“Imagine what your world would be like if you were aware of physical things but were blind to the existence of mental things. I mean, of course blind to things like thoughts, beliefs, knowledge, desires, and intentions, which for most of us self-evidently underlie behaviour. Stretch your imagination to consider what sense you would make of human action (or for that matter, any animate action whatsoever) if, as for a behaviourist, a mentalistic explanation was forever beyond your limits” (Baron-Cohen, 1995, p. 1).

Chapter three investigated the cognitive processing characteristics of PDD in order to understand better how they may underlie the communication characteristics seen. In Chapter three it was proposed that the PASS model provides a useful framework for assessment, as it has the potential to explain how the different cognitive processing explanations for PDD may be related. From an overview of the cognitive processing literature in PDD, it becomes clear that the relationship between the cognitive processing explanations and theory of mind explanation for PDD requires further investigation and, at this stage, the nature of this relationship is still not clear.

The current chapter explores the theory of mind hypothesis of PDD. In particular, the different aspects of theory of mind relevant to children between 5.0 and 7.11 years are looked at. The relationship between theory of mind and language, and theory of mind and cognition is explored. Baron-Cohen & Ring’s (1994) and Baron-Cohen’s (1995) mind-reading system model is presented to help understand the interrelationship between the different areas of theory of mind and to assist in understanding the neurological underpinnings of theory of mind. The limitations of previous research on communication, cognitive processing and theory of mind in PDD are highlighted and the importance of investigating communication, cognitive processing and theory of mind in a systematic and comprehensive way is stressed.

A very influential theory that has been put forward to explain the difficulties seen in PDD, including the communication difficulties, is the theory of mind hypothesis. Difficulty acquiring a theory of mind has been said to underlie many of the developmental
abnormalities that are observed in PDD (Howlin et al., 1999). Frith (1989b) used the lack of theory of mind hypothesis to account for the triad of impairments in children on the PDD spectrum.

Theory of mind is defined as “the ability to infer other people’s mental states (their thoughts, beliefs, desires, intentions, etc.), and the ability to use this information to interpret what they say, make sense of their behaviour and predict what they will do next” (Howlin et al., 1999, p. 2). It refers to an individual’s ability to analyse and interpret the behaviour of others by recognising the mental states and intent behind their behaviour (Muris et al., 1999). However, it does not only involve recognising and interpreting the mental states of others but also appreciating one’s own mental states and understanding the link between mental states and action (Baron-Cohen & Swettenham, 1997). It is a powerful social tool allowing the explanation, prediction, and manipulation of the behaviour of others (Frye & Moore, 1991). Theory of mind, also referred to as mind reading, allows a person to make sense of social behaviour, make sense of communication, deceive others, empathize with others, persuade others, and allows for self reflection (Howlin et al., 1999).

It is important to study theory of mind when studying communication. Understanding other people’s perspectives and appreciating their mental states, as well as understanding how these may or may not differ from our own, is important for successful communication (Miller, 2006). Furthermore, during the pre-school years the development of language and theory of mind appears to be interwoven in complex ways (Miller, 2006). While theory of mind ability is necessary for successful communication, language and communication provide the child with a way to learn about theory of mind (Miller, 2006).

4.1 THEORY OF MIND IN PDD

The ability to understand one’s own mind and others’ appears to occur effortlessly in childhood (Howlin et al., 1999). However, this ability to mind-read does not appear to occur effortlessly in children with PDD. The theory of mind deficit in PDD is said to result in an inability to: be sensitive to other people’s feelings; take into account what other people know; read and respond to intentions; read the listener’s level of interest in one’s speech; understand a speaker’s intended meaning; anticipate what others may think of your actions; understand misunderstandings; deceive or understand deception; understand the motives behind other
people’s actions; and understand “unwritten rules” (Baron-Cohen & Howlin, 1993; Howlin et al., 1999). Theory of mind does not, however, appear to be an all or none phenomenon and a continuum of theory of mind impairment has been suggested (Bauminger & Kasari, 1999; Luckett, Powell, Messer, Thornton, & Schulz, 2002; Sicotte & Stemberger, 1999). According to Frith (1989b) theory of mind difficulties in children with PDD result in communication failure, as they are impaired in their ability to determine what is relevant and what is not and experience difficulty taking account of other’s mental states when communicating. Furthermore, according to Frith (1989b), this deficit results in their experiencing difficulty forming social relationships and engaging in imaginative play, which involves acting out other’s roles.

4.2 THEORY OF MIND CONSTRUCTS

The development of a theory of mind encompasses a number of mental state concepts. Developmental evidence suggests that, even for typically developing children, theory of mind thinking is not automatic and that children develop a number of milestones in different areas of theory of mind before they are able to fully understand mental states (Miller, 2006). Theory of mind, therefore, exists on a continuum of complexity, with the understanding of certain mental states occurring before others (Sicotte & Stemberger, 1999). Mental state concepts that are relevant to the understanding of theory of mind in children up to 7.11 years will be discussed below, with each of these being discussed in relation to normal development and development in autism. These mental state concepts were chosen because they appear to be constructs that have been identified in the literature as important components of theory of mind.

4.2.1 Early precursors to the development of theory of mind

Early precursors to the development of a theory of mind are the development of detecting eye direction (Baron-Cohen & Ring, 1994), understanding goal and desire (Baron-Cohen, 1993; Baron-Cohen & Ring, 1994), understanding intentions (Frye, 1993) and the development of joint attention (Baron-Cohen, 1993, Baron-Cohen & Ring, 1994). Eye detection involves detecting the presence of the eyes, for example, that someone is looking at you (Baron-Cohen & Ring, 1994). Understanding basic goal and desire involves understanding your own and another person’s behaviour (self-propelled actions) according to their goals, likes and dislikes.
(Wellman, 1993). For example, understanding that if someone is moving towards something his or her goal may be to get that thing (Baron-Cohen, 1995). Understanding intention is described as expecting a specific outcome of an action, so that the action is directed towards bringing out that outcome (Frye, 1993). Joint attention is the ability to co-ordinate attention between an object/event and a person in a social context (Mundy & Gomes, 1998; Whalen & Schreibman, 2003). These early precursors to a theory of mind develop in the first and second years of life (Baron-Cohen, 1992, 1993; Baron-Cohen & Ring, 1994; Carpenter, Pennington, & Rogers, 2001; Frye, 1993; Mundy & Gomes, 1998; Schult, 2002; Wellman, 1993). Children with PDD have not been shown to be impaired in understanding basic goal and desire (Baron-Cohen, 1991a, 1993; Tan & Harris, 1991) and in detecting basic eye direction (e.g. that someone is looking at them) (Baron-Cohen & Ring, 1994). They, however, have been shown to be impaired in developing joint attention (Carpenter, Pennington, & Rogers, 2002) and understanding intention (Phillips, Baron-Cohen, & Rutter, 1998), although studies looking at the understanding of intentions in PDD have produced mixed results (Carpenter et al., 2002).

4.2.2 Understanding visual perceptual taking

Level 1 understanding of visual perception has been described as being able to judge whether someone saw something or not and what conditions are required for someone to see something (Baron-Cohen, 1993). This is said to be developed by 2 years (Flavell et al., 1981, as cited by Baron-Cohen, 1993). Level 2 understanding of visual perception is being able to understand how something will appear from a different visual perspective (Baron-Cohen, 1993). This develops at approximately 3 to 4 years in normal children (Flavell et al., 1981, as cited by Baron-Cohen, 1993).

A number of studies has demonstrated that children with autism do not have difficulties on either of these levels of visual perceptual role taking, when compared to control subjects (Hobson, 1984; Baron-Cohen, 1989; Leslie & Frith, 1988; Tan & Harris, 1991; Reed & Peterson, 1990). However, a study by Dawson and Fernald (1987) indicated that autistic children did have some difficulty on a number of level 2 visual perceptual role taking tasks and that their performance was closely related to their performance on measures of social cognition. Dawson and Fernald’s (1987) visual perceptual role taking tasks appeared more complex than those used in the above studies that found this area to be intact in autistic
children. This more complex visual perceptual role taking does not appear to have been studied in PDD children on the high functioning end of the spectrum.

4.2.3 Understanding the mental significance of the eyes

More agreement exists on understanding higher levels of visual perception. In particular, it is generally agreed that understanding that seeing leads to knowing (Baron-Cohen & Goodhart, 1994; Baron-Cohen & Swettenham, 1997) and understanding that the eyes carry meaning is impaired in autism (Shields, Varley, Broks, & Simpson, 1996b). A number of studies has indicated that autistic children experience difficulty understanding the concept that if someone sees something, that person now knows about it (Leslie & Frith, 1988; Perner, Frith, Leslie, & Leekam, 1989; Kazak, Collis, & Lewis, 1997) and that seeing allows you to know about something as opposed to guessing about it (Kazak et al., 1997). This is related to the concept of understanding knowledge. Understanding knowledge has been shown to be easier than understanding belief in both normal (Wellman, 1990) and autistic children (Leslie & Frith, 1988). This may be because knowledge is true belief and, therefore, should be simpler than false belief as misrepresentation is not involved. The comprehension of understanding knowledge, however, does appear to be delayed in autistic children when compared to subjects with a mental handicap (Leslie & Frith, 1988; Perner et al., 1989; Reed & Peterson, 1990). To date the measures used to assess understanding knowledge have generally been based on the assumption that seeing leads to knowing. Wimmer, Hogrefe and Perner (1988, as cited by Baron-Cohen & Goodhart, 1994) demonstrated that children were able to understand that seeing leads to knowing by 4 years of age. Pratt and Bryant (1990, as cited by Baron-Cohen & Goodhart, 1994) used a simpler format and showed that children as young as 3 years were able to understand that seeing leads to knowing.

Furthermore, children with autism have been shown to be impaired in reading that where the direction of the eyes are pointing indicates where they are looking and what that person may want (Baron-Cohen & Cross, 1992; Baron-Cohen, Campbell, Karmiloff-Smith, Grant, & Walker, 1995; Leekam, Baron-Cohen, Perrett, Milders, & Brown, 1997). Lee, Eskritt, Symons, and Muir (1998) have shown that by 4 years normal children are able to use eye direction to infer a person’s desires. Children with autism have been shown to be impaired in understanding that prolonged looking at something indicates an interest in that thing (Montgomery, Bach, & Moran, 1998). Understanding that the eyes may be used to detect
desire has been shown to be impaired in autism, while autistic children have been shown to understand more basic desire (for example, understanding that if someone is moving towards something, they may want that thing) as well as mentally handicapped controls (Baron-Cohen, 1991a; Tan & Harris, 1991).

Children with autism have been demonstrated to experience difficulty inferring mental states such as “thinking” where the cues for this information are provided in the person’s eyes (Baron-Cohen & Cross, 1992; Baron-Cohen et al., 1995). Baron-Cohen and Cross (1992) showed that a group of typical 4-year-olds scored significantly above chance on a thought detection task, where the children were required to infer which person was thinking from looking at the person’s eyes. However, high functioning adults with autism and Asperger’s syndrome have been shown to experience difficulty inferring the mental state of a person from information provided in photographs of the person’s eyes (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). It has more recently been shown that this deficit is not only specific to the eyes, and that individuals with autism were noted to experience difficulty attributing mental states from voices (Kleinman, Marciano, & Ault, 2001).

### 4.2.4 Belief

Understanding beliefs is generally assessed through the understanding of false belief. It has been suggested that this may be the litmus test of a theory of mind as these measures allow one to distinguish between the child’s true beliefs and his/her understanding of someone else’s different belief (Dennett, 1978, as cited by Baron-Cohen, 1993). First-order false beliefs are often assessed by unexpected location/transfer tasks and unexpected identity tasks. In unexpected location/transfer tasks the subject observes a scene where an item is put in one place by a character and then in the character’s absence is moved to a second place by a second character. The subject is then asked where the first character will look for the object when he/she returns. This has been acted out with dolls, puppets, real people etc. in different experiments (Baron-Cohen, Leslie, & Frith, 1985, 1989b; Butterworth, 1994; Leekham & Perner, 1991; Leslie & Frith, 1988; Leslie & Thaiss, 1992; Reed & Peterson, 1990; Wimmer & Perner, 1983). In unexpected identity tasks, when the true identity of an item is revealed to the subject, it is unexpected. For example, the child is asked what is in a smartie box. When he/she replies smarties it is revealed that the box actually contains pencils (Perner et al., 1989). The child is then asked what a second person will say when he/she is asked what the
identity of something is, where the true identity has not been revealed (i.e. when asked what is in a smartie box containing pencils). Subjects who experience difficulty understanding beliefs generally expressed that a second person would respond with the subject’s new understood identity of the item though the actual identity of the item had not been revealed to that person (Gopnick & Astington, 1988; Hughes & Dunn, 1998; Perner et al., 1987, 1989; Slaughter, 1998; Whiten, 1994).

A number of studies has demonstrated that normal children are able to pass first-order false belief tasks at approximately 4 years of age (Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999; Peterson & Segal, 1995; Ruffman, Olson, & Astington, 1991; Wimmer & Hartl, 1991). However, a number of researchers believe that children acquire an understanding of false beliefs at an earlier age than this and that younger children’s poorer performance in studies demonstrating competence at approximately 4 years, is due to performance factors (Freeman, Lewis, & Doherty, 1991; Siegal & Beattie, 1991; Sullivan & Winner, 1991; Wellman & Bartsch, 1988). They believe that when measures used to assess this are simplified and the experiments better controlled, children younger than 4 years show an understanding of false beliefs (Freeman et al., 1991; Siegal & Beattie, 1991; Sullivan & Winner, 1991; Wellman & Bartsch, 1988). This is, however, controversial as it has been suggested that in these experiments supporting an earlier view of the theory of false belief, the children may have received some cueing as to how to respond, or that these experiments were simplified in such a manner that they were no longer assessing theory of mind but earlier developing constructs.

It is accepted that a large percentage of individuals with autism has difficulties on false belief tasks (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen & Swettenham, 1997; Charman & Baron-Cohen, 1995; Holroyd & Baron-Cohen, 1993; Leekam & Perner, 1991; Leslie & Frith, 1988; Naito, Komatsu, & Fuke, 1994; Scott & Baron-Cohen, 1996; Swettenham, 1996; Yun Chin & Bernard-Opitz, 2000). These tasks involve understanding the relationship between a person’s belief and reality (Frith, 1989a, 1989b; Tager-Flusberg & Sullivan, 1994). It must, however, be noted that in most studies assessing the understanding of false belief in autism a percentage of subjects with autism does pass. This observation would appear to suggest that some individuals with autism have an intact understanding of belief. However, a number of more recent studies have suggested that this occurrence may be due to a ceiling effect, as most false belief tasks are expected to be achieved by a mental age of approximately 4 years.
The children with autism who have passed these tasks have been shown to have a mental age well above this. However, individuals with autism have done less well on more complex false belief tasks, generally known as second-order representation false belief tasks.

Studies have shown that normal children usually acquire an understanding of second-order false belief at 6 to 7 years, although this continues to develop beyond this (Baron-Cohen et al., 1999; Perner & Wimmer, 1985). Second-order false beliefs involve a false belief about what one person is thinking about what another person is thinking about reality; for example “John thinks that Mary thinks that …” (Baron-Cohen, 1989b; Bowler, 1992; Dahlgren & Trillingsgaard, 1996; Happe, 1994; Perner & Wimmer, 1985; Tager-Flusberg & Sullivan, 1994). A number of studies found that many of the subjects with autism who were able to carry out first-order false belief tasks experienced difficulty with second-order belief attribution (Baron-Cohen, 1989b; Happe, 1994; Ozonoff, Pennington, & Rogers, 1991; Perner & Wimmer, 1985). However, a number of more recent studies has indicated that certain individuals with PDD do pass second-order false belief tasks, with this percentage being shown to be higher in individuals on the higher end of the spectrum, such as in Asperger’s syndrome (Bowler, 1992; Dahlgren & Trillingsgaard, 1996; Tager-Flusberg & Sullivan, 1994). Tager-Flusberg and Sullivan (1994) demonstrated that as many as 60% of subjects with either autism or Asperger’s syndrome who passed first-order false belief tasks, also passed second-order false belief tasks.

4.2.5 Deception

The ability to deceive another person successfully is said to rely on a fairly good understanding of that person’s beliefs (Leekam, 1992). Deception is generally assessed by tasks where, in order to acquire what he desires, the child is required to deceive. These tasks have included using a character who is perceived as good and a character who is perceived as bad (usually puppets). In order to help the good character and achieve what the child desires, the child is required to deceive the bad character (Peskin, 1992; Sodian, Taylor, Harris, & Perner, 1991; Sodian & Frith, 1992). A number of studies has demonstrated that children develop the mental state of deception at approximately 4 to 5 years (Baron-Cohen, 1993; Russell, Mauthner, Sharpe, & Tidswell, 1991; Shultz & Cloghesy, 1981). However, a number of researchers have suggested that deception develops earlier than this and that the reason that it was only the 4 to 5 year olds who were able to carry out deception in the above
studies was because of the complexity of the assessment tools used. They assessed deception using less complex measures and believe that children as young as 3 years are able to display deception (Chandler, Fritz, & Hala, 1989; Hala, Chandler, & Fritz, 1991). However, it has been suggested that these simplified tasks have methodological problems and, therefore, 4 to 5 years is generally accepted as the age when deception develops (Sodian & Frith, 1993). Deception has generally been shown to be impaired in autistic individuals, although a percentage of these individuals has passed tests of deception (Baron-Cohen, 1992; Russell et al., 1991; Sodian & Frith, 1992).

4.2.6 Understanding emotions

Initially, subjects with autism were shown to experience difficulty with emotion-expression matching tasks (Hobson, 1986). However, more recent studies have found that when matched for verbal mental age, these difficulties are no longer significant (Braverman et al., 1989; Hobson, 1989; Ozonoff, Rogers, Pennington, & Rogers, 1990; Tantam, Monaghan, Nicholson, & Stirling, 1989). Certain studies have shown that subjects with autism experience difficulty predicting emotions based on the character’s belief (Baron-Cohen, 1991b). They were also more impaired in recognising facial expressions such as surprise versus happiness and sadness (Baron-Cohen, 1993). The understanding and expression of emotions has been tested at the level of narratives. This has included an assessment of the understanding of story characters’ thoughts and feelings (Happe, 1994) and the ability to attribute mental states to story characters (Tager-Flusberg & Sullivan, 1995). These studies indicated difficulty with this in children with autism.

4.2.7 Imagination and pretence

The studies that have assessed imagination and pretence can generally be divided into those that assess pretend play versus those that assess the comprehension of the mental state of pretence. A number of studies has assessed autistic children’s ability to produce pretend scenarios. These studies generally report that subjects do not differ from controls in their production of sensorimotor and functional play but do differ significantly in their production of true symbolic play (Ungerer & Sigman, 1981; Baron-Cohen, 1987; Leslie, 1987). However, Lewis and Boucher (1988), Mundy, Sigman, Ungerer, and Sherman (1987), Mundy, Sigman, and Kasari (1993) and Williams, Reddy, and Costall (2001b) also report...
lower levels of functional play in children with autism when compared to controls. Symbolic
play has generally been accepted to occur when: the child uses one object as if it were
another; attributes properties to an object that it does not have; and/or refers to absent objects
as if they are present (Baron-Cohen, 1987; Leslie, 1987). Lewis and Boucher (1988) and
Jarrold, Boucher, and Smith (1996) demonstrated that under conditions of elicitation or
instruction, children with autism did produce some symbolic play, but that their spontaneous
symbolic play and ability to generate pretend acts was severely impaired. They concluded
that children with autism can produce the mechanics required for pretend play, but their
impairments at producing pretence are due to generativity problems. Libby, Powell, Messer,
& Jordan (1997), however, suggested that some difficulty with the mechanics of pretend play
may be evident when assessed at a more complex level. Libby et al. (1997) demonstrated that
children with autism were better than Down syndrome and normally developing children in
imitating single-scheme play tasks but that they experienced considerably more difficulty
than the other two groups imitating multi-scheme tasks. Difficulty with imagination may,
therefore, also be due to the imitation difficulties in PDD. By 3 years normal children have
been shown to substitute objects in their play, demonstrating the development of true
symbolic play (Patterson & Westby, 1998). Jarrold et al. (1996) demonstrated that children
without developmental difficulties (aged 3.11 to 8.1 years) coped well with a task assessing
their ability to generate pretend acts.

Regarding the comprehension of pretence, normal children appropriately assess others’
thoughts to pretend happenings at the age of 3 and 4 years. This appeared to develop before
their understanding of false belief tasks (Hickling, Wellman, & Gottfried, 1997). Jarrold,
Smith, and Boucher (1994), in a study assessing the comprehension of pretence in children
with autism, did not find significant differences between the subjects with autism and the
controls’ ability to identify the pretend substance involved, to predict the pretend outcome of
the actions or to reflect on the pretend nature of the events. This would suggest that it may be
the expression of pretence that is specifically impaired in PDD.
4.3 USING A DEVELOPMENTAL FRAMEWORK TO ASSESS A NUMBER OF DIFFERENT AREAS OF THEORY OF MIND

While a number of studies has confirmed a theory of mind deficit in PDD, these studies generally do not examine a wide range of theory of mind areas in one study in order to determine which aspects of theory of mind are most affected in PDD and how different aspects relate to one another. The use of a developmental assessment framework in order to assess a number of different theory of mind areas in PDD would be useful. In pre-school children this might include:

- **Assessing the understanding of visual perceptual role taking** – Understanding how something will appear from a different visual perspective has been shown to develop in typically developing children by approximately 3 to 4 years (Flavel et al., 1990, as cited by Baron-Cohen, 1993).

- **Understanding the mental significance of the eyes** – Seeing leads to knowing has been demonstrated to develop in typically developing children as young as 3 years (Pratt & Bryant, 1990, as cited by Baron-Cohen & Goodhart, 1994). Using eye direction to infer a person’s desires has been shown to develop in typically developing children by 4 years (Lee et al., 1998). Inferring the mental state of thinking from the eyes has been shown to develop in typically developing children by approximately 4 years (Baron-Cohen & Cross, 1992).

- **First-order false belief** – Understanding first-order false belief such as unexpected identity and unexpected location have been demonstrated to develop by 4 years of age (Baron-Cohen et al., 1999; Peterson & Segal, 1995; Ruffman et al., 1991; Wimmer & Hart, 1991).

- **Deception** – Typically developing children between 4 and 5 years of age have been shown to be able to pass tasks assessing the understanding of deception (Baron-Cohen, 1993; Russell et al., 1991; Shultz & Cloghesy, 1981).

- **Second-order false belief** – Better than chance performance on second-order false belief tasks has been shown to start at 6 years and to continue for the next 3 to 4 years (Perner & Wimmer, 1985).

- **Emotions and pretence** – Specific norms regarding emotions and pretence are less easy to obtain as tasks assessing these concepts are more open ended and appear to involve an element of generativity and these skills continue to be developed in the pre-school and early school years. Children as young as 3.11 years are able to
generate pretend acts in tasks assessing this, with this generativity improving with age (Jarrold et al., 1996). The use of mental state terms such as “think”, “know” and “feel” has been noted to develop from between 2 and 3 years and to develop progressively from this (Miller, 2006).

It would be useful to determine whether children with PDD follow a similar developmental pattern to typically developing children regarding acquiring certain theory of mind concepts and whether in PDD certain aspects of theory of mind are more impaired than others.

4.4 LIMITATIONS TO THE THEORY OF MIND DEFICIT HYPOTHESIS

An initial analysis would suggest that the theory of mind hypothesis is able to account for the marked social difficulties seen across the spectrum of the PDDs (Carter et al., 2005). However, a more detailed analysis reveals some limitations to this theory (Carter et al., 2005). Shaked and Yirmiya (2004) suggest that in order for any one symptom or group of symptoms to be defined as a core deficit, they must be universal (i.e. seen in almost all individuals with PDD); specific (i.e. domain specific); and unique (i.e. that deficit is not frequently seen in individuals with other clinical diagnoses). In most studies of theory of mind, a small proportion of individuals with PDD passed the tests (Sicotte & Stemberger, 1999) and between 15 to 60% of individuals with PDD have been said to pass theory of mind tasks (Happe, 1995; Happe & Frith, 1995), bringing into question the universality of the deficit. It appears that different individuals with PDD achieve theory of mind to different degrees (Prizant, 1996).

The specificity of the deficit has also been brought into question. Carpenter et al. (2001) found that young children with autism, who were impaired in joint intention, were not impaired in their development of understanding others’ intentions. They suggest that this dissociation brings into question the theory of mind deficit hypothesis. Lastly, a theory of mind deficit has not been shown to be unique to only PDD, as individuals with hearing impairment (Peterson & Siegal, 1995), visual impairment (Green, Pring, & Swettenham, 2004) and Down syndrome (Zelazo, Burack, Benedetto, & Frye, 1996) have been noted to experience difficulty on theory of mind tasks. Another difficulty with the theory of mind deficit hypothesis is that the close relationship between social skills and theory of mind has not always been found to exist (Sparrevoorn & Howie, 1995). Theory of mind is said to only be observable in normal children from approximately 2 years (Leslie, 1987). However, many
children with PDD do not show normal social skills in infancy and toddlerhood. It has, therefore, been suggested that in PDD, social impairments may occur before impairments in theory of mind are evident (Klin, Volkmar, & Sparrow, 1992). Moreover, training children on theory of mind tasks in some studies was not found to improve their social skills (Ozonoff & Miller, 1995; Yun Chin & Bernard-Opitz, 2000) or to generalise to non-experimental settings (Muris et al., 1999). Performance on theory of mind tasks was not shown to predict the application of theory of mind to everyday events (Newton et al., 2000, as cited in Begeer, Rieffe, Meerum Terwogt, Stockmann, 2003). Poor performance on theory of mind tasks has been unable to account for certain other features seen in individuals with PDD, such as restricted repertoire of interests, obsessive desire for sameness, islets of ability and savant skills, excellent rote memory and pre-occupation with the parts of objects (Frith & Happe, 1994).

Difficulties with task construction and administration of theory of mind tasks have been described. Most of the work assessing theory of mind development has used false belief tasks, often to the detriment of furthering our understanding of other aspects of theory of mind (Astington, 2001). Furthermore, environmental and task variables affect performance (Begeer et al., 2003). Poor language competence, concentration difficulties or motivational factors may affect performance on false belief tasks and failure on these tasks may be caused by this rather than poor mental state understanding (Begeer et al., 2003). Theory of mind tests generally use fairly complex language in their administration, and language ability has been correlated to theory of mind development (Jenkins & Astington, 1996). As comprehension difficulties have been noted in individuals with PDD, their poor performance may partly be due to difficulty understanding the language involved. Performance on theory of mind tasks has also been closely linked to general cognitive ability (Bauminger & Kasari, 1999). It is believed that some children with autism may use unconventional routes to solve false belief tasks and it has been suggested that these individuals may use a language-based approach to solve false belief paradigms (Luckett et al., 2002). This would appear to support an artificial or rule-based approach to coping with social situations (Luckett et al., 2002). Task variables may, therefore, sometimes result in individuals who do not have theory of mind difficulties failing theory of mind tasks, while some individuals who do have theory of mind difficulties may even pass some theory of mind tasks. The theory of mind deficit hypothesis for autism has been described by a number of researchers as being too simplistic
Hobson, 1991). The relationship between theory of mind and language and theory of mind and cognition highlights the complex nature of these deficits.

4.5 THEORY OF MIND AND LANGUAGE

Considerable language is generally required to participate in most theory of mind tasks (Miller, 2006). Performance on measures of theory of mind has been noted to be linked to language ability. This link has been demonstrated in normal development (O’Deak et al., 2003; Perner, Sprung, Zauner, & Haider, 2003; de Rosnay, Pons, Harris, & Morrell, 2004); in autism (Steele, Joseph, & Tager-Flusberg, 2003); and in SLI (Miller, 2004). Adapting the language in theory of mind tasks has been shown to result in better performance for children with SLI, but not for younger typically developing children matched for language comprehension (Miller, 2006). De Villiers and de Villiers (2000, as cited by Miller, 2006) and Call and Tomasello (1999, as cited by Miller, 2006) developed non-verbal theory of mind tasks. Using these non-verbal tasks did not improve the performance of typically developing children, when compared to the verbal tasks. Miller (2006) suggests that the language demands on false belief tasks may affect performance more for children with language disorders than typically developing children. It appears that further work is required to look at the relationship between language, theory of mind and different types of language disorders.

The nature of the link between language and theory of mind development has been investigated. It is now believed that theory of mind development is required for language development but that at a certain point certain aspects of language development are required before further development in theory of mind can take place (Lohmann & Tomasello, 2003; Steele et al., 2003). Theory of mind development has been shown to be required for word learning in early development (Sabbagh & Baldwin, 2001). It has been suggested that in PDD, due to theory of mind impairment, different processes to learn language may be used (i.e. instead of using joint attention individuals with PDD may rely on imitation to learn language) (Carpenter et al., 2002). In particular, a certain level of language development appears to be required for understanding belief (Astington, 2001). The developmental trend observed on false belief tasks has been suggested to reflect improved language ability, which co-varies with age (Astington, 2001). It appears that language is important not only for understanding false belief tasks but also for developing the understanding of false belief itself.
(Astington, 2001). Language is needed not only for representing false beliefs but also by communicating using language, children become aware of beliefs (Astington, 2001). Studies have shown that children’s mastery of the semantics of mental state terms (e.g. “think”, “know”, “believe”) develop at roughly the same time as their ability to master various false belief tasks (Lohmann & Tomasello, 2003). Furthermore, training in mental talk language results in improvement in false belief tasks (Lohmann & Tomasello, 2003). Teaching conversational skills to children with autism did change their performance on false belief tasks (Yun Chin & Bernard-Opitz, 2000).

Astington and Jenkins (1999, as cited in Miller, 2006), found that children between 3.4 to 3.11 years scores for syntax rather than semantics predicted later theory of mind performance. Farrar and Maag (2002, as cited in Miller, 2006) found that vocabulary (at 27 months) played a more important role than MLU (at 27 months) in predicting theory of mind performance (at 4 years). Ruffman et al. (2003, as cited by Miller, 2006) found that semantic rather than syntactical ability (at age 3 years) was a better predictor of theory of mind performance (at ages 3 and a half, 4 and 5 and a half years). De Villiers and de Villiers (2000) believe that the move from understanding desire to understanding belief is dependent on understanding the syntax of complementation, the grammatical structures with which beliefs are conveyed (Lohmann & Tomasello, 2003). In complementation, “a sentence takes a full clause as its object complement” (Lohmann & Tomasello, 2003, p. 1131), e.g. “Peter thinks he will see you later” or “I know where you are going”. The development of the understanding of complementation as a prerequisite for developing belief has been supported by a number of studies (de Villiers & de Villiers, 2000; Lohmann & Tomasello, 2003; Miller, 2004). However, it has not been supported in some studies that have examined the language of complementation in other languages, for example in German (Perner et al., 2003). Language and theory of mind performance clearly appear related and language has been shown to be a better predictor of theory of mind performance than theory of mind performance is a predictor of language ability (Miller, 2006). It is, however, less clear which aspects of language development best predict theory of mind development, as some studies support a greater influence of semantics and some studies support a greater influence of syntax (Miller, 2006).

Children with language deficits have been shown to perform more poorly on false belief tasks (Miller, 2006). However, studies looking at theory of mind in SLI showed that those
children who did not experience pragmatic difficulties as part of their language problems performed at or near age level on theory of mind tasks (Miller, 2006). Tager-Flusberg (2000, as cited by Miller, 2006) suggest that children with PDD may make greater use of sentence complements with communication verbs than other children to achieve success on false belief tasks. Children with PDD may use these sentence complements to bootstrap an understanding of similar structures with mental state verbs due to their poor insight into mental states. The relationship between theory of mind and language, therefore, appears to be a complex one, with this complexity increased by the relationship of cognition with theory of mind development

4.6 THEORY OF MIND AND COGNITION

Emotion and cognition are closely and dynamically linked (Bell & Wolfe, 2004; Lewis & Stieben, 2004). A debate in the literature exists as to what extent theory of mind understanding reflects an underlying conceptual understanding versus other non-focal cognitive skills (Wellman, Cross, & Watson, 2001). According to the conceptual account, conceptual progress is seen in children’s understanding of mental states (Perner et al., 2003). Wellman et al. (2001) conducted a meta-analysis of studies investigating theory of mind, looking particularly at false belief. This meta-analysis showed a genuine cognitive development in the understanding of false belief in children of 2 to 5 years (Povinelli & Giambrone, 2001). This development occurs in parallel but independent to other cognitive skills (Povinelli & Giambrone, 2001). The meta-analysis demonstrated a universal pattern across the human cultures that were included. Wellman and Liu (2004), in another meta-analytic study, looked at the sequence in which pre-schoolers develop understanding of theory of mind. Results indicated a distinct pattern in the development of children’s understanding of mind. Children were shown to be successful at judging others’ desires before they were successful at judging their beliefs. Furthermore, they were shown to be able to successfully judge diverse beliefs (understanding that they and someone else can have different beliefs about a situation) before false beliefs (understanding that someone can have an incorrect belief about a situation), and to understand ignorance before false belief. In addition, the results indicated that differentiating between real and apparent emotion is an understanding that develops later in the pre-school years (Wellman & Liu, 2004).
Theory of mind ability has been related to general cognitive ability (Bauminger & Kasari, 1999) and difficulties on theory of mind tasks have been suggested to be due to information processing difficulties. It has been suggested that young children’s poorer performance on theory of mind tasks may be due to executive functioning limitations which result in an inability to demonstrate their conceptual knowledge (Russell et al., 1991). Impairments in executive functioning have been put forward to explain the difficulties seen in joint attention in autism (Travis, Sigman, & Ruskin, 2001). Furthermore, executive functioning accounts suggest that children’s difficulties with mental states and false beliefs are due to difficulty inhibiting a preponent response in order to generate a different response (Carlson & Moses, 2001). Wellman and Liu (2004), however, showed that on two tasks that required similar inhibition, more difficulty was experienced on one than the other. They suggest that in the task where more difficulty was experienced, higher level theory of mind abilities were being tested. Furthermore, a dissociation between executive functioning and theory of mind has been shown in some disorders such as ADHD (Perner & Lang, 2002, in Ozonoff et al., 2005). It is possible that theory of mind deficits may co-occur with executive function deficits because of their shared frontal origin in the brain (Carter et al., 2005; Ozonoff et al., 2005). Possible explanations for the association between theory of mind and executive functioning include: independent parallel modular cognitive operations are both affected in PDD; ability in one area is required for development of ability in the other; theory of mind and executive functioning difficulties share an underlying third impairment, or their relationship is due to their sharing similar neural areas (Ozonoff et al., 2005).

Difficulty on theory of mind tasks has also been discussed in relation to weak central coherence (Jolliffe & Baron-Cohen, 1999). Weak central coherence may possibly account for poor performance on some theory of mind tasks as it results in focusing on isolated pieces of information and not taking context into account. However, some individuals with autism who pass theory of mind tasks fail central coherence tasks (Happe, 1997) and not all individuals with PDD fail measures of central coherence (Brian & Bryson, 1996), suggesting that theory of mind and central coherence may be relatively independent processes. The relationship between theory of mind and cognitive processes such as executive functioning and central coherence appears to require further investigation.

What is needed is a study that looks at a range of theory of mind components within a developmental framework. The results of this can then be used to examine the relationship
between language and theory of mind and cognition further. Comparing children with HFPDD and those with SLI may provide valuable insights into the role that language plays in theory of mind performance. Furthermore, understanding theory of mind in relation to a model that links theory of mind to brain functioning and takes the developmental aspects of theory of mind into account would be useful. Such a model is presented below.

4.7 **A MODEL OF THEORY OF MIND**

Baron-Cohen (1995) and Baron-Cohen and Ring (1994) propose a mind-reading system model, which appears useful in understanding theory of mind both in terms of its neurological underpinnings, as well as its developmental aspects. This model is presented in figure 4.1.

![Diagram](image)

**Figure 4.1: The four components of the mind-reading system (adapted from Baron-Cohen, 1995, p. 32 and Baron-Cohen and Ring, 1994, p. 185)**
In this model the mind-reading system is said to comprise four components. The first two consist of the intentionality detector and the eye-direction detector. The intentionality detector interprets self-propelling stimuli in terms of basic goal and desire, with goal being the target of the action and desire being movement towards the target. This device is activated when any perceptual input identifies something as an agent, interpreting the actions of agents as goal-directed (Baron-Cohen, 1995). The eye-direction detector detects the presence of the eyes and builds dyadic representations of eye behaviour (Baron-Cohen & Ring, 1994). It determines whether the eyes are directed toward it or something else and infers that if an organism’s eyes are looking at something, that organism sees that thing (Baron-Cohen, 1995). Both of these mechanisms are believed to be early perceptual mechanisms and are not impaired in autism. They would appear to be early precursors to the development of theory of mind. The essential feature of these two mechanisms is that they are dyadic representations, only specifying the mentalistic relation between two objects (i.e. agent and object, or agent and self) (Baron-Cohen, 1995).

These two mechanisms feed into the shared attention mechanism, which is a central mechanism involving integrating information from the intentionality detector and eye-direction detector. The shared attention mechanism functions to check whether both the child and another person are attending to the same thing, i.e. it is required for joint attention (Baron-Cohen & Ring, 1994). It also allows eye-direction to be read in order to interpret an agent’s goals and desires (Baron-Cohen & Ring, 1994). This shared attention mechanism is thought to be impaired in PDD (Baron-Cohen & Ring, 1994). The tasks of understanding visual perspective taking and understanding the mental significance of the eyes would appear to form part of the shared attention mechanism. The essential feature of the shared attention mechanism is that it involves triadic representations, specifying the relationship between an agent, the self and another object or agent, for example “Mommy sees I see the bus” (Baron-Cohen, 1995).

The shared attention mechanism then feeds into the theory of mind mechanism, which appears to be a more central process. Within the theory of mind mechanism mental state concepts (such as belief, think, know, feel, pretend etc.) are understood and stored. It is, however, also concerned with organising mental state knowledge into a theory of action used for explaining and predicting behaviour (Baron-Cohen & Ring, 1994). The tasks of belief,
deception, understanding emotions and pretence would appear to form part of the theory of mind mechanism.

It would appear that in this model each level requires greater integration of information than the previous level, from dyadic to triadic representations to concept formation. The theory of mind mechanism not only understands and stores concepts but also has an action component. Theory of mind development, therefore, appears to involve both the integration of information, as well as higher level planning to explain and predict behaviour in relation to mental states.

Evaluating theory of mind in relation to a model like this should assist in understanding the underlying mechanisms that have broken down in PDD. By using a range of theory of mind tasks that assess aspects of this model previously thought to be impaired in PDD and by comparing the results of these, the underlying processes that are most affected may be able to be detected. Looking at how these underlying processes tie up with the language processes and cognitive processes thought to be impaired in PDD, should assist in providing a better understanding of this disorder. For example, triadic representations may be linked to conceptual aspects of grammar involving embedding, while the theory of mind mechanism’s function of forming mental state concepts may be related to integrating information and the function of explaining and predicting behaviour may be found to be linked to planning abilities.

Baron-Cohen and Ring (1994) propose that the superior temporal sulcus is involved with the shared attention mechanism, while the orbito-frontal cortex of the pre-frontal cortex is involved with the theory of mind mechanism. The amygdala is also thought to be involved with several components of this system. According to Baron-Cohen and Ring (1994) these brain areas are interconnected forming a circuit.

A developmental assessment of theory of mind and how it relates to this model may provide some insight into where the most break down in this model occurs in PDD. As this model relates somewhat to information processing and brain mechanisms it may provide some insight into how theory of mind is related to cognitive processing and communication in PDD.
4.8 SUMMARY AND CONCLUDING COMMENTS ON THEORY OF MIND IN PDD

Many different areas are important to understanding theory of mind in PDD. This chapter outlined a number of theory of mind skills that are important to assess in children between 5.0 to 7.11 years of age including: the understanding of visual perceptual role taking; understanding the mental significance of the eyes; belief (including first-order and second-order false belief); deception; understanding emotions; and pretence. These areas would appear to be important areas to assess at this age as they assess different aspects of theory of mind thought to be acquired by 5.0 years or still being acquired between 5.0 to 7.11 years. Determining which of these areas are most impaired in PDD may provide insights into the underlying mechanisms that are affected. Furthermore, the intricate relationship between language and theory of mind and cognition and theory of mind was discussed. Baron-Cohen & Ring’s (1994) and Baron-Cohen’s (1995) mind-reading system model and its potential usefulness for interpreting the results of a battery of theory of mind tasks was presented. Assessing language, cognition and theory of mind in the same group of children with PDD and looking at how these areas are associated may provide insights into the relationships between these variables.

4.9 LIMITATIONS OF PREVIOUS RESEARCH LOOKING AT COMMUNICATION, COGNITIVE PROCESSING AND THEORY OF MIND IN PDD

Most of the studies that have investigated communication, cognitive processing or theory of mind in PDD have focused on only one of these areas and have not looked at the relationships between them. Furthermore, many of the studies examining communication, cognitive processing or theory of mind look at only one aspect or a limited number of aspects within these areas, so that overall profiles of communication, cognitive processing and theory of mind on the same group of individuals have not been obtained. Studies that have investigated the relationships between communication, cognitive processing and theory of mind, have tended only to look at how any two of these areas are related at a time, for example, how aspects of cognitive processing may be related to aspects of theory of mind. While there appear to be more studies examining how aspects of cognitive processing and theory of mind may be related in PDD, there appears to be a general dearth of studies looking
at how these aspects are related to communication in this population. Furthermore, studies have only tended to look at how one aspect or a limited number of aspects in one of these areas relate to one or a limited number of aspects in another of these areas, for example investigating how one aspect of cognitive ability such as executive functioning or central coherence relates to one aspect or a limited number of aspects of theory of mind. Studies have also generally not attempted to interpret findings in relation to models of brain functioning. It is felt that this may be beneficial in gaining a better overall understanding of the areas of communication, cognitive processing and theory of mind in PDD.

There also appears to be a general dearth of studies investigating children on the very high end of the PDD spectrum, as well as looking at communication, cognitive processing and theory of mind in younger children. In particular, there appears to be a dearth of studies including both these aspects (children at the very high end of the PDD spectrum and younger children) in one study. It is felt that the results of studies using children on the more severe end of the spectrum may be influenced by confounding variables such as mental retardation. Furthermore, when older participants are used it is more difficult to rule out the effects of previous interventions, as well as the effects of developmental maturation. While a number of studies have looked at the communicative, social-affective and symbolic profiles of young children with PDD (see review by Wetherby, Prizant & Schuler, 2000), these have generally focused on children under 5 years and have thus been unable to examine more formal aspects of cognitive processing and theory of mind, as many of these aspects appear to be difficult to assess reliably prior to 5 years.

While previous studies have provided important insights into the communication, cognitive processing and theory of mind abilities of children with PDD, they have tended to provide fragmented perspectives in these areas. Furthermore, at this stage it is still difficult to understand how different areas are related to each other. There is a need for studies that survey the disorder of PDD as an interrelated whole. This would appear to include a need for studies that assess communication, cognitive processing and theory of mind in a systematic and comprehensive way, in order to obtain overall profiles of strengths and weaknesses in these areas. Studies that take a broader perspective in assessing the relationships between these areas would appear to be useful.
4.10 **IMPLICATIONS FOR THE CURRENT STUDY**

The current study attempts to overcome some of the limitations of previous studies by examining the communication, cognitive processing and theory of mind aspects in HFPDD in an interrelated way. Furthermore, the current study aimed to carry out systematic and comprehensive assessments in the areas of communication, cognitive processing and theory of mind, in order to obtain a better understanding of the overall profile of strengths and weakness in these areas in children with HFPDD. Looking at the relationship between these areas would appear to provide a better understanding of the underlying difficulties in HFPDD. Furthermore, this study focuses on children on the very high end of the PDD spectrum and young children - between 5.0 and 7.11 years, the youngest age that many of these variables (particularly the cognitive processing variables) are felt to be able to be reliably assessed - in order to assess PDD in its more pure form. It is felt that carrying out research in this way should not only assist in providing overall profiles in the areas of communication, cognitive processing and theory of mind and the relationship between these in this population, but should also provide valuable insights into language, cognitive processing and social cognitive development and functioning in general. The following chapter focuses on the methodological aspects of the study.