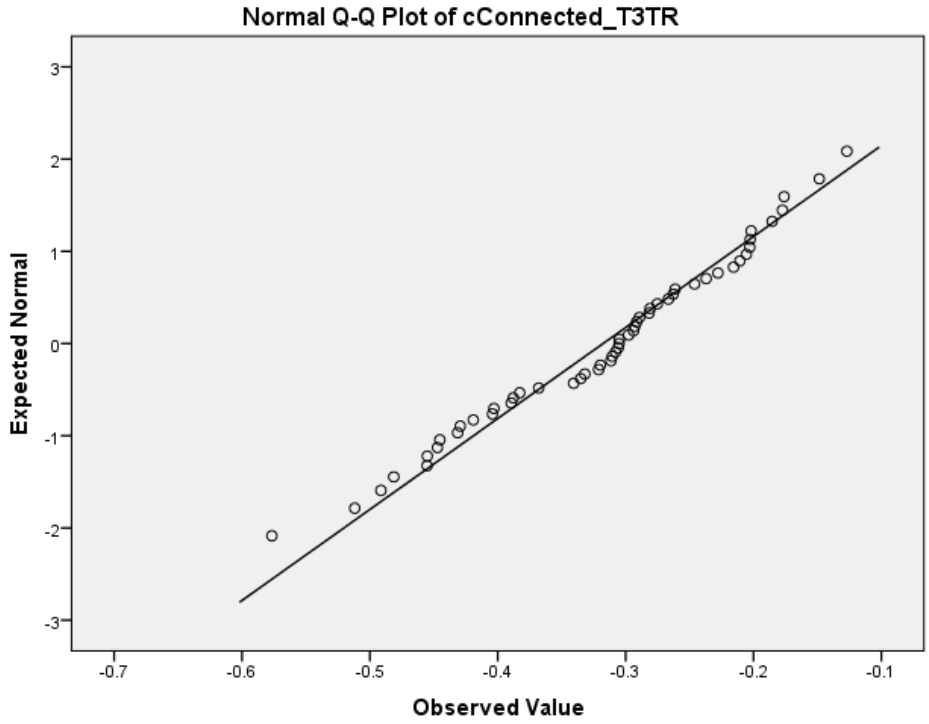
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
cConnected_T1TR	.120	53	.055	.907	53	.001
cConnected_T3TR	.109	53	.170	.976	53	.357
mConnected_T1TR	.178	53	.000	.922	53	.002
mConnected_T3TR	.072	53	.200*	.951	53	.031
cTotalMST_T1TR	.077	53	.200*	.976	53	.358
cTotalMST_T3TR	.120	53	.055	.966	53	.129
mTotalMST_T1TR	.106	53	.200*	.943	53	.014
mTotalMST_T3TR	.171	53	.001	.863	53	.000

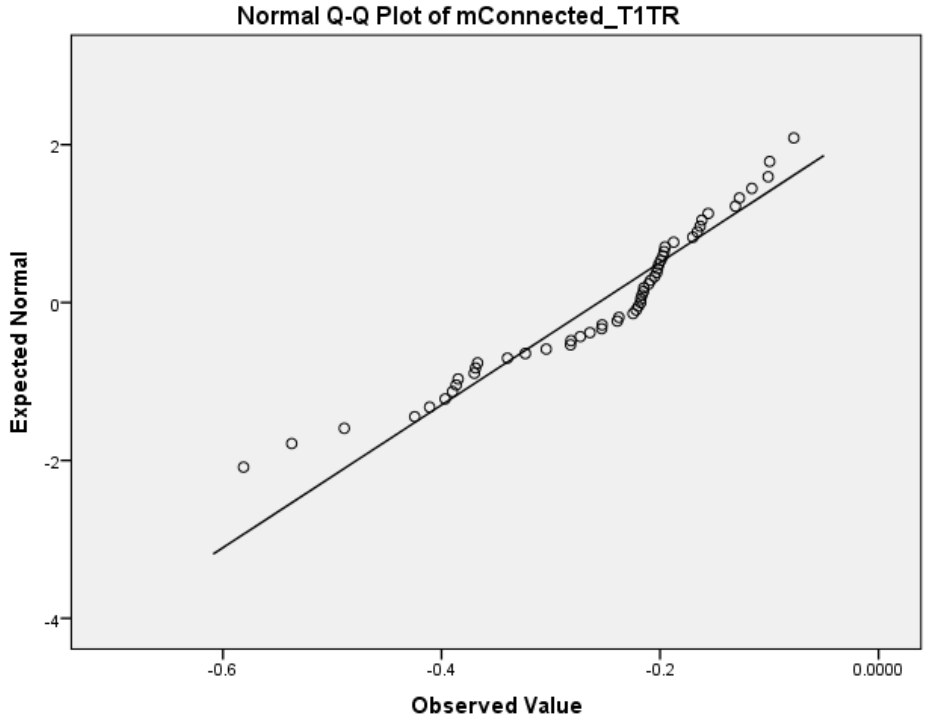
cConnected_T1TR



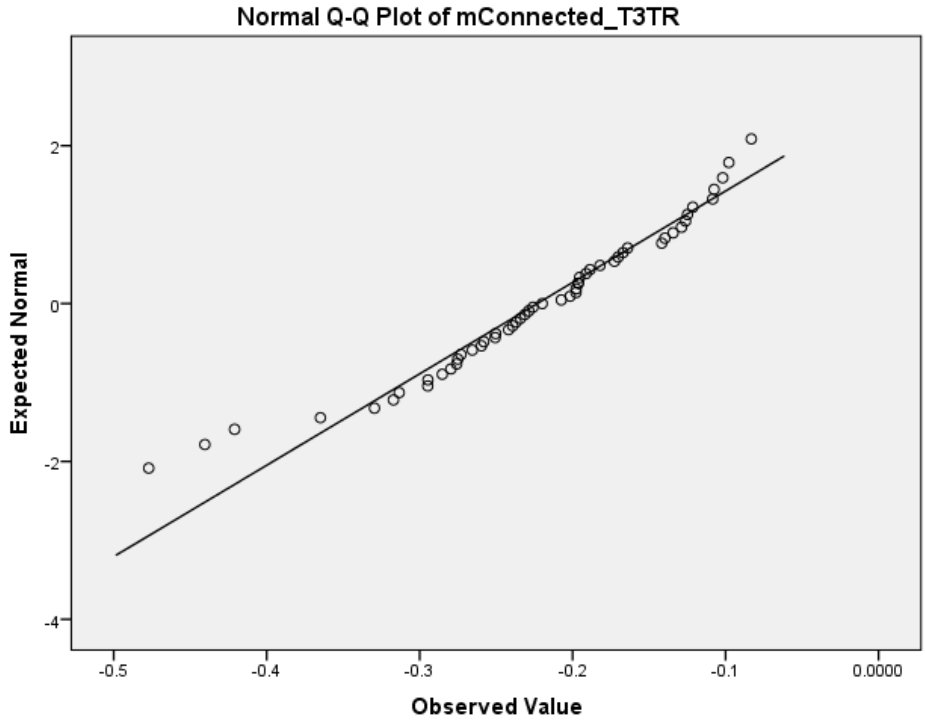
cConnected_T3TR



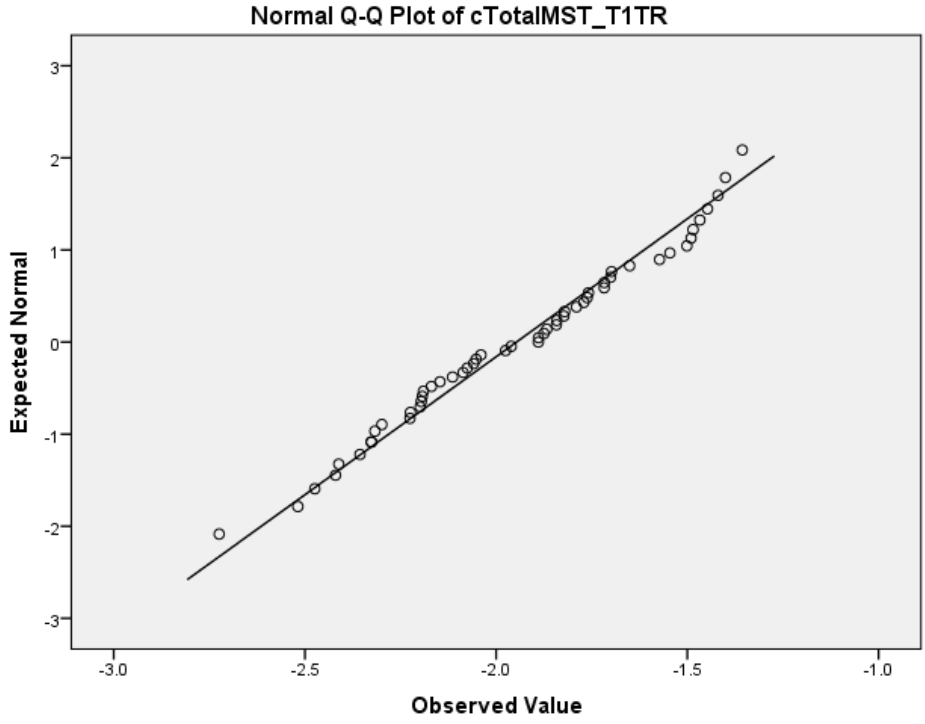
mConnected_T1TR



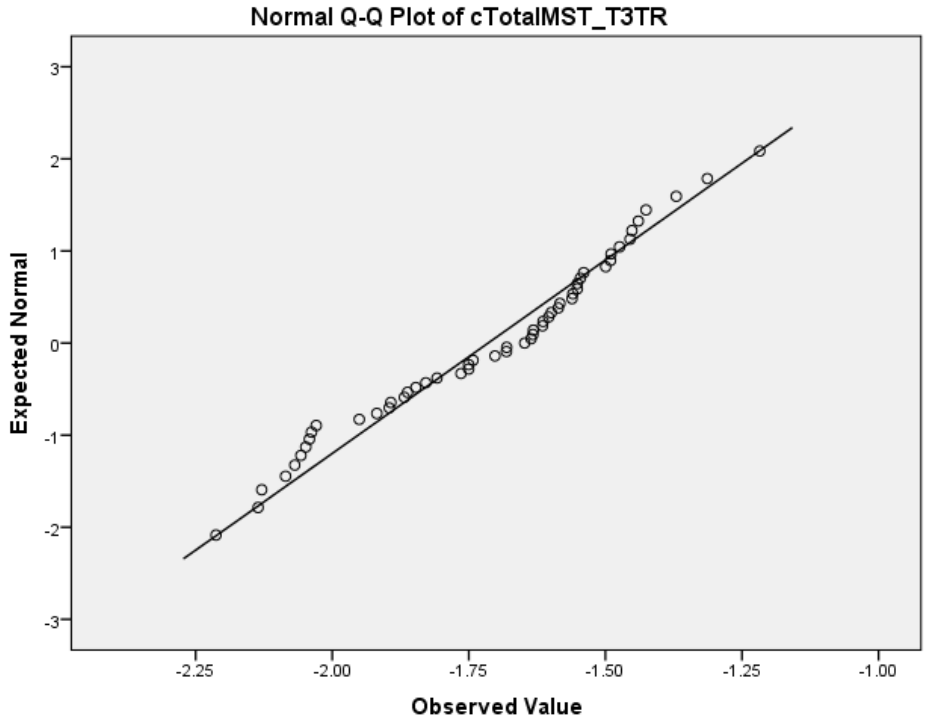
mConnected_T3TR



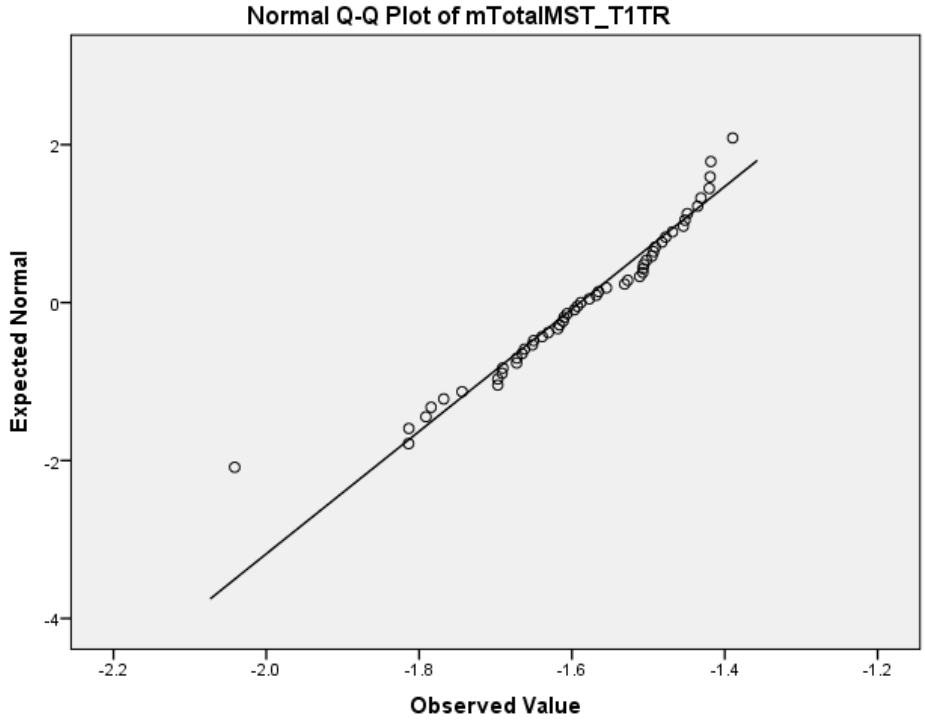
cTotalMST_T1TR



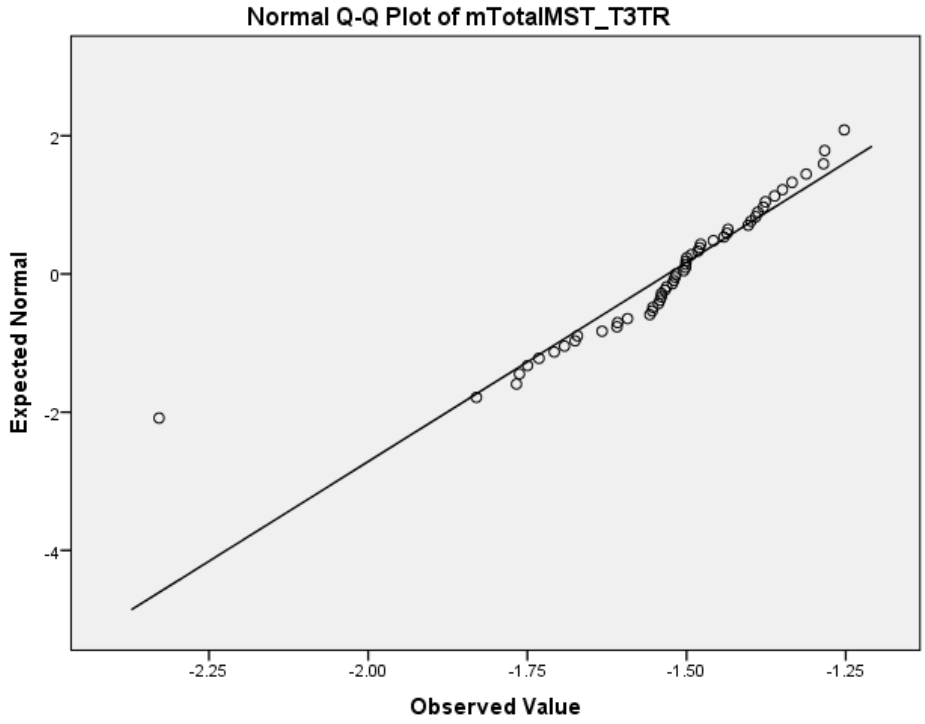
cTotalMST_T3TR



mTotalMST_T1TR



mTotalMST_T3TR



Appendix I: Variable names

Measure	Variable name
Participants	
Participant ID	PID
Child's sex	cSex
Child's date of birth	cDOB
Child's birth order	cBirthOrder
No. children in family at T1	NoKidsFam_T1
No. children in family at T3	NoKidsFam_T3
Are children in daycare at T1	Daycare_T1
Hours spent in daycare at T1	DaycareHrs_T1
Are children in daycare at T3	Daycare_T3
Hours spent in daycare at T3	DaycareHrs_T3
Mother education level	MotherEducLevel_T1
Language survey measures	
Based on the New Zealand English adaptation of the MacArthur-Bates Communication Development Inventory: Word Sentences (CDI)	
T1 age (months)	CDI_age_T1
T1 word size	CDIwords_raw_T1
T1 word percentile (based on NZ norms)	CDIwords_PS_NZ_T1
T1 word combination	CDIwc_T1
Assessment measures	
Receptive One-Word Picture Vocabulary Test, 4th ed. (ROWPVT-4)	
- Time 1	
- age (months)	ROWPVT_age_T1
- raw score	ROWPVT_raw_T1
- Time 3	
- age (months)	ROWPVT_age_T3
- raw score	ROWPVT_raw_T3
Clinical Evaluation of Language Fundamentals - Preschool-2 (CELF-P2)	
- Time 4	
- age (months)	
- Sentence structure raw score	CELF P2_SS_raw_T4
- Concepts & following directions raw score	CELF P2_CF_raw_T4
- Basic Concepts raw scores	CELF P2_BC_raw_T4
- Word structure raw score	CELF P2_WS_raw_T4
- Expressive vocabulary raw score	CELF P2_EV_raw_T4
- Recalling Sentences raw score	CELF P2_RS_raw_T4
- Expressive Language Index standard score	CELF P2_ELI_standard_T4
- Receptive Language Index standard score	CELF P2_RLI_standard_T4
- Language Content Index standard score	CELF P2_LCI_standard_T4

- Language Structure Index standard score	CELF P2_LSI_standard_T4
- Core Language Score standard score	CELF P2_CLS_standard_T4
Raven's Coloured Progressive Matrices (CPM)	
Time 4 age (months)	CPM_age_T4
- No. of correct items of total 12 Set A	CPMTotalSetA_T4
- No. of correct items of total 12 Set B	CPMTotalSetAB_T4
- No. of correct items of total 12 Set C	CPMTotalSetC_T4
- No. of correct items of total 36 (Set A, Set AB, Set C)	TotalCPMScores_T4
Theory of Mind Task (0=failed, 1=passed)	
Time 4 age (months)	ToM_age_T4
- passed/failed test trial 1	ToMTestTrial1_T4
- passed/failed test trial 2	ToMTestTrial2_T4
- passed/failed test trial 3	ToMTestTrial3_T4
- passed/failed test trial 4	ToMTestTrial4_T4
- passed/failed task	ToMTask_T4
Transcription of Spontaneous Playing Situation	
Coding Communication	
-Time 1	
- Communication Child	
- No. of connected turns	cConnected_T1
- No. of failed turns	cFailed_T1
- No. of initiated turns	cInitiation_T1
- No. of unclear turns	cUnclear_T1
- No. of total turns	cTotalTurns_T1
- Communication Mother	
- No. of connected turns	mConnected_T1
- No. of failed turns	mFailed_T1
- No. of initiated turns	mInitiation_T1
- No. of unclear turns	mUnclear_T1
- No. of total turns	mTotalTurns_T1
- Time 3	
- Communication Child	
- No. of connected turns	cConnected_T3
- No. of failed turns	cFailed_T3
- No. of initiated turns	cInitiation_T3
- No. of unclear turns	cUnclear_T3
- No. of total turns	cTotalTurns_T3
- Communication Mother	
- No. of connected turns	mConnected_T3
- No. of failed turns	mFailed_T3
- No. of initiated turns	mInitiation_T3
- No. of unclear turns	mUnclear_T3
- No. of total turns	mTotalTurns_T3
Coding Mental State Terms (MST)	

- Time 1	
-MST Child	
- No. of terms referring to physiological states	cPhysiological_T1
- No. of terms referring to emotional states	cEmotion_T1
- No. of terms referring to desire states	cDesire_T1
- No. of terms referring to cognitive states	cCognition_T1
-Total number of MST	cTotalMST_T1
- Total number of completed words	cTcompletedW_T1
-MST Mother	
- No. of terms referring to physiological states	mPhysiological_T1
- No. of terms referring to emotional states	mEmotion_T1
- No. of terms referring to desire states	mDesire_T1
- No. of terms referring to cognitive states	mCognition_T1
-Total number of MST	mTotalMST_T1
- Total number of completed words	mTcompletedW_T1
-Time 3	
-MST Child	
- No. of terms referring to physiological states	cPhysiological_T3
- No. of terms referring to emotional states	cEmotion_T3
- No. of terms referring to desire states	cDesire_T3
- No. of terms referring to cognitive states	cCognition_T3
-Total number of MST	cTotalMST_T3
- Total number of completed words	cTcompletedW_T3
-MST Mother	
- No. of terms referring to physiological states	mPhysiological_T3
- No. of terms referring to emotional states	mEmotion_T3
- No. of terms referring to desire states	mDesire_T3
- No. of terms referring to cognitive states	mCognition_T3
-Total number of MST	mTotalMST_T3
- Total number of completed words	mTcompletedW_T3
Child T4	
Parent Questionnaires	
Strengths and Difficulties Questionnaire (SDQ)	
- Time 4	
- age (months)	SDQ_age_T4
- Emotional problems scale	SDQEmotionalSymptoms_T4
- Conduct problems scale	SDQConductProblems_T4
- Hyperactivity scale	SDQHyperactivity_T4
- Peer problems scale	SDQPeerProblems_T4
- Prosocial scale	SDQProsocialBehaviour_T4
- generated by summing scores from all the scales except the prosocial scale	SDQTotalDifficulties_T4
- sum of the conduct and hyperactivity scales	SDQExternalising_T4
- sum of the emotional and peer problems scales	SDQInternalising_T4
Social Responsiveness Scale, 2nd ed. (SRS-2)	

- Time 4	
- age (months)	SRS2_age_T4
- raw scores of sum of Awr, Cog, Com, Mot, RRB scores	SRS2TotalRawScore_T4
- T scores of sum of Awr, Cog, Com, Mot, RRB scores	SRS2TotalTScore_T4
- raw scores of social awareness	SRS2AwrRawScore_T4
- T scores of social awareness	SRS2AwrTScore_T4
- raw scores of social cognition	SRS2CogRawScore_T4
- T scores of social cognition	SRS2CogTScore_T4
- raw scores of social communication	SRS2ComRawScore_T4
- T scores of social communication	SRS2ComTScore_T4
- raw scores of social motivation	SRS2MotRawScore_T4
- T scores of social motivation	SRS2MotTScore_T4
- raw scores of restricted interests and repetitive behavior	SRS2RRBRawScore_T4
- T scores of restricted interests and repetitive behaviour	SRS2RRBTScore_T4
- raw scores of social communication and interaction	SRS2SCIRawScore_T4
- T scores of social communication and interaction	SRS2SCITScore_T4

Appendix J: Means and standard deviations with and without outliers

Means and Standard Deviations without Outliers

Variable	*M*	*SD*	*n*	Min.	Max.
Child Connected T1	-0.35	0.12	66	-0.79	-0.16
Child Connected T3	-0.32	0.10	67	-0.58	-0.13
Mother Connected T1	-0.30	0.18	66	-0.92	0.00
Mother Connected T3	-0.26	0.12	67	-0.64	-0.08
Child Mental State Words T1	-1.95	0.33	53	-2.72	-1.36
Child Mental State Talk T3	-1.72	0.22	66	-2.21	-1.22
Mother Mental State Words T1	-1.59	0.12	66	-1.88	-1.39
Mother Mental State Talk T3	-1.52	0.13	66	-1.83	-1.25

Means and Standard Deviations with Outliers

Variable	*M*	*SD*	*n*	Min.	Max.
Child Connected T1	-0.37	0.16	67	-1.22	-0.16
Child Connected T3	-0.32	0.10	67	-0.58	-0.13
Mother Connected T1	-0.31	0.22	67	-1.35	0.00
Mother Connected T3	-0.26	0.12	67	-0.64	-0.08
Child Mental State Words T1	-1.95	0.33	53	-2.72	-1.36
Child Mental State Talk T3	-1.72	0.22	66	-2.21	-1.22
Mother Mental State Words T1	-1.60	0.13	67	-2.04	-1.39
Mother Mental State Talk T3	-1.54	0.17	67	-2.33	-1.25

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