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Examining the relationship between social cognition and humour in young children

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Abstract

Social cognition refers to understanding one's own and others' mental states and to perceive interpersonal knowledge between the self and the other. Humour refers to anything people perceive/produce with cognitive effort and consequently elicit smiling/laughter in the enjoyment of it. The purpose of this thesis is to examine whether social cognition and humour could be linked in young children when these constructs simultaneously emerge together from infancy through pre-school years using three comprehensive research designs. I first investigated longitudinal associations between social cognition and humour using parental surveys with a 6-month-interval in children from 1 to 47 months (Chapter 2). There was a positive relationship between social cognition and humour controlling for age at baseline, and humour at time 1 predicted social cognition at time 2 whereas social cognition at time 1 did not predict humour at time 2. Second, I investigated whether this relationship holds in a laboratory setting using 11 social cognition tasks and a humour appreciation/production test in children from 3 to 47 months. Parents also completed the Early Social Cognition Inventory and the Early Humour Survey out (Chapter 3). There was no relationship between social cognition and humour in children's laboratory performances, but a positive relationship occurred in parental surveys. Finally, I investigated whether there is a causal relationship between social cognition and humour in 3-year-olds using a social cognition training study (Chapter 4). While the experimental group received a social cognition training based on the understanding of emotions and false beliefs, the control group received a Piagetian conservation training. However, social cognition training improved neither children's humour skills nor their socio-cognitive skills. In sum, this thesis provides partial evidence for the relationship between social cognition and humour, and it suggests that it may occur in naturalistic environments with parental engagement rather than psychology laboratories.

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Declaration

I declare that this work was conducted by myself under the supervision of Dr Elena Hoicka and has not submitted to any other professional degree. Some of the studies in this thesis presented in different conferences listed below.

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Chapter One

The Development of Social Cognition and Humour

This chapter presents a review of the current literature on the development of social cognition and humour in early childhood. The introduction begins with how social cognition develops from birth to the school-aged period, followed by conventional and recent theories of social cognition. Then, it moves onto how humour develops from birth to the school-aged period, followed by conventional and recent humour theories and their relations to various humour skills. Finally, we consider how social cognition and humour could be related and identify outstanding questions which we will address with empirical studies.

1.1 Social cognition

Social cognition is a broad area that examines the relationship between thoughts and social behaviours and was introduced by Susan Fiske and Shelley Taylor in 1984 (Ric, 2015). Social cognition focuses on three mechanisms of human thinking: social behaviour, its underlying cognitive processes and representation of the mind (Ric, 2015). The final mechanism of social cognition, representation of one's own and others' mental states, is called Theory of Mind (ToM) (Premack & Woodruff, 1978), which was preferred as a term in some relevant studies to the present research, e.g. Bosacki (2013). Social cognition has been investigated by several subfields of psychology, such as social psychology, developmental psychology, or neuroscience (Decety & Sommerville, 2003), but this thesis will address the issue from the perspective of developmental psychology.

1.2 The development of social cognition from infancy through early childhood

The main focus of my thesis involves how social cognition and humour may be linked from infancy through the preschool period. Therefore, I will introduce how the

first construct, social cognition, develops from birth through preschool years with previous empirical findings in this section. Social cognition covers numerous topics related to humans, such as joint attention, imitation, intentions, desires, emotions, knowledge, beliefs and false beliefs (Grossmann & Johnson, 2007), which I have been measuring in my empirical studies. It is important to acquire these skills for making sense of the social world, developing strong communicative skills with language, making friends, and understanding others' feelings with empathy (Grossmann & Johnson, 2007).

1.2.1 Joint engagement

One key question is what newborns realise and perceive in terms of social cognition. First, they can recognise faces and eye movements. Newborns recognised their mother's face rather than a stranger's based on visual cues, controlled for olfactory information when they were 2-3 days old (Bushnell, Sai & Mullin, 1989). Researchers have been interested in eye contact and eye gaze studies because these studies could give evidence of communication and attention. There are various types of studies based on eye gaze processing. For example, 105 neonates, 36,5 hours old on average, preferred looking longer at human faces with eyes open than with eyes closed (Batki, Baron-Cohen, Wheelwright, Connellan & Ahluwalia, 2000). Within five days, newborns preferred looking at direct gaze more than averted gaze (Farroni, Csibra, Simion & Johnson, 2002), which can be a salient signal of good communication. Beyond this, eye gaze direction facilitated face recognition among 4-month-olds (Farroni, Massaccesi, Menon & Johnson, 2007). After the first months of coming into the world, infants' eyes become their tools of social interaction. Infants could begin to understand others by looking; thus, gaze alternation could be a precursor of joint attention (Carpenter, Nagell & Tomasello, 1998).

1.2.2 Joint attention

Humans are social species and are likely to interact with their social environment, which is a bidirectional process. Joint attention has been investigated for more than 40 years and there is variability in its definition. A recent paper has attempted to bring similar definitions together: Siposova and Carpenter (2019) defined joint attention as "one attends to what the other is attending to" (p. 261) which is called monitoring attention; "not only two individuals attend to the same thing, but they attend to each other's attention to the thing" (p. 262) which is called common attention; "two individuals simultaneously attend to the same thing, such that both of them directly experience each other attending to both to that thing" (p. 263) which is called mutual attention; and "an interaction that meets the criteria for mutual attention between two individuals" (p. 263) which is called shared attention. Therefore, it refers to the capability of infants to use their attention with others for specific purposes.

The most considerable rise in joint attention occurred between 9 and 12 months in a longitudinal study (Carpenter et al., 1998). Interactions with parents, explicitly tracking their parents' eye movements at an early age, helps their language development (Carpenter et al., 1998). Also, in another longitudinal study with 6 to 24-month-olds, infants' responding to joint attention skills were positively correlated with later language acquisition, especially at 12 months (Morales et al., 2000).

Pointing can also be used to share attention or interest as a tool by both infants and parents. If parents showed attention and interest in an event, 12-month-olds pointed more declaratively, however, if parents ignored the event or their babies, infants were dissatisfied (infants repeated pointing until their aim met) (Liszkowzki, Carpenter, Henning, Striano & Tomasello, 2004). Even when experimenters attended to an incorrect referent to that which was pointed to by 12-month-olds, but with extreme interest, infants pointed to the correct referent more to share attention and knowledge with experimenters (Liszkowski, Carpenter & Tomasello, 2007). Beyond this, there is evidence that 12-and

18-month-olds provide information to others by pointing (Liszkowski, Carpenter, Striano & Tomasello, 2006; Liszkowski, Carpenter & Tomasello, 2008).

The role of imperative pointing (simple and automatic expectations) and declarative pointing (comprehension of the other's mind) among infants between 8 and 14 months was investigated, and researchers found that declarative pointing was the next step after the imperative one (Camaioni, Perucchini, Bellagamba & Colonnesi, 2004). Camaioni et al. also found that declarative pointing was associated with the comprehension of the other's mind. Children who generated declarative pointing progressively from 12 months of age displayed a good understanding of others' intentions. Fourteen-month-olds understood intentions when someone pointed or stared at a hidden toy (Behne, Carpenter & Tomasello, 2005). Infants do understand an agent's purpose and can direct their attention to a specific object (Liszkowski et al., 2006). Other studies with the same age group have demonstrated that infants were successful in comprehending what novel for other people, based on people's attention and emotional expressions towards the new objects (Tomasello & Haberl, 2003) and previously experienced ones were (Moll & Tomasello, 2007).

1.2.3 Imitation

The first study of infant imitation found that 18 new-borns, who were between 12 and 21 days old, imitated lip protrusion, mouth opening, tongue protrusion and sequential-finger-movement (Meltzoff & Moore, 1977). Meltzoff and Moore (1983;1989) proceeded to investigate infant imitation in much younger age group (up to 71 hours) with larger sample size (N = 40) and found that new-borns imitated mouth opening, tongue protrusion, and head movements. Further study revealed that infants, who were between 6 weeks and 3 months, imitated a stranger's action as well as their parents (Meltzoff & Moore, 1992). Meltzoff (2013) created the 'like me' hypothesis with

his imitation studies and claimed that social cognition is based on the equivalence between self and other. The most appealing evidence for this hypothesis is mirror neuron studies (Gallese, 2003). Brain imaging studies found that there was no difference in mirror neurons fire in animal studies when the subjects carried out intentional actions, or they were just observers of these intentional actions were performed by others (Gallese, 2003). Therefore, imitation is thought of as an antecedent of social cognition, which enables to understand self and other with observations and experiences (Meltzoff & Decety, 2003).

However, imitation and mirror neuron studies have been criticised because of limited mutual evidence (Suddendorf, Oostenbroek, Nielsen & Slaughter, 2013). For example, mirror neuron studies have focused on intentional actions (e.g. object grasping) in animals whereas imitation studies have focused on facial expressions in infants (e.g. tongue protrusion). However, it is doubtful that facial expressions should be considered as intentional actions. Imitation of intentional actions consists of two components: a movement (motor part) and an action effect (the result of a movement) (Elsner, 2007). Considering these components, object grasping is made to achieve a goal (e.g. to lift it), but the imitation of facial expressions lacks this distinction. When infants produce tongue protrusion after observing a model, we cannot claim that they produce the movement or the action effect because both are the same. The lack of this distinction may be questioned whether infants imitate facial expressions with or without any understanding. Therefore, the neonatal imitation of facial expressions has not seen as intentional actions (Suddendorf et al., 2013). Also, the brain areas activated in mirror neuron and neonatal imitation studies are different: neocortex and subcortex, respectively (Suddendorf et al., 2013). Therefore, mirror neuron studies may not be evidence that neonatal imitation is an antecedent of social cognition. Suddendorf et al. have emphasised the importance of comprehensive longitudinal studies in infant imitation to enlighten these issues. Oostenbroek et al. (2016) showed various gestures that were used in the previous studies

such as the face, hand or vocal gestures to 106 infants while they were 1, 3, 6 and 9 weeks old respectively. The infants did not produce target copies, while gestures were being exhibited. There was no difference between matching models and control models in any gestures. Although tongue protrusion was the most copied gesture and has become frequently used indicator of imitation among infants so far, only half of the infants copied it in this study. Oostenbroek et al. suggested that if infants copied actions while they were being displayed, the outcome would be accepted as an imitation. While infants who were between 5 and 8 weeks were able to imitate tongue protrusion and mouth openings of an adult successfully, they failed to imitate the same gestures when produced by an object simulation (Legerstee, 1991), which can be an indicator that the imitation process is a part of social engagement.

Meltzoff et al. (2018) re-analysed Oostenbroek et al.'s raw data and found that infants significantly imitated tongue protrusion. Meltzoff et al. also showed 11 flaws in Oostenbroek et al.'s study and claimed that it was not a direct replication of previous imitation studies. Regarding this debate, it is worth to point out what imitation studies tell about social cognition. Currently, researchers agreed that neonatal imitation contributes to social cognition (Meltzoff et al., 2019). Imitative learning could be a precursor of understanding others' intentions later on. If infants imitate after observing what an adult does with an object, this means that the infants have learnt a new behaviour. Carpenter, Akhtar and Tomasello (1998) found that infants imitate arbitrary and intentional actions at 12 months.

1.2.4 Goal-directed actions and intentions

A further issue is how infants perceive and interpret others' goal-directed actions or intentions in a psychological way. Csibra (2003) defined two types of intentional actions: One of them includes intentions or goals (e.g., taking an umbrella to avoid the

rain), the other provides referent (e.g., pointing at something to get information or to make a request).

There have been several studies that consider different aspects of goal-directed actions. For instance, 9-month-olds and 13-month-olds discriminated against unwilling and unable actions (Behne, Carpenter, Call & Tomasello, 2005; Legrain, Destrebecqz & Gevers, 2012). Infants were impatient if the experimenter did not want to give a toy intentionally, but they were patient if the experimenter was not able to provide the toy. That is, infants have a good understanding of a real versus a fake intention beyond the action. Not only did infants as young as 14-month-olds distinguish between intentional and arbitrary actions, but they also imitated the intentional ones considerably more than the arbitrary ones (Carpenter et al., 1998; Kolling, Óturai & Knopf, 2014). When the action was followed by a vocal expression (e.g. 'There!') to show its' intentionality, the action was imitated nearly twice as often compared to an action followed by 'Woops!' vocally to show that the action was an accident. In a pilot study, 8-month-olds discriminated between complete and incomplete actions (pouring orange juice into a glass) by looking at incomplete actions longer. However, the same children did not differ between eating/drinking scenarios and pretending eating/drinking ones (Reid, Csibra, Belsky & Johnson, 2007). Pouring can be more exciting than drinking for 8-month-olds. However, 8-month-olds failed to understand unsuccessful attempts of intentional actions, whereas 10-month-olds were successful in comprehending the failure of intentional actions (Brandone & Wellman, 2009). This two months' process may be critical to the comprehension of failed goal-directed actions.

In the studies described above, humans were used as experimenters, and the reactions of the infants towards them were measured. What about the response of infants towards computer-based figures which had goal-directed actions? Twelve-month olds were successful in attributing a goal-directed action to computer stimuli without seeing if

it was completed, whereas 9-month-olds failed at the same task (Csibra, Bíró, Koós & Gergely, 2003). It suggests that the period from 9 to 12 months is important in infant cognitive development. Nine-month-olds differ in attribution to human action or computer stimuli. The reason for their keen understanding of human actions can be bidirectional social engagement that facilitates their comprehension of goal-directed actions. Also, understanding others' intentions can help children to use a novel tool (Esseily, Rat-Fischer, O'Regan & Fagard, 2013). It is not enough just observing people's actions with the novel tool; infants need to appreciate others' goals behind their performance with the device.

Towards the end of 2 years, children develop an understanding of others' aims and the reasons for the behaviours. From about 18-month-old, infants appreciate others' aims even when those aims are not achieved (Meltzoff, 1995). Meltzoff also found that 18-month-olds reacted differently to mechanical objects and people. Infants generated new reactions towards people, but not towards an inanimate object. It suggests that their comprehension of intentions and re-enactment are associated with psychological schemes rather than physical movements. Also, 3-year-olds can discriminate the causes of human actions such as intentions, beliefs, or reflexes (Schult & Wellman, 1997). Between the age of 2 and 3, toddlers are aware of what people know. For example, if their parents do not know the location of a specific object, infants request the objects more with their name/location or point to them (O'Neill, 1996). As well as the use of mental verbs (e.g., 'know'), infants show an understanding of what people know behaviourally.

1.2.5 Emotions

Studies mostly focus on facial gestures and vocal expressions to reveal emotion understanding during the first year of life. There is some evidence that infants are aware of other's emotions, and they are willing to share this emotional situation. In a peekaboo

game, facial expressions based on happiness, sadness, anger, fear, and surprise were shown to 4-month-olds (Montague & Walker-Andrews, 2001). Infants understand correct emotional expressions by looking longer at consistent situations. There was more neural activation in 8-month-olds when they exposed to happiness and fear in upright faces rather than in inverted ones, but not in 4-month-olds (Missina & Grossmann, 2015). In a longitudinal study, infants were examined at 4, 8, 12 and 16 months to elicit fear and anger reactivity intentionally (Braungart-Rieker & Hill-Soderlund, 2010). They used a stranger approach (coming closer to infants) to evoke fear, and gentle arm restraint (blocking infants from holding a toy) to evoke anger. Infants showed more fear and anger reactivity after 4 months of age. While fear reactivity fluctuated over development, anger reactivity showed a steady rise in growth. One reason for studying fear and anger more than other emotions in infancy can be that these emotions could be much stronger and sensitive. Additionally, infants could be smiley in general, and they express their desires by crying. Thus, studying anger and fear is appropriate. Infants are capable of distinguishing basic emotions on facial expressions, and this may help them understand others' different and multiple emotions to the same situations in later development.

Understanding emotions in toddlerhood are much complex than infancy because emotions are not solely based on identifying facial expressions. Children begin to understand that people may not feel the same way in the same situations. For instance, while some people may be annoyed by teasing, others may feel happy. This more profound understanding of emotions is essential for reasoning about others' behaviours. Denham (1986) found that even 2-year-olds have a good understanding of emotions, not just to typical situations (e.g., fear during a nightmare), but also to unexpected situations (e.g., happiness to break a toy). Two-year-olds understand the feelings of others regardless of their feelings about the same situations. Although 2-year-olds have a limited capacity for language, they can express their emotions and understand others' emotions

such as happiness, sadness, fear and anger well (Wellman, Harris, Banerjee & Sinclair, 1995). In Wellman et al.'s longitudinal study, infants emotional terms, including surprise, excitement, or loneliness, became more complex during the first three years. Understanding the complexity of emotions can contribute to an understanding of others' psychological states and can be seen as a socio-cognitive skill.

1.2.6 Desire

Desire has been described as a mental state based on what people want, which leads to an action (Bartsch & Wellman, 1989; Wellman & Woolley, 1990). For instance, if people want to buy a new book, they will visit a bookshop. The first empirical study related to others' desires with relatively younger children was by Repacholi and Gopnik (1997). They presented two different foods (broccoli vs crackers) to young children. When the experimenter tried crackers, she showed disgust; on the other hand, when she tried broccoli, she showed happiness. Young children were asked to give some food to the experimenter. Eighteen-month-olds successfully gave broccoli to the experimenter. It showed that 18-month-olds could reason about others' desires. Desire comprehension was closely related to emotion comprehension in Repacholi and Gopnik (1997). Two-year-olds correctly comprehended people's actions via their desires and emotions (Wellman & Woolley, 1990). For instance, if Sally wants an apple, she will stop looking for it when she gets it. After her action, she will feel happy or pleased.

It may be controversial to claim that 18-month-olds understand others' desires because other researchers have not found the same result (Ruffman, Aitken, Wilson, Puri & Taumoepeau, 2018). Repacholi and Gopnik (1997) did not include children who were unresponsive across the desire task in the statistical analysis; therefore, they found the majority of 18-month-olds gave the expected food and were seen successful in the task. However, if they would not exclude children who were unresponsive across the task, the

success rate in 18-month-olds would have decreased by the chance level. Ruffman et al. (2018) changed the task and used both food (chips vs broccoli) and object (colourful children's books vs scholarly books) conditions in a longitudinal design. Regarding that, there was no difference between the use of different items, Ruffman et al. (2018) pointed out that children develop an understanding of others' desires at 3 years of age.

Studies have investigated desires, emotions, and beliefs in psychological relations after 3 years of age (Wellman & Bartsch, 1988; Harris, Johnson, Hutton, Andrews & Cooke, 1989). Although desires and beliefs are internal mental states, they differ in their emotional outcomes. If you get something you want, you become happy in the end (desire). If you believe something happy will not happen, you become surprised when it comes true (belief). Four-year-olds have shown that they could distinguish beliefs and desires, and they can understand others' emotional reactions (Wellman & Bartsch, 1988; Harris et al., 1989). Belief-desire reasoning was also found after the age of 3 in a unique tribe, people of Baka in Cameroon (Avis & Harris, 1991). Namely, if an intention comes true, someone will be satisfied. Pre-schoolers do not understand why people are surprised when their belief does not come true by 4 years of age, but they understand why people are satisfied when their desire does come true after 3 years of age (Hadwin & Perner, 1991). It suggests that desire understanding precedes belief understanding in young children.

1.2.7 Use of mental state language

The purpose of this section is that I used mental states language frequently in the social cognition training study while explaining others' perspectives to children (Chapter 4) even if there are no direct measures of mental states language in any studies (Chapter 2, 3 & 4). For example, 'feel' has been used in emotional labelling and perspective-taking training while 'think' and 'know' have been used in false belief training such as the plaster

box test and the Maxi test. Considering the contribution of the use of mental state languages to the understanding of desire, emotions and false beliefs in young children from the above empirical findings, I have included this section to provide a theoretical background for the social cognition training study (Chapter 4).

Language acquisition is a milestone in early cognitive development (Bartsch & Wellman, 1995). The critical point of understanding others' minds is to use words to express internal states for the self and others. In a longitudinal study, children from 10 months through 28 months were observed and reported by their parents in terms of the use of mental state terms (Bretherton & Beeghly, 1982). Children used internal state words including see, look, watch, cold and hurt; physiological state words including hungry, thirsty, sleepy, tired, sick; emotional expressions including like, love; volition including want, need; and moral judgemental words including good, bad. Cognitive words followed later, but they were aware of using know, think, mean, guess and believe at the end of 3rd year (Shatz, Wellman, & Silber, 1983). Consistently, the use of mental verbs started at 2 years and reached a peak at 3 years in a longitudinal study (Furrow, Moore, Davidge & Chiasson, 1992). Know and think was the most common verbs that were used by children. These findings support the notion that children's desire language develop earlier than their belief language. Indeed, children understand others' desires before others' beliefs in individualist countries (Wellman & Liu, 2004). Therefore, the use of mental state language has been investigated to explore children's social cognition by researchers.

In the last two decades, there have been several studies that explore the comprehensive longitudinal associations between parental mental state language and children's understanding of desires, emotions, or false beliefs. The first finding of these studies is that parents use desire-related-words (e.g., want, need) with younger children (e.g., 15-month-olds) whereas they use belief-related words (e.g., think, know) when

children grow up (Taumoepeau & Ruffman, 2006; Ensor, Devine, Marks & Hughes, 2014; Razuri, Howard, Purvis & Cross, 2017), which could be a reason that children develop desire understanding before belief/knowledge understanding (Wellman & Liu, 2004).

The second finding was that parental desire-related talk (e.g., want, like) when children were at 15 months predicts not only children's desire understanding but also their emotion understanding when they became 24 months old (Taumoepeau & Ruffman, 2006; 2008). A recent study investigated the longitudinal associations between parental mental state language and emotional situation knowledge in 3-year-olds, including a comparison between European children and Chinese ones (Doan, Lee & Wang, 2019). Emotion situation knowledge was explained as understanding reasons for emotions in some situations in the study. The findings were impressive: The European parents referred to mental states more than the Chinese ones in book-reading sessions, which facilitates children's emotion understanding at 3-year-olds for European children who scored higher in emotion situation knowledge. However, Chinese children caught up with their European peers when they were 4,5 years in terms of emotion understanding.

The third finding is related to whether a parental mental state has an impact on children's false belief understanding over time. Parental mental state language was investigated during free play sessions in 2-year-olds (Symons, Fossum & Collins, 2006). Desire-related words as want, need predicted children's false belief understanding three years later; however, belief-related words did not. One reason could be that parents generally prefer using desire-related words more than belief-related ones when children are two years of age (Taumoepeau & Ruffman, 2006; Razuri et al., 2017). Investigating parent-child dyads in mental state language was necessary for children's third year to examine if parents will use more belief-related words that predict later false belief understanding. Children's false belief understanding and its relation to parental mental

state language were tested at 2, 3, 6 and 10 years of age (Ensor et al., 2014). Parental mental state language was a good predictor of children's false belief understanding from the preschool period to school-aged years. A similar pattern of these findings demonstrated when children had been tested with non-traditional false belief tasks by measuring anticipatory looking time in 2,5-year-olds (Roby & Scott, 2018). The use of parental mental state languages such as think or know was a good predictor of children's false belief understanding after a book-reading task at an even younger age. Book-reading could play an essential role in improving children's socio-cognitive skills rather than free play sessions or daily life events. Children's and parent's mental state language have a substantial impact on the development of social cognition.

1.2.8 Knowledge

Conceptual perspective-taking was investigated among 3-4-year-olds, and it was found that children had enough knowledge both themselves and others in hiding objects (Pillow, 1989; Pratt & Bryant, 1990). If someone sees an object where it is hidden, the children do answer correctly what it is and have an idea what others know and where it is as well. That is, just looking is a source of knowledge by itself for children. Likewise, 4-year-olds could determine the source of their knowledge, whether it was related to seeing, being told or feeling, whereas 3-year-olds did not (O'Neill & Gopnik, 1991). Older children were successfully able to identify how they knew. Even if some parts of information restrict this for other people (e.g., a small part of a picture), 4-year-olds could evaluate whether other people do identify what they see, whereas 3-year-olds did not (Taylor, 1988). These results require powerful mental verbs to be used by children. Four-year-olds discriminated between know and think or know and guess and had an idea that know includes certainty (Moore, Bryant & Furrow, 1989).

More recently, younger children have been investigated if they are aware of the difference between knowledge and ignorance (Harris, Ronfard & Bartz, 2017). This study claimed that 2-year-olds might realise that others might not know something they know. According to the analysis of children's spontaneous utterances at home, toddlers used 'know' more than it was thought. Harris et al. also asked children the names of two entities which one of them was much straightforward to depict. Indeed, if toddlers do not know what the picture depicts, they demonstrated their ignorance explicitly (e.g., saying I do not know) or implicitly (e.g., looking for help). However, there is a need to be cautious while interpreting these results because only six children's language has been tested. This work could be inspiring to conduct further studies with a larger sample size to examine the concept of knowledge and ignorance for toddlers.

1.2.9 False beliefs

Pre-schoolers have a unique ability that younger children do not have. They know the explicit representations of people's false beliefs. The standard procedure of understanding false belief tasks is that a person knows where an object is. If the object's location is changed while the person is away, children need to understand that the person will believe that the object is still in its original place. Children can express what they think verbally as well as pointing to the object's location (Wimmer & Perner, 1983). Researchers found that 4-year-olds are capable of understanding of explicit false beliefs, but 3-year-olds are not (Wimmer & Perner, 1983; Perner, Leekam & Wimmer, 1987). Also, false belief tasks were introduced to young children with a photograph version (Zaitchick, 1990). An object of a photo was taken in a particular place, and then the object's location was changed. The location of the object was asked to children in the photo. As usual, 3-year-olds did not attribute false beliefs, while 4-year-olds succeeded in this study. Elicited-response tasks, which are based on asking direct questions to

children about objects' locations or identities, are used in these examples. According to these tasks, it is clear that there is no understanding of false beliefs by the age of 4.

Some researchers have changed the nature of the tasks and have used spontaneous-response tasks, which are based on observing children's looking time and their anticipation of others' reactions (Baillargeon, Scott & He, 2010). These tasks have allowed researchers to investigate younger children in false-belief understanding. Onishi and Baillargeon (2005) tested 15-month-olds by the use of this new task, and they discovered that infants looked longer at an object's location that was changed in the absence of the experimenter. Besides, similar results were found by using the nonhuman agents (animal animations) among 13-month-olds (Surian, Caldi & Sperber, 2007). Two-year-olds also predicted an agent's actions based on a false belief when using an eye tracker instead of a verbal prompt (Southgate, Senju & Csibra, 2007). Infants under the age of 2 years had an understanding of others' false perception (e.g., presuming a skunk as a doll's hair when both are hidden) and false objects' identities (e.g., 1-piece penguin or 2-piece-penguin) based on spontaneous-response tasks as well as the knowledge of false objects' locations (Song & Baillargeon, 2008; Scott & Baillargeon, 2009).

There is another age group between infants who can succeed spontaneous-response false belief tasks and children who can achieve elicited-response false belief tasks after the age of 4: toddlers who are between 2 and 4 years and are in the process of language development. Even though this age group has the capability for responding to questions verbally, researchers have tried a different measurement based on both verbal and observational methods. While a story was told to toddlers, some pictures based on the story were shown to them about a changed object's location (Scott, He, Baillargeon & Cummins, 2012). Toddlers looked longer, the pictures that depicted an agent's false belief. They were considered successful at attributing an agent's false belief.

However, some researchers have been curious about how much these non-verbal false belief measurements are robust and have replicated above studies with 24-month-olds to investigate the reliability and convergent validity of the measures such as anticipatory looking, looking time and communicative interaction (Dörrenberg, Rakoczy & Liszkowski, 2018). Researchers also added a new measurement of implicit false belief understanding: pupil dilation. However, this study has had no robust evidence neither in reliability nor in the convergent validity of these non-verbal false belief measures, including pupil dilation. The only distinction is related to looking time and pupil dilation: Infants have shown some understanding of true or false beliefs by looking longer or an increase in pupil size if they have watched the incongruent action first rather than the congruent one, which means that there has been an order effect. This finding has provided limited evidence that infants understand implicit false beliefs; therefore, false belief understanding for younger children needs a careful interpretation.

1.2.10 Conclusion

Based on the review of social cognition literature the following conclusions can be taken: 1) children develop socio-cognitive skills from birth through preschool years (see Table 1.1). Table 1.1 depicts which age children are expected to acquire each socio-cognitive skills. For example, desire understanding develops after 3 years of age. The present research will consider ordering appropriate socio-cognitive tasks by age to measure social cognition. 2) It is important to measure each socio-cognitive skill, from joint attention to false belief, to obtain a comprehensive understanding of its development rather than relying on a few socio-cognitive skills. For example, examining only emotion or false belief understanding is not equal to examine social cognition, which would give us limited knowledge about children's social cognition. Social cognition should be examined with all components, which will be one of the focuses of the present research. 3) There are some controversial issues on infant imitation, desire understanding, emotion

understanding, and false belief understanding. Contradictory findings can be due to the nature of studies, the use of different measurements or researchers' interpretations. For example, anticipatory looking time in implicit false belief tasks has not found reliable (Dörrenberg et al., 2018). Therefore, there is a need for careful research design and interpretation of findings for social cognition. 4) The development of social cognition is an indicator of healthy development for children. All children with typical development are expected to have these socio-cognitive skills by 4 years of age regardless of gender, ethnicity, parental background or culture.

Table 1.1 The development of socio-cognitive skills from birth to 3 years

	<1 year	**1 year**	**2 years**	**3 years**
Joint engagement	√	√	√	√
Joint attention	√	√	√	√
Imitation	√	√	√	√
Intention	√	√	√	√
Emotion	√	√	√	√
Desire				√
Mental state language			√	√
Knowledge				√
False belief (non-traditional)		√	√	√

1.3 Social cognition theories

After the introduction of social cognition to the psychology field (Fiske & Taylor, 1984), researchers have developed theories to explain this construct based on empirical evidence. I will introduce different theories that attempt to explain how children understand mental states and make sense of the social world. Each theory

complements each other's shortcomings. The theories which will be presented in this section are theory theory, modularity theory, simulation theory, intentional relations theory and second-person theory.

1.3.1 Theory theory

This theory explains the understanding of mind as a naive implicit theory and emphasises the changes in developmental processes from 2 to 5 years of age (Gopnik & Wellman, 1994). It focuses on the importance of explanation, prediction, interpretation, and dynamism towards actions. According to this theory, children are good at reasoning about specific actions. Three- and four year- olds give logical explanations about others' beliefs and desires, just like adults in open-ended questions (Bartsch & Wellman, 1989). Children also make correct or incorrect predictions about desires (Repacholi & Gopnik, 1997) or emotions (Denham, 1986). This theory assumes that young children already have representations of these different concepts in their mind and that these representations could change in a transitional period from 2 to 5 years of age. For example, while 3-year-olds do not understand false beliefs, 4-year-olds show understanding of them (Wimmer & Perner, 1983; Perner et al., 1987). This shift between 3 and 4 years is an example of how children understand others' mind intuitionally (Meltzoff & Gopnik, 2013). To make it more concrete, Gopnik (1996) claimed that children's minds could be working similarly to scientists' minds. Scientists approach similar questions with a similar scientific way. If Newton had not found the law of gravity, another scientist would have found it, because scientists have the same intuitive theory. This third-person approach has been explained by observations of the others' behaviours. It misses the critical parts of action: one is the self, and the other one is the object that the subject interacts. Is the self only a passive observer? It also neglects the infancy.

1.3.2 Modularity theory

This theory addresses how pre-schoolers learn about other's false beliefs (Baron-Cohen, Leslie, Frith, 1985; Wimmer & Perner, 1983) without sensory cues such as seeing, hearing, touching, etc. Thus, architectural modules in mind were suggested to explain propositional attitudes (Scholl & Leslie, 1999). These modules have information limitations. That is, some information inside the module is not accessible from outside the module or vice versa. The modularity theory has three main assumptions (Fodor, 1985): First, a module is encapsulated informationally; therefore, people who desire to access such information encounter restraints. Second, a module consists of a cluster concept. Third, this theory emphasises the distinction between perception and cognition as opposed to the approaches that demand their continuity. Overall, this theory suggests that it is domain-specific, mandatory and fast (Scholl & Leslie, 1999). Leslie (1994) explains this theory with a link between pretending and metarepresentation of mind. When a subject pretends (attitude) that a banana (the object) is a phone (truth), this subject-centred behaviour requires representation in mind. The behaviour should be fast to perceive pretending in the interaction. Because pretending cannot be understood via physical senses, infants should reason about it. It suggests that pretending is domain-specific and modular.

Baron Cohen's theory (1995) supported Leslie's metarepresentation of mind theory because Baron-Cohen found that autistic children were not able to grasp others' mental states (Baron-Cohen et al., 1985); thus, metarepresentation could be modular and domain-specific in mind. Baron-Cohen categorised representations into two types that could be detected visually: Dyadic and triadic. Dyadic representations refer to simple, visual attentional skills and include the perception of the self. It could be bidirectional (between two subjects) or unidirectional (between a subject and an object). For instance, I see my brother, or I see the cat. However, triadic representations refer to embedded, visual attentional skills and include the perception of the self and the other. It requires

shared attention where two subjects should look at the same thing (e.g., I see my brother sees the cat). The self and the other both see the object. This triadic representation is crucial for joint attention which is the first step of social cognition, and it could be a precursor for Leslie's (1994) metarepresentation theory.

1.3.3 Simulation theory

Unlike the theory theory or the modularity theory, this theory emphasises the importance of the self more than the other initially, and the self as a subject simulates its own experience to understand others' behaviours (Gordon, 1986). Thus, the experience is the critical point for understanding others' mental states. People first make their predictions towards particular events, and then they can predict what others will do or how they will feel in the same situation. The crucial question here is to understand others "-What would I do in that person's situation?" Tomasello (1995) proposed that infants firstly understand the difference between ends and means, which leads to understanding 'intentionality.' When they experience their intentional behaviours, they simulate it to understand others' intentions. When they use their goal-directed actions, such as reaching a toy, they understand their intention after they achieve their goal. When they see others (e.g., parents) who try to reach a plate on the top shelf, they understand that their parents have an intention that is very similar to their intention. They make sense of adult's goal-directed behaviours similarly. It is a first-person approach emphasises the self more than the other and the object that the subject engages. However, the theory does not sufficiently explain children who do not have any experiences in a particular action. Does this mean that children will not predict anything until they have some experiences? It seems that while the modularity theorists point out the cognitive features of social cognition, the simulation theorists point out social features of social cognition.

1.3.4 Intentional relations theory

There are two basic requirements of social cognition (Barresi & Moore, 1996). The first requirement of understanding one's own and others' mind is 'intentional relations,' which has three elements: the subject, the object and the activity between them. All these three elements are found in a relational structure. The subject directs its activity to the object. Some relations can be simple (e.g., The elephant fears the mouse), that involves intentional-emotional relation between the subject and the object. Other relations can be more complicated involving second-order intentions (e.g., Mummy knows that daddy does not like broccoli). There are two types of information sources in this relational structure. One of them is first-person information, that means that the subject should be aware of its intentional relation to the object. The other one is third person information that means that the subject should perceive others' intentional relations to the object. The latter one is observable. That is, the subject infers from others' activities such as looking at facial expressions or others' emotions.

The second requirement of understanding self and others' mind is the equivalence of self and other as subjects (Moore, 1996). A problem occurs at this point because the understanding process of self and other cannot be equivalent technically. While first-person information requires hands-on experience between the subject and the object, third-person information is mainly visual between the subject, the object, and the subject's activity. However, infants are capable of matching their activity towards the object and others' activity while they imitate (Barresi & Moore, 1996). Imitative learning plays a vital role in making equivalent self's and others' minds. For instance, infants correctly imitate arbitrary and intentional actions after the performance of a second person who uses vocal cues such as 'Woops!' or 'There!' (Carpenter et al., 1998). Thus, self's and other's intentional relations could be combined through imitative learning.

1.3.5 Second-person theory

The most recent approach underlines being an active participant rather than a passive observer as a second person in interaction to understand their own and others' mental states (Gallagher, 2008). In a traditional false belief task, children observe what two toy figures do (Wimmer & Perner, 1983; Perner et al., 1987), but they never interact with these toy figures. Direct perception of social understanding could open the door to perceive others' mental states, but it cannot be adequate to assume that 4-year-olds understand others' false beliefs without being in social interaction. Evidence of initial direct perception can be found in imitation studies (Meltzoff & Moore, 1977; 1989; 1992). Newborns imitate facial expressions and gestures successfully. Interacting socially with others is the next step beyond direct perceptions to understand complex mental states. However, Gallagher (2008) neglected to explain how interaction can lead to a social understanding; thus, De Jaegher (2009) has remarked the implications of social interaction. De Jaegher explained this situation with a pointing example. Infants use pointing to direct attention to a specific object with others (Liszkowski et al., 2006). In case the other person does not grasp which object was being pointed to by an infant, they will develop a mutual understanding together to make sense of the situation.

Based on the review of social cognition theories the following conclusions may be made (see Table 1.2). 1) The first line of the features in the table shows how children understand one's and others' mental states. This process could be innate which suggests children are born with this ability or it may be environmental or relational which suggests children are shaped by exogenous factors such as interactions with other people or objects. 2) The second line of the features in the table shows which tools children use while understanding one's and others' mental states. Children may observe people's moves to reason what people do or may experience themselves first to perceive others' mental states. 3) The last line of the features in the table shows what is the most important component in the process of understanding one's and others' mental states. Is it the self,

the others, or both? In sum, these theories contribute to the development of social cognition in young children with different assumptions and they are open to evaluation with empirical studies.

Table 1.2 Features and examples of social cognition theories

Theories	**Theory theory**	**Modularity**	**Simulation**	**Intentional relations**	**Second-person**
Features	Inherited	Inherited	Environmental	Relational	Direct perception
	Observational	Domain-specific	Experience	Observational	Interaction
	Third-person approach (the others)	Third-person approach (the others)	First-person approach (the self)	Both first-and third-person approach	Active participation
Examples	Young children could reason others' behaviours because they have a representation of them in mind.	Autistic children do not understand false beliefs because the module that relates to this understanding is impaired.	Young children could understand others' intentions because they put themselves in others' shoes.	Young children could distinguish intentional and arbitrary actions through imitation.	Young children could develop a mutual understanding with others through pointing, although others do not get it initially.

1.4 Humour

Humour is defined as anything people perceive or produce with cognitive effort and consequently elicit an emotional response as laughter in the enjoyment of it (Martin, 2007). There are four components of humour according to this definition: funniness, cognitive processes, smiling/laughter and enjoyment. These components have been measured with multiple designs in children since the 1970s. The first attempts at measuring humour in infants began with examining the onset of smiling/laughter in observational laboratory settings (Sroufe & Wunsch, 1972) and observational home settings (Mireault et al., 2012). These studies are important to show when infants smile/laugh and what kind of stimuli they laugh at. Also, observational studies allow researchers to examine children's humour skills during social interactions. However, the stimuli are mainly based on sensorimotor skills such as visual, auditory or tactile, so that they are not exhaustive. Therefore, researchers have created absurd, incongruent or unexpected events to measure cognitive aspects of humour in infants (Mireault et al., 2018), toddlers (Hoicka & Wang, 2011) and preschoolers (Pien & Rothbart, 1974). These studies are also important to show how children appreciate humour but neglect how children produce humour. Therefore, humour production has been investigated from infancy through preschool years using parental reports (Reddy, 2001), observational home settings (Mireault et al., 2012), laboratory tasks (Hoicka & Akhtar, 2011), or both parental reports and observations (Mireault, Sparrow, Poutre, Perdue & Macke, 2012; Hoicka & Akhtar, 2012). It is valuable that humour studies have explored humour within different facets, appreciation and production, and by using multiple research designs so that they have an opportunity to complete each other's shortfalls. For example, parental reports may indicate parents' desired responses rather than children's actual humour skills or laboratory tasks may not generalise to everyday life, which leads to a lack of ecological validity. Comprehensive humour research may benefit from multiple research designs

which is one of the purposes in this thesis. The details of these humour studies will be explained in the next section within three subheadings: smiling/laughter, humour appreciation/comprehension, and humour production.

1.5 Humour development from infancy through early childhood

I will introduce how the second construct, humour, develops from birth through the preschool years with previous empirical findings in this section. Humour has a social, adaptive and emotional impact on child development (Semrud-Clikeman & Glass, 2010). Humour develops social interaction, improves relationships and builds up social bonds (Gest, Graham-Bermann, Hartup, 2001; Carson, Skarpness, Schultz & McGhee, 1986). Humour also aids to physical and mental health by relieving tension, dealing with stressful life events and being used therapy sessions (Dionigi & Canestrari, 2018; Yorukoglu, 1974). It is therefore important to know when and how humour develops, which factors contribute to it and which cognitive mechanisms are used.

1.5.1 Smiling/Laughter

Provine (2004) defined laughter as "-an instinctive, contagious, stereotyped, unconsciously controlled, social play vocalisation that is unusual in solitary settings-" (p. 215). From this perspective, it is an instinctive trait that is unlearned and occurs among all members of society. The onset of laughter is found among 4-month-olds and increases in each trimester in the first year of life (Sroufe & Wunsch, 1972). Researchers observed infants from 4 months through 12 months for when and what they laughed at. The youngest group (4-6 months) exhibited laughter at especially social items as "-gonna get you-" while children between 7 and 9 months of age found auditory and tactile elements, such as jiggling high overhead funny. The oldest group (10-12 months) exhibited laughter through visual and social elements, such as pull off a cover on the baby's face.

Recent studies have examined infant humour correlational rather than calculating the frequency of laughter. For example, exploring clowning, absurd nonverbal behaviour, starts at 3 months during the parental engagement (Mireault et al., 2012). Infants tend to smile at 7 months to their parents when the parents give humorous cues rather than when parents remain neutral (Mireault et al., 2015). Pien and Rothbart (1980) found that toddlers between 24 to 28 months of age smiled when shown an unexpected toy, a Jack-in-the-box. The critical point of this toy was that researchers presented a vocal cue for toddlers "-Let me show you this funny man. He makes a funny noise-" (Pien & Rothbart, 1980, p. 11). It can be assumed that toddlers' smiling was not because they were surprised; it was because they expected funniness with a vocal cue.

1.5.2 Humour appreciation/comprehension

Researchers have investigated which aspects of humorous events infants laugh at (Mireault et al., 2018). They found that 5-month-olds appreciated humour cognitively because they did laugh at humorous acts regardless of a cue; however, 4-month-olds did not. Thus, Mireault et al. concluded that 4-month-olds laughed socially rather than cognitively. It could be deduced that humour appreciation emerges at 5 months because infants do not need a parental cue to smile or laugh in response to absurd events at this age. Infants distinguish different acoustic sounds (humorous versus sweet) and look significantly longer when these sounds do not match with target actions (humorous vs sweetness) as young as 15 months (Hoicka & Wang, 2011). Humorous sounds refer to elicit positive emotions from incongruous actions (putting a shoe on one's hand) whereas sweet sounds indicate to evoke kind-hearted emotions from loving actions (placing a shoe on one's foot). It suggests that infants show an understanding of incongruous actions when they hear humorous cues. Similarly, infants expect caring actions when they hear sweet cues.

Humour appreciation may also help infants how to use a new tool from observation (Esseily, Rat-Fischer, Somogyi, O'Regan & Fagard, 2016). Eighteen-month-olds observed the experimenter while they demonstrated how to use a new tool. The experimenter made a joke before showing it in the experimental group, but not in the control group. Infants who laughed at the joke produced the target action more than the infants who did not laugh. Esseily et al. suggested that humour appreciation may play an essential role in observational learning. Furthermore, older children demonstrate a reasonable understanding of pure irony (the opposite of what they mean), and it develops by 6 years of age (Angeleri & Airenti, 2014).

Humour comprehension in older children was examined in the frame of incongruity and resolution in the 1960s and 1970s. Shultz (1974) found that children over 8 years were able to comprehend resolvable incongruities, but 6-year-old children were not. Shultz classified incongruity as pure and resolvable, respectively. However, Pien and Rothbart (1976) found that even 4- to 5-year-olds found the version of a cartoon that included both incongruity and resolution more humorous, so it was challenging to determine stages in terms of humour development. Yalisove (1978) classified riddles into three categories (reality riddles, ambiguous riddles, and absurdity riddles) to discover which ones might be understood at different ages. Yalisove found that these categories followed each other respectively with increasing age. Children need to develop cognitive abilities to grasp from concrete humour to abstract forms.

1.5.3 Humour production

Seven- and 12-month-olds can create humorous acts intentionally, such as head shaking, nodding, and wobbling according to parents' reports, and this is called infant clowning (Reddy, 2001). Not only do infants laugh or smile at humorous acts, but they also make people laugh. It seems that the perception of humour in infancy builds between

stimulus (vocal cues or tickling) and sensorimotor functions, which is a relationship of action and reaction. Two-year-olds were capable of generating humorous object-based acts, such as putting underwear on their head, rather than label-based humour (calling a cat a dog) or conceptual humour (a pig says moo) (Hoicka & Akhtar, 2012). When children are 3 years old, they can produce new jokes that were never shown by experimenters (Hoicka & Akhtar, 2011). Children are inclined to use riddle jokes, little moron jokes and knock-knock jokes between 5 and 11 years of age (Honig, 1988). Rőnkkő and Aerila (2018) have examined humour in the holistic learning process with a Finnish sample. The holistic learning process includes drawing collaboratively or individually, craft-making, storytelling and discussions, which is used in Finland's education system.

Humour production is also linked to language development. Horgan (1981) examined a typical child called Kelly, who was exposed to some language games and looked at how she developed humour. When Kelly was 16 months old and had acquired about 20 words, she violated semantic meanings and used a nightgown as a shoe accompanied by laughter. At 20 months, Kelly used some phonetic games such as "-Cow go moo, or Mommy go mamoo-" (Horgan, 1981, p. 219). Kelly made up some rhymes such as "-Seven ox. Close the box or Nine tens. Start agains-" at 27 months (Horgan, 1981, p. 219), and she started to create her riddles at 30 months. Kelly gained more complex cognitive abilities in developmental progress to make up various jokes. Another case study also showed that the development of verbal humour in Mervis's elder son, Ari (Johnson & Mervis, 1997). Ari's verbal humour production started just after his first symbolic play such as incongruent label jokes or puns and nonsense words, respectively. Johnson and Mervis's study is evidence that demonstrates the relationship between humour production and symbolic play. It is known that children enjoy generating rhymes with the help of advanced language skills (Horgan, 1981), and they find incongruous

appearances and nonsense words funny as a bike with square wheels (Honig, 1988). These attempts can be seen as trying to create unique humour.

1.6 Cognition and humour

Humour appreciation and comprehension must require advanced cognitive skills. One of the crucial points about humour comprehension is its level of difficulty (McGhee, 1979). If a joke or a cartoon is too simple or too complicated, people do not find it funny, because they do not need to push themselves to grasp the idea. The fundamental component of a joke is that it should be illogical in reality but logical in a fantasy world. For example, Superman can fly without wings is a reasonable argument for the fantasy world. If that a child claims they can fly that would be a rational argument for their fantasy world, but not in reality, which could elicit humour. The moderate level of difficulty and the condition of being sensible and illogical at the same time have to be integrated. As a result of this integration, pleasure is elicited. As evidence, a moderate level of difficulty revealed the enormous mirth response to cartoons regardless of gender differences among children in the third, fifth and seventh grades (Zigler, Levine & Gould, 1967).

Another important point about humour appreciation is that humour depends on cognitive ability. Older children comprehend humour better than younger children. Children from grades 2 to 4 showed a positive correlation between cognitive skills and humour appreciation, but surprisingly not for children from grades 4 to 5 (Zigler, Levine & Gould, 1966). Similarly, riddle comprehension increased among children from grades 1 through 5, so it was evident that cognitive maturity seemed like a factor in terms of humour comprehension (Whitt & Prentice, 1977).

Stimulus characteristics, cognitive skills, and cognitive maturity play an essential role in humour development. The most fundamental point of cognition is individual differences. While some children can understand a joke easily because of their age or

experiences, other children can have trouble comprehending it. It is consistent with developmental cognitive theories. To illustrate, even though Piaget did not study humour, he argued that children under 2 years of age use their sensory-motor skills to comprehend the environment (Evans, 1973). While children use reflexes in this stage, they begin to use symbolic functions to the events with developed language skills after 2 years of age (Evans, 1973). That is, young children may engage with the non-verbal jokes that mostly based on sensory-motor skills such as clowning (Reddy & Mireault, 2015).

1.7 Social influences and humour

Infants begin to develop smiling and laughter as a part of a sense of humour in the first year of life (Mireault et al., 2012; Sroufe & Wunsch, 1972). This section will explore what causes some children to have a sense of humour and the role of both genetic and learning processes. This section will also examine whether there is a connection between childhood and humour and whether children are affected by their social peers. The role of individual differences in terms of comprehension and appreciation of humour will be another important issue, and this section will include a discussion of environmental influences.

The first interaction with the social environment begins with the family. Thus, parental influences on humour development play a substantial part. Mireault et al. (2015) examined whether infants can realise absurdity themselves or whether they use some parental cues. In Mireault et al.'s study, 5-and-6-month-olds smiled and laughed at nonsensical behaviours regardless of parental cues; however, 7-month-olds smiled and laughed more when they had received parental cues. Also, parents provided some vocal cues to help children to grasp humorous intentions (Hoicka, Jutsum & Gattis, 2008; Hoicka & Wang, 2011; Hoicka & Gattis, 2012) and parents generated explicit cues to help children in distinguishing pretending and joking (Hoicka & Butcher, 2016). McGhee

(1980) investigated the relationship between behavioural humour, such as laughter, joking or clowning, and maternal behaviour longitudinally with pre-schoolers and school-aged children. McGhee found that children displayed some cues of humour if they had warm, approving and protective mothers during the first three years of life. However, after 3 years of age, children who were rejected by parents demonstrated more humour development. One explanation of this could be related to attachment theory in the first year of life. Infants who have developed a secure attachment with their parents showed trait humour, which was defined as a temperamental disposition at 6 months (Mireault, Sparrow et al., 2012). After 3 years of age, children may want to behave more independently of their parents. McGhee (1980) did not find any correlation between humour and maternal behaviour during the elementary-school years and noted that this result might be because school-age children could take humour models to fathers more than mothers.

The second question was whether children influence their peers in terms of humour. Children do show more frequent laughing when they are in groups (Addyman, Fogelquist, Levakova & Rees, 2018). Chapman, Smith, and Foot (1980) investigated the relationship between friendship and humour among school-age children. Chapman et al. had five conditions for watching comedy cartoons: alone, with an unreactive experimenter, with a reactive experimenter, with a same-sex peer and with both a same-sex peer and a reactive experimenter. For the first three conditions, Chapman et al. did not find any major differences in laughter or smiling, but the presence of same-age companion encouraged children to laugh or smile more.

Similarly, there is evidence that children can be affected by their peer's laughter while playing humorous recordings, and as a consequence, their mirth scores increased (Chapman & Wright, 1976). Also, children with a good sense of humour develop networking, are like more by their peers and have more friends (Gest et al., 2001). Social

companions can be an important detriment to prompt laughter and smiling and their peers more easily accept those humorous children. One thing to consider here is that humour and laughter are not the same things. While humour requires a cognitive process, the incongruity and resolution (Shultz, 1972) like a stimulus, laughter may be seen as a biological process and a reaction to this stimulus.

Finally, children display discrepancies because of individual differences, such as personality characteristics. Children are expected to respond verbally or behaviourally to a humorous event, to imitate some funny acts with entertainment, or to attempt to produce new jokes. In these cases, children should be socially responsive. Carson et al. (1986) examined the link between temperament and humour in pre-schoolers. High activity levels were closely related to verbal or behavioural humour initiatives in young children. Therefore, social unresponsiveness could make the process of humour appreciation and production difficult. For instance, personality traits, such as shyness, could inhibit joke-making in young children.

From the above discussion, it is clear that humour developed as a combination of individual traits and environmental factors. Both factors have an important role, and they affect each other such that the relationship between them is a bidirectional one.

1.8 Gender differences in humour

Studies on gender differences in humour appreciation and production have mainly focussed on two age groups since the 1970s: pre-schoolers and school-aged children. Zachopoulo, Trevlas, and Tsikriki (2004) conducted an observational study on teachers of Greek pre-schoolers. They found that boys showed more enjoyment during independent play. Also, boys were more inclined to tease and joke than were girls. Gender played an essential role in the appreciation of pictorial humour among pre-schoolers (Brown, 1993) but it did not play any role in the Greek sample (Loizou, 2006). McGhee

(1976) also investigated gender differences. McGhee found that there was no difference among pre-schoolers, but there was among school-aged children. School-age boys were more inclined to laugh, create jokes and demonstrate hostility in humour than were girls. Similarly, Yorukoglu (1974) found that boys tended to tell their favourite jokes twice as often as girls during therapy.

Researchers have discovered that school-aged children differ in humour types. Qualitative studies have found that while boys enjoy minor misfortunes more than girls, but girls prefer 'soft' jokes such as tickling, funny voices/images (Dowling, 2014; Neuβ, 2006). While boys use incongruence, actions, and imaginary characters to surprise people in their drawings, girls prefer typical objects or characters, like clowns, to cheer people up (Aerila, Laes & Laes, 2017). However, some studies have found no major differences between boys and girls at elementary school in terms of comprehension (Zigler et al., 1966; Zigler et al., 1967); and no significant gender differences among school-aged children in terms of appreciation of cartoons, riddles and verbal jokes (Shultz, 1972; Shultz, 1974; Shultz & Horibe, 1974). Pitri (2011) did not find any gender differences in children's humorous drawings.

Gender differences have not been investigated before 3 years of age, but some studies conducted with this age group have checked if gender has an impact on humour. Such studies did not find any differences between girls and boys between 16 months to 3 years in terms of humour appreciation or humour production (Hoicka & Butcher, 2016; Hoicka & Akhtar, 2012; Mireault et al., 2014; Hoicka & Gattis, 2012; 2008).

According to previous studies, the results based on gender differences in humour do not reach a consensus. Participants in the same developmental stages as pre-schoolers display different outcomes, and some studies on pre-schoolers have gender differences while others do not. Thus, developmental stages cannot be a factor to explain why the

studies have different findings. However, mixed results on gender may be because of various measurements used such as surveys, pictures, cartoons or riddles.

1.9 Conclusion

Based on the review of the humour literature the following conclusions may be made: 1) smiling/laughter are behavioural indicators of humour and emerge from 3 months (Mireault et al., 2012). In general, each smile/laugh does not necessarily occur due to humour, but each humorous event leads to smiling/laughter. Therefore, the present research will use smiling/laughter as indicators of humour appreciation/production in young children. 2) Humour has two dimensions appreciation and production which emerges from 5 months (Mireault et al., 2018) and 7 months (Reddy, 2001) respectively. Not only do young children understand humorous events with appropriate cues, but they also produce jokes deliberately to elicit smiling/laughter. The present research will measure both dimensions of humour. 3) Humour has multiple aspects such as cognitive, social and emotional, which needs to be considered in combination in the present research. 4) The role of gender in humour studies is mixed: while there are no differences by 3 years of age (Hoicka & Butcher, 2016; Mireault et al., 2014; Hoicka & Akhtar, 2012; Hoicka & Gattis, 2012; 2008), there are some differences for pre-schoolers and school-aged children (Aerila et al., 2017; Dowling, 2014; Neuβ, 2006; Zachopoula et al., 2004; Brown, 1993; McGhee, 1976; Yorukoglu, 1974). The present research will consider gender as an exploratory variable.

1.10 Humour theories

1.10.1 Relief theory/arousal safety

One theory of humour is called *relief theory* or *arousal safety*, which covers psychodynamic characteristics of humour and relates to the tension relief (McGhee, 1979). For a long time, many therapists used muscle extension-relaxation techniques to

get rid of stressful situations, which aimed to reduce tension and to discharge stress (McGhee, 1979). Likewise, laughter that is an outcome of humour might act to release stress due to the activation of the muscle system of the body (McGhee, 1979). Giles and Oxford (1970) proposed that laughter might be a component of the behavioural result in terms of releasing tension in anxious circumstances. Furthermore, because people seek to overcome stress, according to psychodynamic theories, approaching a problem with a sense of humour can be the right solution (McGhee, 1979). For example, Martin and Lefcourt (1983) showed that humour decreases stress among undergraduate students regardless of the type of humour measurements: self-report or behavioural. Martin and Lefcourt found that a sense of humour may be a powerful moderator between stressful daily events and mood. Students who produced humour in response to stressful situations experienced lower correlations between stress and bad temper. Szabo, Ainsworth and Danks (2005) used humour, new-age music and stationary cycling to reduce mood disturbance and state anxiety among healthy female adults and found that humour resulted in the most considerable decrease in negative mental situations. Additionally, undergraduates with high humour abilities approached exams with a positive and challenging attribution more than did those with low humour abilities (Kuiper & Martin, 1993). These studies suggest that humour may be a positive contribution to stressful life events.

1.10.2 Incongruity theory

Humour can be produced automatically as a reaction if there is something unexpected and inappropriate (McGhee, 1979). Deckers and Devine (1981) investigated whether mirth can be generated if there is an expectancy and how much humour can be produced among undergraduates. Two identical copies of the same book were used as stimuli, but one of them was filled with lead shot to make it heavier to create an unexpected situation. The participants were asked to rate all books according to their

covers and their desires; also, their facial expressions were recorded. They found that heavy books lead to more considerable mirth and humour. A recent study attempted to model incongruity in humour production among undergraduates by using the pairs of words (Hull, Tosun & Vaid, 2017). Words were presented to participants as intentionally humorous or incidentally humorous. Hull et al. found that humour was greater in contexts including contrasts and differences rather than ones related and similar as well as in an incidental way.

Shultz (1972) conducted two experiments based on a cognitive theory of humour, specifically incongruity and resolution in school-age children, and found that the first purpose of the children was to identify incongruity, then to resolve it in cartoons. Identification and resolution require cognitive abilities to grasp what incongruity is and why it is funny. This cognitive process has been supported by neuroimaging studies as well. For instance, humour had neural correlations between the incongruity and resolution process and nonsense cartoons (Samson, Hempelmann, Huber & Zysset, 2009). Also, the neural correlations of humour appreciation have been investigated in school-aged children: the temporal-occipital-parietal junction and mesolimbic system activated towards humorous video clips (Neely, Walter, Black & Reiss, 2012). The detection of incongruities occurred in the right hemisphere; the resolution of incongruities occurred in the left (Chan et al., 2013).

1.10.3 Superiority theory

This theory assumes that people tend to laugh at others' misfortunes, and they feel superior to them (Mulder & Nihjolt, 2002). It seems hostile to choose someone as a victim of a joke in this way. This situation has been even observed in infants (Loizou, 2005). Infants between 15 and 22 months violated expectations because they would like to feel superior to their carers intentionally, and they enjoyed it a lot. Their favourite joke was

that they used their mouths to clean the area around them instead of using a sponge while they were smiling to their carers. Joking relationships can either be friendly or hostile (Radcliffe-Brown, 1940). Radcliffe-Brown mentioned a joking relationship seen in Africa, Asia, Oceania, and North America, based on a funny relationship without offence between two people and widespread between relatives by marriage. For example, a man can make jokes to his wife's younger siblings, but not older ones, because he needs to show respect to older ones. Besides, humour serves as a social function to decrease social distance at working places as long as jokes are begun by a manager (Coser, 1960). That is, humour is shared among social groups.

1.10.4 The socio-cognitive theory of humour

Reddy (2001) claimed that conventional humour theories focus on the understanding of verbal humour while neglecting humorous non-verbal actions. Reddy highlighted that humour is a combination of social and emotional skills in engagement, and clowning is the best example of non-verbal humour that infants use, such as head shaking or wobbling. Reddy observed that infants use clowning intentionally to re-elicit laughter from others. When infants violate expectations, they also engage others emotionally. If others do not give appropriate reactions to humorous situations or do not show appropriate emotions, humour could not appear again. Therefore, it is difficult to distinguish the social and emotional aspects of humorous actions.

Leekam (1991) pointed out the intentionality of falsehood: while mistakes are unintended falsehoods, lies/jokes are intended ones. Infants are good at distinguishing between mistakes and jokes (Hoicka & Gattis, 2008), which shows they can make a distinction between intentionality and unintentionality. However, Leekam (1991) pointed out that distinguishing between lies and jokes could be complicated because both include intentionality. X wants Y to believe their lie to get some benefit in a lie condition, whereas

X wants Y to believe their joke to elicit smiling or laughter in a joke condition. Indeed, primary school-aged children distinguished jokes from lies (Sullivan, Winner & Hopfield, 1995). The only condition that allowed this ability to distinguish was that children should have had a representation of others' knowledge, not others' beliefs. Thus, understanding a joke requires the understanding of intentionality, while creating a joke requires second-order knowledge. Hoicka (2016) discussed the possible link between socio-cognitive skills and humour and used the term '*humourous intentions*,' which could be a gateway to understand others' mental states later on, because humour develops at an early age as doing falsehood deliberately (Hoicka & Gattis, 2008; Hoicka et al., 2008).

Based on the review of humour theories the following conclusions may be made: 1) humour theories have been built up according to the functions of humour such as physical and emotional well-being (relief theory), cognitive function (incongruity theory), social function (superiority theory) and a combination of these functions (socio-cognitive theory). 2) Relief theory is a basis for clinical or intervention studies to provide well-being using humour, which will not be explored further in the present research. 3) Incongruity theory is a basis for measuring humour appreciation using incongruous, but funny stimulus which the present research explores further to examine young children's humour appreciation and production. 4) Superiority theory is a basis for social bonds as friendships. The present research will not explore this theory directly, but the jokes will be presented to children through social interactions. 5) The socio-cognitive theory of humour emphasises the importance of socio-cognitive skills in humour such as emotions, intentions or knowledge, which will be a focal point for the present research.

1.11 The relationship between social cognition and humour

The definitions and components of social cognition and humour indicate that they are distinct domains but develop in parallel from infancy. Indeed, developmental theorists

point out some socio-cognitive skills such as intentions (Hoicka, 2016; Leekam, 1991), emotions (Reddy, 2001) and knowledge (Leekam, 1991) may play an important role in appreciating and producing humour. Examining the relationship between social cognition and humour may help identify factors which contribute to social cognition or humour, reveal whether social cognition is a prerequisite for humour or vice versa, and verify the assumptions of the socio-cognitive theory of humour (Hoicka, 2016; Reddy, 2001; Leekam, 1991). There have been few attempts to examine the relationship between social cognition and humour in young, healthy children.

Robison (2000) examined the relationship between mental states and humour in 25 pre-schoolers (4-and-5-year-olds) and 33 primary school-aged children (7-and-8-year-olds). Four scenarios which included different mental states of two protagonists were presented to children and children were asked which protagonist they would choose to tell a joke to. In the unexpectedness scenario, one protagonist knows the joke whereas the other does not know the joke. Therefore, children were expected to choose the one who does not know the joke. In the comprehension scenario, one protagonist knows what dinosaurs are in the joke whereas the other does not know what dinosaurs are in the joke. Therefore, telling a joke related to dinosaurs to someone who does not know them will not make sense. These two scenarios measure the relationship between others' knowledge and humour. In the vision scenario, one protagonist looks at the window and the other one does not look at the window. Children were asked which protagonist they would choose to tell a joke related to windows. In the desire scenario, one protagonist wants candy whereas the other does not want candy. Similarly, children were asked to which protagonist they would choose to tell a joke related to candies. Robison found that there was a positive relationship between others' knowledge (someone who does not know the joke) and humour production in 5-7-and-8-year-olds, but not in 4-year-olds. There was a positive relationship between others' knowledge of the concepts (e.g. a dinosaur) in a

joke and humour production in only 8-year-olds. There was no relationship between vision or desire understanding and humour production at any age groups. Robison suggested that understanding of others' knowledge may be essential for humour production in pre-schoolers, but the understanding of others' desires may not be important. This study suggests that some socio-cognitive skills as knowledge may underpin humour understanding in young children, but some others may not.

Bosacki (2013) also aimed to discover longitudinal associations with 2-year intervals between ToM, and humour in self and humour in others among 28 school-aged children who were 8 years old. The second aim of this study was to capture individual differences at both time points. Bosacki used open-ended narratives to measure whether children identify emotions of protagonists, causes of their emotions, and predictions and thoughts on their expected behaviours, across ambiguous situations. Children's humour skills have been measured in two dimensions. One dimension was how much they attribute themselves as a funny person (humour in self). The other dimension, humour in others, has been measured using the same open-ended narratives that were used in measuring ToM. Children's views on how much they found protagonists funny were coded. Bosacki found that there was a positive relationship between ToM and humour in others, but not humour in self at baseline. Children's ToM understanding at time 1 was positively correlated with understanding others' humour at time 2. In terms of individual differences, there was a significant increase from time 1 to time 2 in ToM understanding, and humour in others, but not humour in self. There were no gender differences in humour in self or in others across both time points. This study suggests that children who were good at understanding others' emotions, thoughts or perceptions tended to understand others' humorous intentions more.

Training studies are another approach to examine the nature of the relationships between two variables and may contribute to our knowledge about the causal relationship

between social cognition and humour. To date, there are some attempts to apply social cognition training to improve humour skills as well as socio-cognitive skills among typically developing children (Lecce, Bianco, Demicheli & Cavallani, 2014) or atypically developing children (Gevers, Clifford, Mager & Boer, 2006; Begeer et al., 2011), but there is no study to apply humour training to socio-cognitive skills. Lecce et al. (2014) trained typically developing pre-schoolers (4-and-5-year-olds) on first-order false belief to examine whether their advanced ToM skills such as second-order false beliefs and belief-desire reasoning and their metamemory improved. Advanced ToM skills also included understanding jokes. Both the experimental and control group listened to the same stories, but the experimental one was trained on the understanding of false beliefs whereas the control one was trained on physical states of the protagonists in the stories. Pre-schoolers in the experimental group demonstrated improved humour understanding after training in comparison with their peers in the control group. Similarly, Gevers et al. (2006) applied a ToM based social cognition training to school-aged children from 8 to 11 years of age with a Pervasive Developmental Disorder (PDD) over 5 months to improve socio-cognitive skills such as perception/imitation, emotion, pretence, false belief understanding as well as humour. Children showed improved humour understanding, however, there was no control group and the details of the training were not clear. It could be questioned whether atypically developing children benefit from such training. Therefore, Begeer et al. (2011) targeted the same ToM training and similar participants to examine whether children with Autism Spectrum Disorder (ASD) benefit from this training in comparison with a waitlist control group. The experimental group was trained on perception/imitation, distinguishing reality and fantasy, intentions, emotions, deception and humour by therapists over 16 weeks whereas the control group did not receive any training. Begeer et al. did not find the same humour improvement among children with ASD after ToM training. It is obvious that children with ASD do

not benefit from social cognition training (Gevers et al., 2006; Begeer et al., 2011), however, their healthy counterparts do (Lecce et al., 2014). Therefore, social cognition training could be a promising approach to discover whether social cognition and humour are causally related, especially in typically developing children. It is worth noting that there is no empirical attempt to improve socio-cognitive skills with humour training in either a typically developing or an atypically developing sample.

The evidence so far demonstrates that some socio-cognitive skills such as understanding of others' knowledge (Robison, 2000) and others' emotions (Bosacki, 2013) are positively related to humour whereas the understanding of others' desires is not (Robison, 2000). There is also a causal relationship between social cognition and humour in typically developing pre-schoolers (Lecce et al., 2014). There is a developmental continuity in terms of this relationship from the preschool period (Robison, 2000) through school years (Bosacki, 2013) although understanding of others' desires does not contribute to it. It is surprising that whether such a relationship exists in younger children has never received attention. There could be some practical reasons for ignoring younger age groups. For example, reaching younger children may be challenging and consequently, it may not be feasible to obtain statistically robust findings due to small sample sizes. Contacting nurseries/schools may be much easier to collect data. Researchers may also deal with some methodological challenges in creating developmentally appropriate tasks for young children's limited attention.

Beyond practical reasons, the current literature on the relationship between social cognition and humour has also some limitations. The first limitation is that the current literature has degraded social cognition to just a few socio-cognitive skills such as desire understanding, emotion understanding or knowledge (Robison, 2000; Bosacki, 2013). The relationship between humour and other socio-cognitive skills such as joint attention, imitation, intentions or false beliefs have been neglected. Joint attentional skills such as

eye contact, pointing or sharing are a necessity for humour development (Mireault, Sparrow et al., 2012). Infants need to be involved in an attentional process with others to appreciate funny events, therefore, joint attention may contribute to appreciating the humour in infants. There could be a close relationship between joint attentional skills and humour appreciation in infants. As presented in the social cognition section, socio-cognitive skills diversify as children grow. Imitation serves as a social learning tool for toddlers (Call, Carpenter & Tomasello, 2005), and toddlers benefit from imitation in humour production (Hoicka & Akhtar, 2012). Imitative learning may contribute to humour production or humour may provide opportunities to practise imitation. For example, young children enjoy repeating clowning and teasing to elicit laughter (Reddy & Mireault, 2015). There could be a reciprocal relationship between imitation and humour.

The socio-cognitive theory of humour (Hoicka, 2016; Leekam; Reddy, 2001) has been built on the idea that humour includes intentions and emotions. Researchers showed that young children distinguish mistakes (unintentional falsehood) and jokes (intentional falsehood) from 19 months and understand jokes based on intentional cues from 25 months (Hoicka & Gattis, 2008). However, the relationship between intention understanding and humour appreciation/production has never been investigated. Therefore, there is a need to examine this relationship from birth through preschool years with all socio-cognitive measurements rather than focusing on a few skills. This research will acknowledge whether social cognition or humour may be prerequisite for each other.

The second limitation is that the current literature has small sample sizes (Robison, 2000; Bosacki, 2013), which may lead to statistical error. Robison (2000) used a total of 58 children for four different age groups which are adequate to detect a large effect with a power of 0.80 for both correlation and regression analyses. Bosacki (2013) tested 28 children, which is adequate to detect a large effect with a power of 0.80 for

correlation analysis but is not adequate to explore predictive relationships between social cognition and humour. This means that Bosacki's findings may disappear when adding control variables. The present research will aim to exceed the previously reported sample sizes to detect at least a medium effect, which will reduce the possibility of statistical error.

Based on the review of the possible relationship between social cognition and humour, the following conclusions may be made: 1) There could be a reciprocal relationship between social cognition and humour in early development, but there has been no empirical evidence to show this relationship. It is important to investigate predictive relations in the younger age group. 2) Previous studies (Robison, 2000; Bosacki, 2016) used a single social cognition task with different scenarios. It is wise to use multiple socio-cognitive tasks considering social cognition is not just desire or emotion understanding. 3) Social cognition training may be useful to improve children's humour skills in pre-schoolers.

The studies in the present research were designed to answer these issues. Chapter 2 presents an examination of longitudinal associations between social cognition and humour in children from 1 month to 47 months using parental surveys. To the best of my knowledge, this is the first study to examine this relationship from 1 month using a parent-report measure. This study investigated predictive relations between these two constructs from early ages, which benefited from direct observations of parents in naturalistic environments. Indeed, parental surveys are reliable to measure social cognition (Tahiroglu et al., 2014) and humour (Mireault, Sparrow et al., 2012; Reddy, Williams & Vaughan, 2002). Although parental surveys are cost-effective and able to reach larger samples, they have some limitations such as the response-bias effect (Miller, 1986). The accuracy of parents might be doubtful while they evaluate children's cognitive development (Miller, 1986).

The study presented in Chapter 3 investigated the same relationship between social cognition and humour in children from 3 months to 47 months using a large battery of social cognition tasks and several jokes that children appreciate and produce from 1 month. To the best of my knowledge, this study is also the first attempt to examine this relationship using multiple tasks in a laboratory setting. This study was designed to replicate the findings of the study in Chapter 2 and show whether there is an overlap between parental observations and children's actual performances. It is important to reach ecological validity considering the limitations of parental surveys (Miller, 1986).

The study presented in Chapter 4 was designed to gain more understanding of the nature of the relationship between social cognition and humour. It investigated whether there is a causal relationship between social cognition and humour in 3-year-olds using a social cognition training paradigm. The rationale for this study was based on the findings of the longitudinal study in Chapter 2: a positive relationship between social cognition and humour emerged at baseline. Social cognition training was preferred due to the existence of a successful attempt to improve humour skills with similar training in 4-and-5-year-olds (Lecce et al., 2014). However, this study was designed before we explored the findings of predictive relationships at time 2, reported in Chapter 2. Humour training may also be appropriate to improve socio-cognitive skills in pre-schoolers.

In sum, the purpose of the present research was to discover whether there is a relationship between social cognition and humour in early development. The causal relationship between these constructs was also investigated. Gender was explored as a moderator in this relationship.

Chapter Two

Study 1: Longitudinal associations between social cognition and humour from 1 to 47 months: A survey study

Study 1 aims to examine longitudinal associations between social cognition and humour in young children. Six-hundred-and-eleven parents participated in the study at time 1, and 230 of them repeated the study 6 months apart. Parents filled the Early Social Cognition Inventory (ESCI) and the Early Humour Survey (EHS) out. There was a significant positive relationship between these constructs at time 1. Humour at time 1 predicted social cognition at time 2; however, social cognition at time 1 did not predict humour at time 2. It suggests that humour promotes children's performance in social cognition.

2.1 Introduction

Social cognition is defined as "the perception of others, the perception of the self, and interpersonal knowledge" (Beer & Ochsner, 2006, p. 99). Humour is defined as anything people find amusing with the help of cognitive processes, and which reveals an emotional response such as smiling or laughter (Martin, 2007). Humour is an intended falsehood and needs to be resolved with cognitive skills to distinguish it from other forms of intended falsehoods such as lies, hoaxes (Hoicka, 2016; Leekam, 1991), thus, intentionality is an important component of humour. Because humour provokes positive feelings, it is also an emotional experience (Mireault & Reddy, 2016). Therefore, humour is often considered to be an aspect of social cognition because of intentionality (Hoicka, 2016; Hoicka & Akhtar, 2011; Hoicka & Butcher, 2016; Hoicka & Gattis, 2008, 2012; Leekam, 1991; Loizou, 2005) and emotionality (Mireault et al., 2018, 2015, 2014; Mireault, Sparrow et al., 2012). However, there is little research examining the relationship between social cognition and humour in the early years, when both of these

skills first emerge (Carpenter et al., 1998; Hoicka & Akhtar, 2012; Mireault et al., 2015, 2014; Mireault, Poutre, et al., 2012). The goal of this study is to determine whether (1) social cognition and humour are linked from 1-47 months; and (2) humour predicts socio-cognitive development 6 months later, vice versa, or both. This will tell us more about how these two skills develop together early on.

Humour is implicitly often theoretically assumed to be part of social cognition, as shown through social cognition scales and tests. The Theory of Mind Scale for children with PDD developed by Muris et al., (1999) includes the understanding of humour as a subscale. Happé's, (1994) advanced test of Theory of Mind, focusing on children with ASD or intellectual disabilities, also includes jokes and ironic stories to assessing mental state understanding. The Children's Social Understanding Scale (CSUS) (Tahiroglu et al., 2014) aims to measure the social cognition skills of pre-schoolers with six subscales. The intention subscale of the CSUS includes looking at the difference between being serious and joking and understanding of teasing. The inclusion of humour items in social cognition scales (Happé, 1994; Muris et al., 1999; Tahiroglu et al., 2014) suggests that humour is a component of social cognition. Indeed, the humour items are reliable within the overall social cognition scales. These studies point to a probable link between social cognition and humour development.

It is well-known that individuals with ASD have a lack of understanding of both social cognition (Baron-Cohen et al., 1985) and humour (Lyons & Fitzgerald, 2004). It is thought that the mechanism which leads to a social cognition deficit among these individuals may play an essential role in the understanding of humour (Baron-Cohen et al., 1985). Samson, Huber, and Ruch (2013) examined the traits and humour styles of adults with ASD. Samson et al., (2013) found low scores on cheerfulness, affiliative humour style, and self-enhancing humour style in adults with ASD. Adolescents with ASD were tested on humour comprehension and appreciation (Wu et al., 2014).

Compared to typically developing peers, adolescents with ASD did not understand nonsense jokes and incongruity-resolution jokes as well. Furthermore, pre-schoolers with ASD or Down's syndrome were observed in their daily lives in terms of laughter as a result of humorous interactions (Reddy et al., 2002). Children with ASD showed less laughter to humorous interactions such as funny faces, clowning, or teasing compared to children with Down's syndrome, suggesting their humour was less social in nature. There is mixed evidence as to whether social cognition training may improve humour skills in people with ASD, and hence mixed evidence of the link between social cognition and humour. For example, a Theory-of-Mind-based social cognition program led to a significant increase in humour understanding among school-aged children with ASD (Gevers et al., 2006). The most crucial drawback of this study was the absence of a control condition. Thus, the same procedure was applied to school-aged children with ASD with a passive control condition (Begeer et al., 2011). However, there was no training effect on humour and irony understanding in either the experimental or control condition. Similarly, social cognitive training for adolescents with ASD did not improve humour, although it did improve all other mental states such as emotions, thoughts, and beliefs (Lee et al., 2016).

The relationship between social cognition and humour has been less studied in typically developing children. One study found a positive longitudinal relationship between some aspects of social cognition and humour (Bosacki, 2013). Eight-year-olds who had a good understanding of others' emotions and perceptions and causes of emotions attributed humour more in vague situations two years later. Another study found a positive relationship between children's humorous drawings and understanding of their peers' intentions among 5-year-olds and 9-year-olds (Kielar-Turska & Białecka-Pikul, 2009). It suggests that young children may understand others' mental states via humour. A similar study found a positive relationship between others' knowledge and humour

production (e.g. joke-telling behaviour) among 5-7-and-8-year-olds, but no relationship between others' desire understanding and humour production (Robison, 2000). The relationship between social cognition and humour is fairly consistent in typically developing children from 5 to 10 years regardless of different research design (Bosacki, 2013; Kielar-Turska & Białecka-Pikul, 2009; Robison, 2000). Furthermore, it holds in typically developing adults (Uekermann, Channon, & Daum, 2006). There is a positive relationship between the understanding of incongruity-resolution jokes and mentalistic questions that represent social cognition in typically developing adults (Uekermann et al., 2006).

From developmental psychology research, three crucial features of early humour development stand out. First one is the importance of joint engagement which is sharing attention by two agents (Carpenter, Nagell et al., 1998). Observational research found that humour is evident from 3 months with the appreciation of absurd non-verbal behaviours such as shrieks or odd faces while engaging with parents (Mireault, Poutre, et al., 2012). From 5 months, infants show a greater response to humour if their parent smiled and laughed at the joke (Mireault et al., 2015, 2014). Clowning, such as head shaking or nodding, has been found among 8-month-olds who repeat acts intentionally to re-elicit laughter from others (Reddy, 2001). Children copy their parents' jokes as early as the first year and start to create their novel jokes from 2 years when engaging with parents, and this reaches a peak at 3 years (Hoicka & Akhtar, 2012). Beyond this step, they begin to develop irony comprehension from 3 years in naturalistic home environments with their parents (Angeleri & Airenti, 2014).

The second one is the importance of imitation in early humour development. Imitation has been accepted as a precursor of social cognition, which helps to understand children's and others' mental states by developmental theorists (Meltzoff, 2013; Meltzoff & Decety, 2003). The Like-me hypothesis (Meltzoff, 2013) proposes that infants start to

understand the social world by observing other people and develop an understanding of others' mental states. Infant imitation serves to create a learning environment through observations and self-experience. It suggests that imitation has a learning role for young children. Imitation has also been used considerably by young children in humour studies, especially in humour production (Reddy 2001; Hoicka & Akhtar, 2012). Imitation of jokes helps young children practice humour.

A final important feature of early humour development is intention. Jokes are intentional acts involving doing the wrong thing which needs to be distinguished from other mental states such as mistakes, pretence or lies for children (Hoicka, 2016; Hoicka & Akhtar, 2011; Hoicka & Butcher, 2016; Hoicka et al., 2008; Hoicka & Gattis, 2008, 2012; Hoicka & Martin, 2016; Leekam, 1991). Because intentions are an important aspect of social cognition (Behne et al., 2005; Legrain et al., 2012) a clear question, therefore, is whether there is a link between social cognition and humour. Fifteen-month-olds are capable of distinguishing humorous (unexpected actions) and sweet (loving actions) intentions from vocal cues (Hoicka & Wang, 2011). Similarly, 16-month-olds are also capable of distinguishing joking and pretending with the help of both implicit and explicit parental cues (Hoicka, 2016; Hoicka & Butcher, 2016). Baron-Cohen (1997) used a false-naming paradigm to measure young children's understanding of mental states if an object is named falsely. The aim of this study was for children to identify the intention of why the objects were mislabelled. Two-year-olds were asked to identify the utterances as mistakes, pretence, or jokes. Two-year-olds with typical development, and 2-year-olds with learning difficulties, but without ASD, mostly judged false statements as jokes, which demonstrates young children understand intentions to joke. However, children with ASD did not. Furthermore, 2-year-olds distinguish intention to joke from mistakes, and intentions to pretend (Hoicka & Akhtar, 2011; Hoicka & Gattis, 2008; Hoicka & Martin,

2016), while 5-year-olds distinguish intentions to joke and intentions to lie (Leekam, 1991).

What we do not yet know is whether there is a relationship between social cognition and humour in very young children. The two emerging constructs presented above have remarkable commonalities and are functionally intertwined. Some socio-cognitive skills which developed before 4 years of age such as joint attention, imitation and intention may help children appreciate or produce jokes. Additionally, enjoyable or playful activities may increase children's attention to others' behaviours, emotions or thoughts. This longitudinal investigation will clarify the nature of the relationship between social cognition and humour in early development. Online parent-report surveys were used to measure both skills separately. Parents were asked to complete the surveys twice six months apart to examine the longitudinal associations between social cognition and humour. We hypothesised that there would be a positive relationship between social cognition and humour in young children. Over time, we expected social cognition to predict humour and vice versa. Gender was explored as a possible moderator in the longitudinal associations between social cognition and humour, but no prior hypothesis was made because the previous studies have not explored it (Bosacki, 2013; Robison, 2000). To the best of our knowledge, this is the first study to investigate this relationship during the emergence of both types of skills.

2.2 Time 1

2.2.1 Method

2.2.1.1 Participants

A power analysis found 134 participants were needed for a two-tailed medium effect size (p = 0.3), with α = 0.05, power = 0.95 (Faul, Erdfelder, Lang & Buchner, 2007). The demographic characteristics of the participants were presented in Table 2.3.

Further children were excluded due to incomplete data (18), being over 47 months (6), being under 1 month (4), the wrong age reported (1) and withdrawal (1). One parent reported their child's age as a later date than when they completed the surveys. Other countries children (and parents) lived in, but not reported in Table 2.3, are France (3), Denmark (2), India (2), Jamaica (2), South Africa (2), Trinidad and Tobago (2), Antigua and Barbuda (1), Bangladesh (1), Brazil (1), China (1), Germany (1), Greece (1), Hong Kong (1), Ireland (1), Latvia (1), Netherlands (1), New Zealand (1), Norway (1) Portugal (1) and Sweden (1).

Table 2.3 The demographic characteristics of the participants at Time 1 (T1) and Time 2 (T2)

	T 1	**T 2**
N	611	230
Age in months:		
Mean	26.65	31.08
SD	11.06	10.72
Range	1-47	7-53
Gender:		
Female	308	115
Male	301	115
Not Reported	2	0
Ethnicity:		
Arab	1	0
Black	5	2
East Asian	3	0
Mixed	16	7
Other [a]	29	15

South Asian	6	0
White	544	203
Not Reported	7	3
Country:		
Australia	11	6
Canada	13	6
United Kingdom	477	166
United States	76	39
Other [b]	27	12
Not Reported	7	1
Children's Development:		
Typical development	578	229
Premature	31	11
Disability [c]	2	1

Note. [a] Parents identified ethnicity information as Other, but without specification. [b] The details of other countries are in the text. [c] At term with a disorder that might affect development at T1 (1 with agenesis of the corpus callosum, 1 with hearing impairment, but using hearing aid) and T2 (1 with hearing impairment, but using hearing aid).

There were 611 parents; 528 female, 41 male *(M*age = 33.79, *SD* = 5.13, Range = 18 – 65 years; 42 parents did not report their age). Parents were White (521), East Asian (8), Black (6), South Asian (5), of mixed ethnicity (9), identified as Other, but without specification (16), or ethnicity information was not reported (46). Participants' highest level of education was a Postgraduate degree (291), Undergraduate degree (211), High school (68), Community College (28), or education information was not reported (12). British parents had a mean household income of £59,622 GBP (*N* = 298 reported, *SD* = £50,612, Range = £6,000 – £750,000). American parents had a mean household income of $131,030,384 USD (*N* = 66 reported, *SD* = $59,864, Range = $20,000 – $250,000).

Canadian parents had a mean household income of $124,090 CAD (*N* = 11 reported, *SD* = $46,943, Range = $50,000 – $200,000). Australian parents had a mean household income of $103,571 AUD (*N* = 7 reported, *SD* = $56,233, Range = $50,000 – $200,000). We did not report the other household incomes as further samples were less than five.

2.2.1.2 Measurements

The Early Social Cognition Inventory (ESCI) has 22 items to measure various aspects of social cognition such as intentions, desires, knowledge, perspective-taking, joint attention, imitation, emotions, mistakes, and beliefs (Hoicka et al., under review). Some questions in the survey are: "Is your child aware of other people's motives? E.g., They might give someone a gift to make them happy.", "Is your child aware of their desires? E.g., Prefer chocolate over broccoli" and "Does your child understand that sometimes things are not as they appear? E.g., something that looks hard might feel soft," etc. Parents answer yes or no for each item. A reliability coefficient of α = .89 for all participants at T1, α = .90 for the longitudinal subset at T1 and α = .87 for the longitudinal subset at T2 were found with the current sample.

The Early Humour Survey (EHS) has 20 items asking parents whether their children appreciate or produce different types of jokes (Hoicka, Soy-Telli, Prouten, Mireault & Fox, in prep). Some jokes in the survey are: "Making fun of others (e.g., calling someone a poopoohead)," "Strange actions with objects (e.g., put a cup on the head)" and "Referring to gross things (e.g., poo, sneezing, smelly foot)." Parents answer yes or no for each item. A reliability coefficient of α = .85 for all participants at T1, α = 84 for the longitudinal subset at T1 and α = .82 for the longitudinal subset at T2 were found with the current sample. (See Appendix A for both surveys with instructions).

2.2.1.3 Design

It was a correlational design. The main variables were the total social cognition score and the total humour score.

2.2.1.4 Procedure

Both surveys including demographic characteristics were completed on babylovesscience.com. Parents were required to open an account on this website. Parents ticked boxes to indicate their consent for the surveys. Once the surveys were completed, participants had an automatic, unique submission number from the website. The identical unique submission number was assigned when parents repeated the surveys 6 months later. Therefore, we matched the identical submission numbers for the longitudinal subset in Excel. The surveys took around 10 minutes in total. Small gifts were given to participants for taking part in the study. Ethical approval was obtained from the Psychology Department at the University of Sheffield.

2.2.2 Result

Table 2.4 presents descriptive statistics of raw scores for social cognition and humour.

Table 2.4 Descriptive statistics for baseline variables

	Mean	***SD***	**Range**	**Skewness**	**Kurtosis**
Social Cognition	15.58	4.94	0-22	-0.80	0.21
Humour	11.84	4.23	0-20	-0.33	-0.31

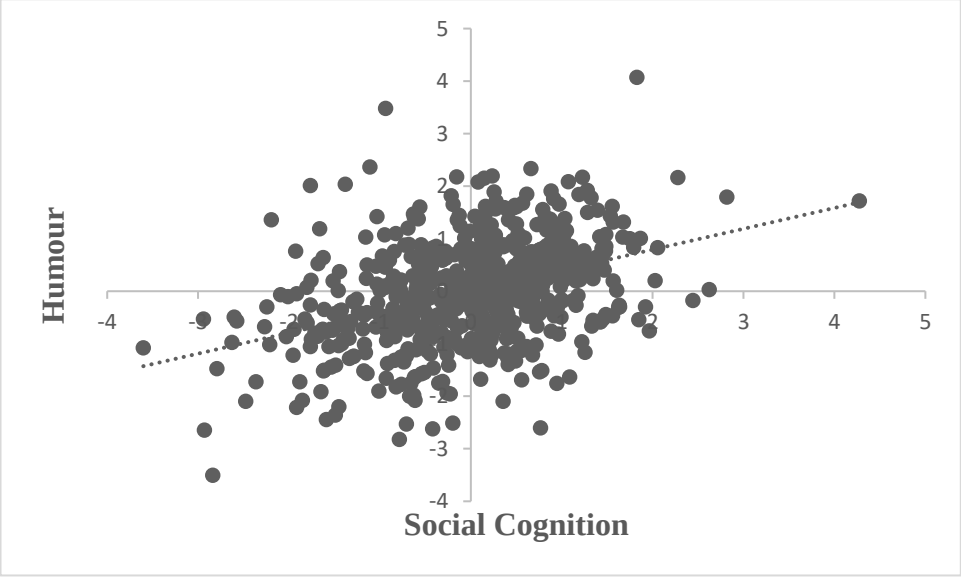
Note. $N = 611$.

The normality of variables was checked. Both the total humour score and the total social cognition score were negatively skewed (Table 2.4); however, humour data was normalised with a 1.5 root transformation after reflection while social cognition data was normalised with a square root transformation after reflection to bring them to an

acceptable level (Osborne, 2010). All scores were on a widely acceptable level of skewness between ± 2 (George & Mallery, 2010).

A Pearson product-moment correlation was run to determine the relationship between age in days and social cognition (reflected transformed). There was a strong, positive correlation between age in days and social cognition, which was statistically significant (r = .767, N = 611, p < .01). Similarly, the same analysis was conducted to look at the relationship between age in days and humour (reflected transformed). There was a strong, positive correlation between age in days and humour, which was statistically significant (r = .706, N = 611, p < .01). Therefore, we ran a partial correlation while controlling for age to determine the relationship between social cognition and humour. There was a positive correlation between social cognition (reflected transformed) and humour (reflected transformed) controlling for age, which was statistically significant (r' = .396, N = 611, p < .001, see Figure 2.1). The result was similar when we excluded participants who were born prematurely or had disabilities (r' = .403, N = 578, p < .001).

Figure 2.1 The relationship between the standardised residuals of social cognition and humour scores controlling for age



2.2.3 Discussion

We found that there was a medium to large, positive correlation between social cognition and humour development in young children based on parental reports, controlling for age. This suggests there is a relationship between humour and social cognition in the early years. However, this does not tell us about the nature of the relationship – whether social cognition predicts humour; humour predicts social cognition; or both. The following longitudinal analyses will clarify this.

2.3 Longitudinal subset

2.3.1 Method

A power analysis found 89 participants needed for a two-tailed medium effect size ($r = 0.15$), with $\alpha = 0.05$, power = 0.95 (Faul et al., 2007). The demographic characteristics of the participants at T2 were also presented in Table 2.3. Further children were excluded due to incomplete data at Time 1 (3) or Time 2 (2), being under 1 month at Time 1 (2) and repeating the surveys after over 7 months (2). Other countries children (and parents) lived in, but not reported in Table 2.3, are France (3), Antigua and Barbuda (1), Bangladesh (1), China (1), Greece (1), Jamaica (1), Norway (1) Portugal (1), South Africa (1) and Trinidad and Tobago (1).

There were 230 parents who were contacted via email 6 months apart; 217 female, 11 male (*M* age = 34.03, *SD* = 4.58, Range = 18 – 45 years; 2 parents did not report their age and gender). Parents were White (207), East Asian (4), Black (2), South Asian (1), of mixed ethnicity (4), identified as Other, but without specification (9), or ethnicity information was not reported (3). Participants' highest level of education was a Postgraduate degree (123), Undergraduate degree (75), High school (19), Community College (11), or education information was not reported (2). British parents had a mean household income of £57,001 GBP (*N* = 109 reported, *SD* = £33,071, Range = £9,000 – £200,000). American parents had a mean household income of $144,243 USD (*N* = 37

reported, *SD* = $52,142, Range = $47,000 – $250,000). Canadian parents had a mean household income of $110,833 CAD (*N* = 6 reported, *SD* = $40,250, Range = $60,000 – $190,000). Australian parents had a mean household income of $99,000 AUD (*N* = 5 reported, *SD* = $56,071, Range = $50,000 – $200,000). We did not report the other incomes as further samples were less than five.

2.3.2 Result

Table 2.5 presents descriptive statistics of raw scores for social cognition and humour at T1 and T2.

Table 2.5 Descriptive statistics for social cognition and humour at T1 and T2

	Mean	***SD***	**Range**	**Skewness**	**Kurtosis**
Social Cognition T1	15.16	5.19	0-22	-0.68	-0.20
Social Cognition T2	17.16	4.38	0-22	-1.12	1.34
Humour T1	11.43	4.09	0-20	-0.23	-0.21
Humour T2	13.23	3.75	2-20	-0.33	-0.15

Note. *N* = 230.

The normality of variables was checked. As with the previous data, the total social cognition score at T1 and T2 and the total humour score at T2 were negatively skewed (see Table 2.5). Humour T2 and social cognition T1 data were normalised with a square root transformation after reflection, while social cognition T2 data was normalised with a cube transformation after reflection to bring them to an acceptable level (Osborne, 2010). All scores were on a widely accepted level of skewness between ± 2 (George & Mallery, 2010).

For Pearson correlations of all variables, see Table 2.6. Spearman's rho correlations were applied for gender. All variables were positively correlated with each other ($p < .01$) except for gender, which did not correlate with any variables ($p > .05$).

Gender was therefore not included in any multiple regression analyses but we explored whether it may moderate the longitudinal associations between social cognition and humour.

Table 2.6 Summary of Pearson and Spearman's rho correlations for all variables

Variables	***1***	***2***	***3***	***4***	***5***	***6***
1. Age T2		-.04	.67**	.58**	.77**	.62**
2. Gender [a]			-.03	-.03	-.09	-.02
3. Humour T1				.73**	.69**	.62**
4. Humour T2					.59**	.64**
5. Social Cognition T1						.81**
6. Social Cognition T2						

Note. [a] Gender was coded as 0 for girls, 1 for boys.

**$p < .01$, $N = 230$.

Hierarchical multiple regression was conducted to examine whether social cognition predicts humour six months later (see Table 2.7). Humour at T2 was entered as the dependent variable. Humour at T1 and age in days at T2 were entered on step one, and social cognition at T1 was entered on step two as independent variables. There was a multivariate outlier that was then excluded from the analysis. The hierarchical multiple regression was re-run, and all assumptions of multiple regression met. The overall regression model was found to be significant ($R^2 = .55$, $p < .001$). In predicting humour (T2) the variable social cognition (T1), when entered on step two, did not account for a significant increment in R^2 ($R^2 \Delta = .002$, $\beta = .07$, $p > .05$).

Table 2.7 Summary of hierarchical multiple regression analysis for social cognition at T1 predicting humour at T2

	R^2	Δ R^2	β
Step 1	.55		
Age T2			.17**
Humour T1			.61***
Step 2	.55	.002	
Social Cognition T1			.07

Note. $p^{**} < .01$, $p^{***} < .001$, $N = 229$.

To explore whether gender moderates the relationship between social cognition at baseline and humour at a 6-month follow-up, a separate hierarchical multiple regression was conducted, controlling for humour at T1 and age in days at T2. To do this, social cognition at T1 was entered on step two as a predictor and a product term (social cognition T1 × gender) was entered on step three to check possible moderation effect. Age in days at T2 and social cognition at T1 were centred before inclusion in the model. Because gender is a dichotomous variable, it was dummy-coded such that girls were coded as "-1" and boys coded as "1". The product term (social cognition T1 × gender) did not make a significant contribution to R^2 (R^2 Δ = .004, β = .06, $p > .05$), which suggests that gender did not moderate the relationship between social cognition at T1 and humour at T2.

Another hierarchical multiple regression was conducted to examine whether humour predicts social cognition six months later (see Table 2.8). Social cognition at T2 was entered as the dependent variable. Social cognition at T1 and age in days at T2 were entered on step one, and humour at T1 entered on step two as independent variables. The same outlier was excluded from the analysis. The hierarchical multiple regression was re-

run, and all assumptions of multiple regression met. The overall regression model was found to be significant (R^2 = .65, p < .001). In predicting social cognition (T2) the variable humour (T1), when entered on step two, accounted for a significant increment in R^2 (R^2 Δ = .009, β = .14, p < .05). The positive beta coefficient indicates that the higher humour scores at T1, the greater the increase in social cognition from T1 to T2.

Table 2.8 Summary of hierarchical multiple regression analysis for humour at T1 predicting social cognition at T2

	R^2	Δ R^2	β
Step 1	.65		
Age T2			.01
Social Cognition T1			.80***
Step 2	.65	.009	
Humour T1			.14*

Note. p* < .05, p*** <.001, N = 229.

To explore whether gender moderates the relationship between humour at baseline and social cognition at 6-month follow-up, a separate hierarchical multiple regression was conducted, controlling for social cognition at T1 and age in days at T2. To do this, humour at T1 was entered on step two as a predictor and a product term (humour T1 × gender) was entered on step three to check possible moderation effect. Similarly, age in days at T2 and humour at T1 were centred to before inclusion in the model. The product term (humour T1 × gender) did not make a significant contribution to R^2 (R^2 Δ = .000, β = -.01, p > .05), which suggests that gender did not moderate the relationship between humour at T1 and social cognition at T2.

2.3.3 Discussion

We found that there was a positive one-way relationship between social cognition and humour six months apart. While humour predicted social cognition across time, social cognition did not predict humour. It suggests that children who engage with humour may be good at developing better socio-cognitive skills. Gender did not moderate the longitudinal relationship between social cognition and humour.

2.4 General discussion

It is the first study to investigate the longitudinal associations between social cognition and humour from 1 to 47 months via parental surveys. As we expected, we found a positive relationship between social cognition and humour at baseline controlling for age. The regression model found that once age and social cognition T1 were accounted for, humour T1 predicted social cognition T2. However, another regression model found that once age and humour at T1 were accounted for, social cognition T1 did not predict humour T2. There was no difference between girls and boys in terms of this relationship. Study 1 suggests that there is a one-way relationship between social cognition and humour at early development. Young children who score higher on humour T1 are more likely to practise socio-cognitive skills six months later.

The findings of Study 1 at baseline are consistent with previous studies which found a positive relationship between social cognition and humour even if there were experimental differences among them (Bosacki, 2013; Kielar-Turska & Białecka-Pikul, 2009; Uekermann et al., 2006). To the best of our knowledge, there is only one longitudinal study to investigate this relationship in 2-year-intervals among 8-year-olds (Bosacki, 2013). Contrary to our findings, Bosacki, (2013) found that social cognition was positively correlated with humour two years later, but not vice versa. It is noted that Bosacki's study is small-scale (N = 28) and the findings may not replicate once it is conducted with powerful sample size or is controlled for baseline scores. Therefore, all

explanations will be made by accepting Bosacki's study as a pilot. There are some similarities and differences between Study 1 and Bosacki's study that need to be examined to enlighten why these constructs predict each other differently.

First, Study 1 covered a wide range of socio-cognitive skills from joint attention to false belief understanding that were suitable for the age group (Hoicka et al., under review). It would not make sense to ask if 8-year-olds were aware of others' desires or emotions; therefore, Bosacki (2013) developed a different task to assess the causes of emotions, predictions on actions and understanding of morality via ambiguous stories. School-aged children were asked why others feel happy/sad about some ambiguous social situations. Wh- questions such as who, what, when, where, why, or how are also used at 34% by parents of 24-month-olds in comparison with yes/no questions (66%), but especially the frequency of why questions (up to two utterances) are much less than how questions (up to seven utterances) (Rowe, Leech, & Cabrera, 2017). Despite this low frequency, the use of wh- questions by parents predicts children's verbal reasoning skills one year later. Expectedly, the use of wh- questions should increase by age. Social cognition may predict humour in later ages because causal questions may be more important than how questions (e.g., Why does this boy feel that way? vs How does this boy feel?) to appreciate the humour or to have a sense of humour. Making predictions in emotions or assessing moral behaviours require inferences in school-aged children and these abstract thinking skills may lead to better humour skills. In other words, complex verbal reasoning in social cognition may be a prerequisite for humour, which cannot be the case for Study 1 because of the age-appropriate tasks.

Second, this study consisted of humour survey items according to the classification of the jokes reported by parents of 2-and-3-year-olds (Hoicka et al., in prep; Hoicka & Akhtar, 2012). Bosacki (2013) also adopted these jokes to 8-year-olds to assess humour in two ways: Children were asked if they see themselves as a funny person

(humour-self) or if they see others as funny people in ambiguous social stories (humour-others). Both studies evaluated children's humour skills with similar measurements. One explanation of controversial findings may be related to the role of playfulness in this relationship. Reddy and Mireault (2015) pointed out that a playful framework is a need to reveal clowning and to tease in young children. Besides, parental and emotional engagements provoke smiling/laughter. For example, poking a clown nose and saying 'beep' consistently revealed smiling/laughter even among 5-month-olds (Mireault et al., 2018). If the young age group enjoys incongruities or nonsense in a playful context, the possibility of practising the same joking behaviours may increase. Practising the same jokes by infants may lead to improve later imitative learning skills (Hoicka & Akhtar, 2012). Mireault, Poutre, et al. (2012) pointed out that humour includes joint attention in infants so that sharing humorous activities with others may also lead to better joint attention. Thus, humour may provide a social and emotionally positive environment to practice skills relating to social cognition such as imitation or joint attention for young children due to playfulness, but not for older ones.

From a theoretical perspective, Study 1 supports the notion that humour is an intentional falsehood (Hoicka, 2016; Leekam, 1991); includes emotional engagement (Reddy, 2001); and may be seen as a component of social cognition just like the social cognition scales have developed before (Happé, 1994; Muris et al., 1999; Tahiroglu et al., 2014). Appreciating and producing humour may facilitate understanding of intentions later in Study 1 because children comprehend jokers' intentions when they involve in a humorous event. Humorous activities with parents may promote to understand others' first-order mental states as intentions or beliefs while children grow up. Furthermore, smiling or laughter may be predictors of understanding emotions because these expressions may boost happiness (Kraut & Johnston, 1979). Indeed, infants showed more engaged in absurd events when their parents smiled rather than stayed neutral (Mireault

et al., 2015). Understanding emotions may help understanding desires and perceptions better in 2-and-3-year-olds because these mental states are interrelated with each other (Wellman, Phillips, & Rodriguez, 2000). While the desired object causes positive emotions, an undesired object causes negative ones. That humorous activities assist children's emotion understanding may indirectly lead to a better understanding of others' desires.

Third, another possible explanation of why humour was a good predictor of social cognition may be related to how much cognitive effort different age groups make to understand humour. Children develop several humour skills from understanding incongruent non-verbal actions (Mireault, Poutre, et al., 2012) to comprehending irony (Angeleri & Airenti, 2014) from 3 months through 4 years. There are several signs of progress going on at early development simultaneously as being discussed in the introduction. Study 1 covered these humour skills from simple non-verbal jokes (e.g., peekaboo) to complicated verbal ones (e.g., puns). On the other hand, older children evaluated themselves if they were funny or attributed others' viewpoints in ambiguous stories as humorous or not (Bosacki, 2013). How much cognitive effort school-aged children depend on the level of difficulty of the tasks, not the age (Chevalier, 2018). If the tasks are challenging, school-aged children may look reluctant to pass the tasks and may find it costly (Chevalier, 2018). It shows that school-aged children have good manipulation skills over challenging tasks. On the contrary, young children may find it valuable to engage in humorous activities with parents rather than finding them costly. Therefore, development of various humour skills at early development may require much cognitive effort to appreciate and produce humour for young children even if it is challenging, which may affect socio-cognitive skills positively in later life whereas evaluating themselves or others as humorous may be less effortful for school-aged children.

One strength of Study 1 is to have a culturally diverse sample, different parental education levels, and socio-economic backgrounds. It suggests that this positive relationship between social cognition and humour may be generalised regarding demographics heterogeneity. Another strength of Study 1 is to have good statistical power, therefore, the findings of Study 1 are reliable. Yet, the longitudinal findings would reveal a bidirectional relationship between social cognition and humour with larger sample sizes. Therefore, future research may consider examining this predictive relationship with larger sample sizes. Larger sample sizes may also enable to examine any age differences in this relationship and detect the onset of this relationship considering the wide age range used in Study 1.

There are a few limitations that need to be pointed out here. Study 1 was conducted with only parental reports. Although parent-report measures have been used and found reliable and valid in many developmental areas such as language development (O'Neill, 2007), temperament (Putnam, Helbig, Gartstein, Rothbart & Leerkers, 2014; Goldsmith 1996), social cognition (Tahiroglu et al., 2014), and executive function (Nilsen, Huyder, McAuley & Liebermann, 2017), one study found that parents overestimate their children's basic cognitive skills such as intelligence and Piaget's conservation tasks (Miller, 1986). Social desirability bias may be an issue in Study 1, therefore, future research may benefit from performance-based measurements. Another limitation of Study 1 is to have a limited period of 6 months and only two-time points. Future research should include a more extended period and more time points to examine the trajectories of this relationship.

In sum, Study 1 suggests that the relationship between social cognition and humour exist in a natural environment with parental engagement. However, this positive relationship is not bidirectional across time. Better socio-cognitive skills may be

explained by humorous events children involve in younger ages; however, no evidence showing good socio-cognitive skills may make children funnier in later life.

The next study has been built upon the promising findings, taking into consideration the limitations of this longitudinal. The use of a multi-method approach may contribute to a better understanding of this relationship. As well as parental reports, performance-based measurements of social cognition and humour have been included in the next study. The experimental method (laboratory-based) may provide more control over variables. Additionally, a laboratory-based study may prevent parents from overestimating their children's cognitive skills because they may acknowledge that we will be measuring their children's cognitive skills related to social cognition and humour using multiple tasks in the laboratory.

Chapter Three

Study 2: The relationship between social cognition and humour development from 3 to 47 months: A laboratory study

Study 2 follows on from the correlational survey study reported in Study 1 (see Chapter 2), which demonstrated that there was a positive correlation between socio-cognitive skills and humour in young children. Study 2 investigated whether there is still a positive correlation between these two skills in young children in a laboratory setting. Eighty-four children from 3 to 47 months completed 11 short social cognition tasks and one humour appreciation and production test including 21 jokes and 21 control actions. There was no significant correlation between social cognition and humour once age was controlled for. It suggests that children's performance on social cognition and humour laboratory tasks did not replicate the survey-based correlation.

3.1 Introduction

Social cognition is critical to comprehend how people make sense of the social world (Ric, 2015). Throughout the process of understanding the social world, human beings have developed various abilities from infancy such as face recognition (Farroni et al., 2007), imitation (Meltzoff & Moore, 1977; 1989; 1992; 1994), and intention understanding (Behne et al., 2005; Legrain et al., 2012). Humour emerges with smiling from 3 months (Mireault et al., 2012), and it develops up to more sophisticated forms such as irony from the pre-school period (Angeleri & Airenti, 2014). Reddy (2001) proposed that humour consists of social and emotional skills in parental engagement from infancy. Infants are involved in an interaction with their parents to re-elicit laughter and positive feelings intentionally via clowning such as head shaking or screwing up faces. If a joke includes doing something intentionally and evokes positive feelings, which Hoicka

(2016) mentioned about humorous intentions previously, socio-cognitive skills and humour skills may be intertwined.

Humour appreciation and production require many socio-cognitive skills. For example, infants use pointing to share attention, to show interest, and to provide information to others in the first year of life (Liszkowski et al., 2004; Liszkowski et al., 2006; Liszkowski et al., 2007; 2008). They also look longer when parents provide humorous cues or look away when parents remain neutral (Mireault et al., 2015). In other words, they use pointing and eye gaze as 'social referents' in parental engagement for both socio-cognitive and humour skills. Social looking/referencing could be a mutual cognitive mechanism which assists infants to get attention or information and to perceive humour. School-aged children also identify what is funny when they are asked to justify humorous drawings and stories (Kielar-Turska & Bialecka-Pikul, 2009). While they create their jokes or funny pictures, they think about what makes others laugh. While they give explanations to funny drawings or stories drawn by their friends, they realise the humorous intentions of their peers, which may be evidence that humour includes intentions.

General findings related to individuals with ASD demonstrate that these populations lack an understanding of both others' minds (Baron-Cohen et al., 1985) and humour (Lyons & Fitzgerald, 2004). For example, preschoolers with ASD exhibited less laughter to humorous acts (Reddy et al., 2002), while adolescents with ASD did not comprehend nonsense jokes and incongruity-resolution jokes (Wu et al., 2014) in comparison with their typically developing peers. Also, adults with ASD have low scores in terms of affiliative humour style and self-enhancing humour style (Samson et al., 2013). Individuals with ASD experience less humour appreciation regardless of age. Researchers have focused on domain specificity of ToM since studies showed a core deficit in the metarepresentation of mental states among individuals with ASD (Stone &

Gerrans, 2006). If there is a link between understanding mental states and humour, the view of domain-specificity may also explain why individuals with ASD do not comprehend humour. There may be a shared underlying mechanism between understanding mind and humour.

Previous studies on the particular relationship between social cognition and humour suggest these constructs are closely related from 1 month through school-aged children in different research designs. Parental reports in Study 1 (Chapter 2) found there was a positive relationship between social cognition and humour in children from 1-47 months, and humour was a good predictor of social cognition in young children 6 months later, whereas the reverse pattern did not hold. Robison (2000) examined the same relationship between some mental states such as desire understanding and knowledge and humour production (e.g. joke-telling behaviour) in older children (4-to-8 years). Robison found that others' knowledge and humour production were positively related to each other after 5 years of age whereas the understanding of others' desires and humour production was not. Bosacki (2013) conducted an experimental study that investigated ToM skills, self-concept, and perceptions of humour in self and other longitudinally among school-aged children. Bosacki used Social Ambiguous Stories to assess ToM skills. Children who were good at this ToM assessment at time 1 tended to use more humour-related concepts when they were evaluated on the same task two years later. Bosacki suggests that socio-cognitive skills are related to humour over time in preadolescence. Intervention studies that attempt to reveal a causal link between social cognition and humour were mostly run with atypical school-aged children (Gevers et al., 2006; Begeer et al., 2011). After implementing ToM-based social cognition training, school-aged children with PDD, which is the same as ASD, showed a significant improvement in humour understanding as well as perception/imitation, pretence and first-order belief (Gevers et al., 2006). However, the same age group of children with ASD did not show any

improvement in humour, perception, imitation, or second-order beliefs after a similar training (Begeer et al., 2011).

Previous studies mentioned above have some important limitations which must be considered (Robison, 2000; Bosacki, 2013). First, Study 1 (Chapter 2) had positive findings based on parental reports. Carers are the most important people that observe and contribute to child development. They spend a longer time with children; thus, children may feel comfortable while exhibiting their socio-cognitive or humour skills around them. However, there is still a need for a laboratory-based experiment to obtain more objective results based on direct observations, because it may prevent parental bias. It is important to show evidence relying on children's performances as well as parental reports in terms of child studies because it will give us greater validity and reinforce the findings of Study 1 (Chapter 2) if the findings hold in another research setting. Second, the studies that examined the relationship between social cognition and humour reduced socio-cognitive skills to only a few tasks that measure desire, knowledge and emotion in laboratory settings (Bosacki, 2013; Robison, 2000). Most studies have involved only a few ToM tasks, rather than a fuller set of socio-cognitive skills, but social cognition includes several important skills such as joint attention, imitation, intentions and false beliefs emerging from birth (Carpenter et al., 1998). Examining only a few features of social cognition such as desire, emotion and knowledge and excluding others is a reductive approach, which may provide limited knowledge about children's socio-cognitive skills. Therefore, there is a need to conduct a laboratory-based experiment with a broader assessment of socio-cognitive and humour skills from infancy through pre-school age.

The aim of Study 2 is to investigate the relationship between social cognition and humour from 3 months to 47 months in a laboratory setting. Children participated in a series of social cognition tasks and a humour appreciation/production test. We

implemented 11 short social cognition tasks to measure how much they understand others' minds. We presented 21 jokes, and 21 normal control acts, to measure whether children smile or laugh at increasingly advanced jokes and whether they produce them. Furthermore, parents completed the surveys we used in Study 1 to demonstrate whether there is a positive correlation between social cognition and humour as a replication of Study 1. We hypothesised that we would get similar findings in the laboratory setting as Study 1, where there will be a positive relationship in both children's performances and parental reports since they are theoretically linked. Gender will be explored further as a moderator in this relationship, but we do not expect to find that there will be a moderator effect since Study 1 (Chapter 2) did not discover such a finding. To the best of our knowledge, it is the first attempt to examine this particular relationship using a broader array of assessments in younger children.

3.2 Method

3.2.1 Participants

A power analysis found 77 participants were needed for a two-tailed medium effect size ($p = 0.15$), with $\alpha = 0.05$, power = 0.8 (Faul et al., 2007). Participants were 84 typically developing children from 3 to 47 months (*M* age = 23 months, 11 days, *SD* age = 13 months, 22 days, Range = 3 months, 7 days – 46 months, 4 days; 43 males, 41 females). The participants were White ($N = 74$), of mixed ethnicity ($N = 6$), or did not report their ethnicity ($N = 4$). All children exposed to English, but 13 of them exposed to other languages as well. Children were recruited from the database of the Sheffield Cognitive Development Group, the Facebook page of this group and bounty packs/Facebook advertising. Further children were excluded because they did not complete tasks, or were unwilling to join in (26), experimental error (9), technical

problems with the videos/the fish box (3), parental interference (2), or because of a development disability (1).

There were 84 parents: 2 males, 71 females, and 11 did not declare their gender. The majority of the parents were White (69), did not report their ethnicity (11), were of mixed ethnicity (2), or preferred not to say (1). Participants' highest level of education was a Postgraduate degree (29), Undergraduate degree (32), High School (18), or did not report their education level (5). Parents had a mean household income of £54,166.67 (*N* = 69 reported, Range = £12.000 - £120.000).

3.2.2 Materials

The materials for the humour appreciation/production test were a teddy bear, a glove, a toy pig, a toy cow, a toy dog, a feather ball, a doll, and a small towel, a toy sheep, three toy bricks, a hat, straws, a toy horse, a plastic spoon, a child book, a toy plane and a sheet of crumpled paper.

The materials for the social cognition test were a toy watering can for the joint engagement task; a transparent plastic box and a toy goat for the physical obstacle task; a toy bird for the imperative and declarative production of pointing task; a toy carrot and two cubes for the point following task; a blue dog toy and two toy bricks for the gaze following task; a big fish box (a mechanism including a button that has a door that can be opened automatically, see Figure 3.2) for the imitation of intentional actions task; broccoli and crackers for the desire task; four pictures of children's faces for the affective labelling task; a monkey puppet, an elephant puppet, a toy orange, a picture of an ice-cream cone and a picture of a bar of chocolate for the affective perspective-taking task; two dolls, a marble and two small baskets for the false belief task.

Two SONY digital video cameras were used to record both tasks. The laboratory room had a small green table and four chairs for children and a big table and two chairs

for parents. Besides, the ESCI (22 items) (Hoicka et al., under review) and the EHS (20 items) (Hoicka et al., in prep) were used. A Toshiba laptop was used to collect the survey data through Qualtrics.

3.2.3 Design

It was a correlational design. There were six variables for humour appreciation and production test: a Joke Smile score, a Joke Laugh score, a Joke Copy score for the humour trials and a Control Smile score, a Control Laugh score and a Control Copy score for the control trials. There was another variable for social cognition test which called as the total social cognition score. Both tests were counterbalanced. Also, another correlational design was used for survey variables that were the total humour survey score and the total social cognition survey score.

3.2.4 Procedure

Before the study, parents signed consent forms and were informed about the study. The experimenter (E) played with children in the lounge area for a warm-up until children felt comfortable and ready for the study. Parents also filled the surveys out for replication of Study 1.

3.2.4.1. Humour appreciation and production test. Five blocks included 21 control actions/utterances and 21 jokes in total (see Appendix B for the full list). Each block consisted of four or five control or humorous actions. They started with types of humour that most children would understand and ended with the types of humour that the least number of children would understand based on the Early Humour Survey (Hoicka et al., in prep). E and the child sat face to face. E said to the child: “I am going to show you some things!” Each block started with the control trials first. Before showing each action, E said, “Look” to focus their attention. Each action was repeated twice. A small laugh followed each action. Children were then asked, “Can you try?” in the control trials,

and “Can you joke?” in the joke trials. E waited up to 10 seconds for the child’s response. After the child’s response, E said, “Okay!” regardless of the response. If the child did not smile/laugh/copy at all within one humour block, the experiment was stopped. Because we had a wide age range, from 3 to 47 months, we did not expect younger children to show an understanding of the following types of jokes (e.g., puns). We used this stop-rule to avoid any distress for children. The experiment was video recorded. Some children were offered breaks between blocks. Reliability coefficients of α = .98, α = .94 and α = 97 were found with the current sample for smiling, laughter and humour production respectively.

3.2.4.2. Social cognition test. Initially, this test consisted of 13 different short tasks to measure how young children understand others’ minds, however, two of the social cognition tasks, imperative production of pointing task (Camaioni et al., 2004) and level 1 perspective-taking task (Moll & Tomasello, 2006), were excluded from the study because children often produced responses that could not be coded, such as climbing over the table to grab objects instead of pointing. When children did not pass three tasks in a row, the test was ended to avoid any distress for children. Moreover, some children were very young and were not expected to last very long as they would stop being successful in the tasks. All tasks were video recorded. A reliability coefficient of α = .85 was found with the current sample.

Joint engagement task (Carpenter et al., 1998). E played with a toy watering can in silence while E alternated her gaze between the child and the object. The episode lasted around 15 seconds or until the child looked from the object to E’s face and back to the same object.

Physical obstacle task (Carpenter et al., 1998). We used this task to measure whether children intentionally remove an obstacle to reach a target object. A toy goat was

placed on the table in front of the child. A transparent plastic box was positioned upside down over the toy such that the child could see the toy but could not obtain it without moving the box. Then, E said, “Can you get the toy?” and waited up to 10 seconds for a response. If they did not succeed, E repeated the verbal prompt one more time.

Imperative and declarative production of pointing task (Camaioni et al., 2004). E made a toy bird fly up to 10 seconds. E hid the bird behind her back so that the child could not see it. E said, “What happened?” and waited up to 5 seconds for a response. If there was no response, E repeated the question and waited for another 5 seconds. E named the toy, “It is a bird.”

Point following task (Carpenter et al., 1998). This task measures whether children look where adult points. E gave the child a toy carrot to play. Then, E put two different cubes in two separate locations on the table. E pointed to one of the cubes with her right hand while alternating her gaze between the child’s eyes and the cube. E’s pointing continued up to 10 seconds, or until the child looked at the correct cube.

Gaze following task (Carpenter et al., 1998). This task measures whether children look where an adult looks. E gave the child a blue dog toy to play. Then, E put two toy bricks in two separate locations on the table. E turned her head between the child and one of the bricks. E’s head turns continued either until the child fixated on the correct brick or until E turned her head ten times.

Imitation of arbitrary action tasks (Carpenter et al., 1998). This task measures whether children copy arbitrary actions. E patted the plastic box with her hand several times. E oriented the box toward the infant and said, “Can you do that?” and gave 5 seconds to copy. If there was no response, E repeated the action one more time and waited for another 5 seconds.

Imitation of intentional action tasks (Carpenter et al., 1998). This task measures whether children copy intentional actions and avoid accidental actions. E put a big fish box that works with a battery. E flapped the top of the box and said, “Whoops!” and then E pressed the purple button and said, “There!” and waited for the flap to open, showing a fish (see Figure 3.2) mechanically. E said, “Can you make it work?” and waited 5 seconds for a response. If there was no response, E repeated the question and waited for around five more seconds.

Figure 3.2 Details of the fish box experiment

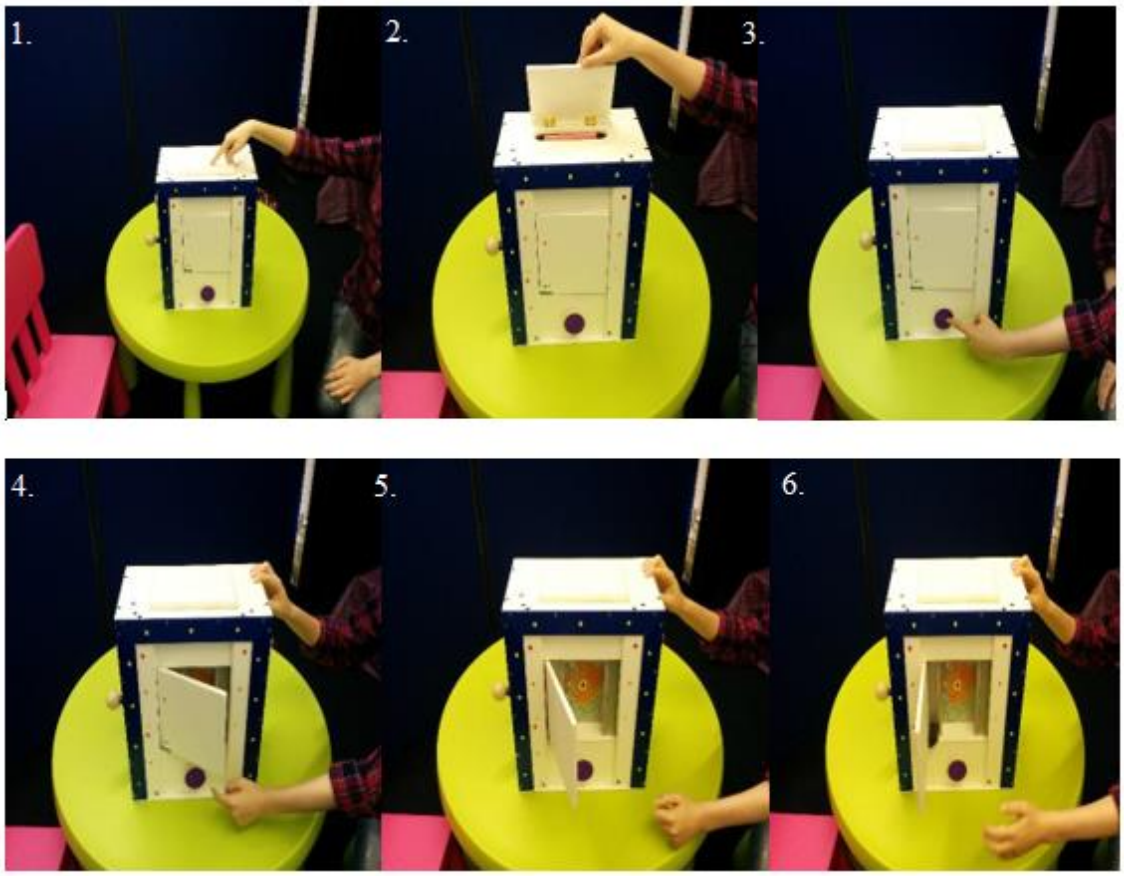


Figure 3.2 The second photo demonstrates where E said, “Whoops!” The third photo demonstrates where E said, “There!”.

Desire task (Repacholi & Gopnik, 1997). This task measures whether children are aware of others’ desires. Two plates of food (broccoli and crackers) were presented, and E said, “Try these!” and waited until the child tried. First, E tasted the child’s preferred

food and acted disgusted and said, “Eww!” Second, E tasted the other food and said, “Yum!” and looked happy. E placed one hand, palmed facing up, precisely between the two plates and said, “Can you give me some?” and waited up to 10 seconds. E repeated the question twice if necessary.

Affective labelling task (Denham, 1986). This task measures whether children are aware of others’ emotions. E showed four pictures of children's faces, with happy, sad, angry, and afraid expressions. E asked, “How does this boy/girl feel?” and waited up to 10 seconds for a response.

Affective perspective-taking task (Denham,1986). Four pictures of children’s faces were placed in front of the child. First, E used a monkey puppet and said, “I have got an ice-cream, yay!” while showing a picture of the ice-cream. E asked the child, “How is the monkey feeling?” Second, E used the monkey puppet again and said, “I have got an orange” while showing a toy orange. Suddenly, E dropped the orange and said, “Oh, no!” E asked the child, “How is the monkey feeling?” Third, E used an elephant puppet and said, “I have got chocolate, oh no!” while showing a picture of the chocolate. E asked the child, “How is the elephant feeling?” Finally, E used the elephant puppet again and pretended that the elephant puppet was walking around and fell over suddenly, then said, “I fell over, yay!” E asked the child, “How is the elephant feeling?” After each question, E waited up to 10 seconds for a response and repeated the question if necessary. In this task, two of the items involved emotions that we might expect so should be easy to identify, while two involved emotions we would not expect (the third and the fourth scenarios above), so children would have to go beyond how they would feel and pay attention to the puppet’s reaction instead.

Sally- Anne task (Baron-Cohen et al., 1985). This task measures whether children understand false beliefs. E introduced Sally and Anne, saying, “This is Sally, and this is

Anne." E asked the child their names. "Who is she? Do you remember her name?" E said, "Sally is putting the ball into her basket and is hiding behind me. Anne is moving the ball into her basket and leaves as well. When Sally returns, where will she look for the ball?" E waited for around 5 seconds for a response and repeated the question if there was no response. E waited for another 5 seconds.

3.2.5 Coding

Humour coding was done across two dimensions: humour appreciation and humour production. Humour appreciation scores consist of smiling and laughter at E's jokes, while humour production scores consist of children's imitation of jokes with enjoyment (smiling/laughter). Coders used their intuition to code smiles and laughs following past research which relied on this method provide that agreement was good (Hoicka & Akhtar, 2011; 2012; Hoicka et al., 2008). The main difference between a smile and a laugh was a sound that comes out (e.g. one ha or ha-ha pattern of vocalisation (Masten. 1989). The smile does not appear with the sound, but the laugh does. Even small smiles or small laughs have been scored if children have shown enjoyment.

For smiling, children received one point for each joke if they smiled when E performed the joke. The total number of joke trials for which children smiled were summed to give a Joke Smile score. In the control condition, children received one point for each control actions if they smiled when E performed the action and another point if they kept smiling on their turn regardless of action production. The total number of control trials for which children smiled were summed to give a Control Smile score. Smiling was one dimension of humour appreciation.

For laughter, children received one point for each joke if they laughed when E performed the joke. The total number of joke trials for which children laughed were summed to give a Joke Laugh score. In the control condition, children received one point

for each control actions if they laughed when E performed the action and if they kept laughing on their turn regardless of action production. The total number of control trials for which children laughed were summed to give a Control Laugh score. Laughter was another dimension of humour appreciation.

For humour production, children received one point for each joke if they produced the joke while they smiled/laughed. The total number of joke trials for which children produced were summed to give a Joke Copy score. In the control condition, children received one point for each control actions if they produced while they smiled/laughed. The total number of control trials for which children produced were summed to give a Control Copy score. If children never laughed/copied the jokes within a joke block, coding stopped, to be consistent with the testing stop rule. A second coder coded 18 (21%) of the videos. Agreement was excellent, *ICC* = .992 for smiling; *ICC* = 1 for laughter; *ICC* = .995 for imitation.

Children scored one point on the *Joint engagement task* if they looked from the object to E's face and back to the same object, thus coordinating attention to both the adult and the object. Children scored one point on the *Physical obstacle task* if children removed the obstacle. Children scored one point on *Imperative and declarative production of pointing task* if children pointed to the object or gave a verbal cue asking for it. Children scored one point on the *Point following task* if children first looked at the toy to which E pointed. Children scored one point on the *Gaze following task* if children first looked at the toy that E looked. Children scored one point on the *Imitation of arbitrary action task* if children reproduced the modelled action. Children scored one point on the *Imitation of intentional and accidental actions task* if children reproduced the intentional action, but not the accidental action. If children were attempting to reproduce the intentional action but were unsuccessful owing to lack of strength/dexterity, they were given credit for reproducing that action. Children scored one point on the

Desire task if children offered their non-preferred food to E. Children scored one point on the *Affective labelling task* if children identified emotional dimensions for at least 3 out of 4 pictures. Children scored one point on the *Affective perspective-taking task* if children correctly identified how the puppets felt for at least 3 out of 4 scenarios. For example, the puppet with the ice-cream expressed happiness; the puppet with the orange expressed sadness; the puppet with chocolate expressed sadness (even though he had chocolate); the puppet who fell expressed happiness (even though he fell). Children scored one point on the *Sally-Anne task* if children pointed to the previous location of the ball or said the previous location. Scores were summed for an overall social cognition score. If children did not pass three tasks in a row, coding stopped, to be consistent with the experimental stop rule. A second coder coded all videos for agreement. Agreement was very good, *ICC* = 0.873.

3.3 Result

3.3.1 Descriptive statistics and intercorrelations

Table 3.9 presents descriptive statistics of raw scores for laboratory and survey measures on social cognition and humour.

Table 3.9 Descriptive statistics of raw scores for all variables

	Mean	***SD***	**Range**	**Skewness**	**Kurtosis**
Social Cognition	4.39	2.84	0-10	0.37	-1.11
Joke Smile	8.98	7.16	0-21	0.21	-1.60
Joke Laugh	1.83	3.13	0-14	2.19	4.49
Joke Copy	4.75	6.39	0-20	1.03	-0.46
Control Smile	7.15	6.62	0-19	0.41	-1.41
Control Laugh	0.74	1.65	0-8	2.93	8.56
Control Copy	4.00	5.55	0-18	1.15	0.26
Soc. Cog. Survey	13.70	5.38	1-22	-0.49	-0.46
Humour Survey	11.75	4.30	3-20	-0.07	-0.77

Note. Soc. Cog. = Social Cognition.

N = 84 for laboratory measures, N = 81 for survey measures.

The normality of variables was checked. Laughter scores in both joke and control trials and copying scores in both joke and control trials were positively skewed. However, we normalised laughter scores in-joke trials with fourth root transformation and copying scores in both joke and control trials with cube root transformations to bring it to an acceptable level (Osborne, 2000). All final scores were within a level of skewness that is widely considered to be of an acceptable ± 2 (George & Mallery, 2010). Laughter in control trials appeared rarely, therefore, these scores turned into a categorical variable as laugh and no laugh conditions across the experiment.

For point biserial correlations of laboratory measures, see Table 3.10. All variables were positively correlated with each other ($p < .01$) except for gender ($p > .05$).

Table 3.10 Summary of point biserial correlations for all variables

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Age in days		.02	.75**	.58**	.49**	.66**	.57**	.37**	.62**
2. Gender [a]			-.06	.07	.14	.01	.09	.17	-.03
3. Social Cognition				.48**	.39**	.54**	.48**	.32**	.47**
4. Joke Smile					.77**	.89**	.95**	.58**	.88**
5. Joke Laugh						.73**	.74**	.66**	.70**
6. Joke Copy							.84**	.56**	.92**
7. Control Smile								.61**	.85**
8. Control Laugh									.48**
9. Control Copy									

Note. [a] Gender was coded as -1 for girls and 1 for boys.
**$p < .01$, $N = 84$.

3.3.2 Validity analyses

A paired samples t-test was conducted to compare each of smiling/laughter/copying between the joke and control conditions to ensure that children appreciated the jokes. There was a significant difference in the scores for smiling in the joke ($M = 15.76$, $SD = 13.32$) and control ($M = 13.43$, $SD = 12.41$) conditions; $t(83) = 5.80$, $N = 84$, $p < .001$, $d = 0.63$. Similarly, there was a significant difference in the transformed scores for laughter in the joke ($M = 0.60$, $SD = 0.69$) and control ($M = 0.30$, $SD = 0.46$) conditions; $t(83) = 5.33$, $N = 84$, $p < .001$, $d = 0.66$. However, there was no significant difference in the transformed scores for producing in the joke ($M = 0.99$, $SD = 1.07$) and control ($M = 0.92$, $SD = 1.02$) conditions; $t(83) = 1.58$, $N = 84$, $p > .05$.

Concurrent validity was checked for both social cognition and humour measures to ensure that children's laboratory tests were significantly correlated to parental reports.

Three participants were excluded from validity analyses because parents of these children did not complete the surveys. First, we checked the validity of social cognition measures. A reliability coefficient of $\alpha = .90$ was found with the current sample for the ESCI. Social cognition laboratory scores correlated moderately with the ESCI (*Spearman's Rho* $r = .551$, $N = 81$, $p < .001$). A partial Spearman's Rho correlation found the same moderate correlation between children's social cognition laboratory scores and the ESCI, controlling for age in days (which was skewed) ($r' = .551$, $N = 81$, $p < .001$). This suggests that children's actual laboratory performances on social cognition were related to parental reports once age was controlled for.

Second, we checked the validity of humour measures. A reliability coefficient of $\alpha = .87$ was found with the current sample for the EHS. Humour laboratory scores including control variables significantly correlated with the EHS except for gender and laughter scores in control trials, $p > .05$ (see Table 3.11 for Spearman's rho correlations). Hierarchical multiple regression was conducted to control for age and humour laboratory control scores. The EHS was entered as a dependent variable. Age (in days) and smiling/laughter/copying in control trials were entered on step one, and smiling/laughter/copying in-joke trials entered on step two as independent variables. The final model, $F(7, 73) = 11.00$, $p < .001$, $R^2 = .52$, found EHS scores increased with age, $\beta = .66$, $t = 6.14$, $p < .001$. Laboratory smiling scores in-joke trials did not correlate with EHS scores, $t = -0.94$, $p > .05$, nor did in control trials, $t = 0.45$, $p > .05$. Laboratory laughter scores in-joke trials did not correlate with EHS scores, $t = 0.34$, $p > .05$, nor did in control trials, $t = -0.76$, $p > .05$. Laboratory humour production scores (copying) in-joke trials did not correlate with EHS scores, $t = -0.03$, $p > .05$, nor did in control trials, $t = 1.08$, $p > .05$. This suggests that humour laboratory measure did not relate to the EHS once age was controlled for.

Table 3.11 Spearman's Rho correlations between humour laboratory scores and the EHS

Lab humour measures	***r* EHS**
1. Age in days	.71**
2. Gender	-.04
3. Joke Smile	.37**
4. Joke Laugh	.35**
5. Joke Copy	.48**
6. Control Smile	.38**
7. Control Laugh	.20
8. Control Copy	.49**

Note. $^{**}p < .01$, $N = 81$.

3.3.3 Predicting social cognition laboratory scores with humour

Stepwise multiple regression was conducted to examine whether humour variables (smiling/laughter/copying and parental reports of humour) predicted social cognition laboratory scores. Social cognition laboratory scores were entered as the dependent variable. Age (in days), gender, and smiling/laughter/copying in control trials were entered on step one, and smiling/laughter/copying in-joke trials entered on step two as independent variables. The overall regression model was found to be significant ($F(1,82) = 107.94$, $p < .001$). In predicting social cognition laboratory scores, the variables on step two did not account for a significant increment in R^2 ($p > .05$) (see Table 3.12).

Table 3.12 Summary of stepwise multiple regression analysis for demographic and humour variables predicting social cognition laboratory scores

	R^2	*b*	SE *b*	β
Step 1	.57			
Constant		.51	.43	
Age (in days)		.01	.01	.75***
Gender				-.07
Control Smile				.08
Control Laugh				.05
Control Copy				.01
Step 2				
Joke Smile				.07
Joke Laugh				.03
Joke Copy				.08

Note. p*** < .001, N = 84

3.3.4 Predicting humour laboratory scores with social cognition

Three hierarchical multiple regression analyses were conducted to examine whether social cognition laboratory scores predicted any humour laboratory variables. First, smiling in-joke trials was entered as a dependent variable, which represents humour appreciation. Age (in days), gender and smiling in control trials were entered on step one, and social cognition laboratory scores were entered on step two as independent variables. The overall regression model was found to be significant (R^2 = .93, p < .001). In predicting smiling in-joke trials, the variable on step two did not account for a significant increment in R^2 (R^2 Δ = .000, p > .05) (see Table 3.13).

Table 3.13 The first hierarchical multiple regression analysis for control variables and social cognition predicting smiling in-joke trials (humour appreciation)

	R^2	ΔR^2	β
Step 1	.93		
Age (in days)			.07
Gender			.01
Control Smile			.92***
Step 2	.93	.000	
Soc. Cog. Lab			.03

Note. p*** < .001, N = 84

Second, laughter in-joke trials were entered as a dependent variable, which represents humour appreciation. Age (in days), gender and laughter in control trials were entered on step one, and social cognition laboratory scores were entered on step two as independent variables. The overall regression model was found to be significant (R^2 = .51, p < .001). In predicting laughter in-joke trials, the variable on step two did not account for a significant increment in R^2 (R^2 Δ = .000, p > .05) (see Table 3.14).

Table 3.14 The second hierarchical multiple regression analysis for control variables and social cognition predicting laughter in-joke trials (humour appreciation)

	R^2	Δ R^2	β
Step 1	.51		
Age (in days)			.28*
Gender			.05
Control Laugh			.54***
Step 2	.51	.000	
Soc. Cog. Lab			.01

Note. $p^{***} < .001$, $p^{*} < .05$, $N = 84$

Third, copying in-joke trials were entered as a dependent variable, which represents humour production. Age (in days), gender and copying in control trials were entered on step one, and social cognition laboratory scores were entered on step two as independent variables. The overall regression model was found to be significant ($R^2 = .87$, $p < .001$). In predicting copying in-joke trials, the variable on step two did not account for a significant increment in R^2 (R^2 Δ = .005, $p > .05$) (see Table 3.15).

Table 3.15 The third hierarchical multiple regression analysis for control variables and social cognition predicting copying in-joke trials (humour production)

	R^2	ΔR^2	β
Step 1	.87		
Age (in days)			.13*
Gender			.03
Control Copy			.84***
Step 2	.87	.005	
Soc. Cog. Lab			.10

Note. *$p < .05$, ***$p < .001$, $N = 84$

3.3.5 Predicting parental survey scores with children's laboratory scores

Stepwise multiple regression was conducted to examine whether humour laboratory scores (smiling/laughter/copying in-joke trials) predicted social cognition survey scores. Social cognition survey scores were entered as the dependent variable. Age (in days), gender, and smiling/laughter/copying in control trials were entered on step one, and smiling/laughter/copying in-joke trials were entered on step two as independent variables. The overall regression model was found to be significant ($F(1,79) = 86.83$, $p < .001$). In predicting social cognition survey scores, none of the variables on step two accounted for a significant increment in R^2 ($p > .05$) (see Table 3.16).

Table 3.16 Summary of stepwise multiple regression analysis for demographic and humour laboratory scores predicting social cognition survey scores

	R^2	*b*	SE *b*	β
Step 1	.52			
Constant		6.58	.87	
Age (in days)		.01	.01	.72***
Gender				.07
Control Smile				.05
Control Laugh				-.06
Control Copy				.02
Step 2				
Joke Smile				.05
Joke Laugh				-.02
Joke Copy				.03

Note. p*** < .001, N = 81

Another hierarchical multiple linear regression was carried out to examine whether social cognition laboratory scores predicted humour survey scores. Humour survey scores were entered as the dependent variable. Age (in days) and gender were entered on step one, and social cognition laboratory scores were entered on step two as independent variables. The overall regression model was found to be significant (R^2 =.49, p < .001). In predicting humour survey scores, none of the variables on step two did account for a significant increment in R^2 (R^2 Δ = .000, p > .05) (see Table 3.17).

Table 3.17 Summary of hierarchical multiple regression analysis for demographic and social cognition laboratory scores predicting humour survey scores

	R^2	ΔR^2	β
Step 1	.49		
Age (in days)			.70***
Gender			-.05
Step 2	.49	.000	
Soc. Cog Lab			-.02

Note. p*** < .001, N = 81

3.3.6 Gender differences

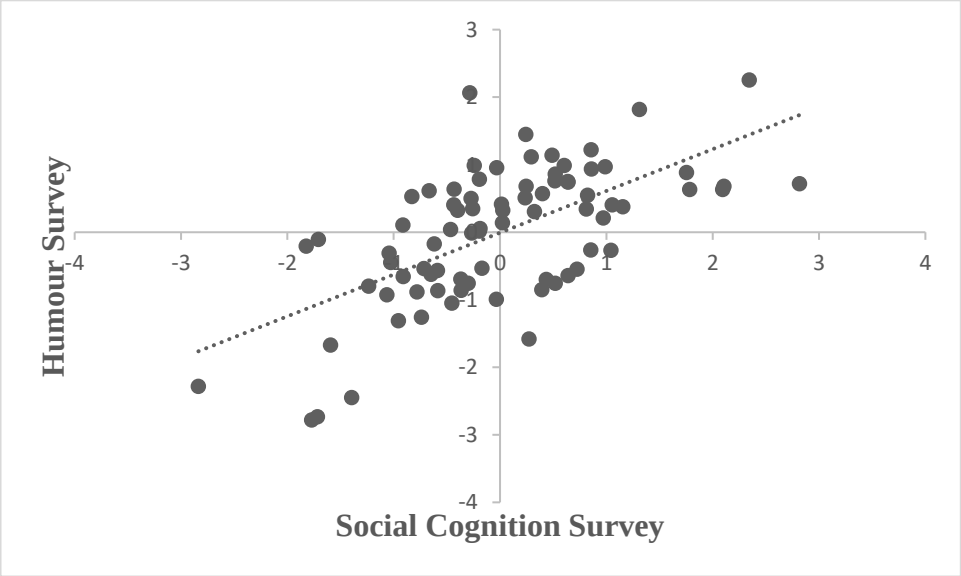
All the above hierarchical multiple regression analyses were repeated to check whether gender moderated any associations. All independent variables were centred to before inclusion in the models. Because gender is a dichotomous variable, it was dummy-coded such that girls were coded as "-1" and boys coded as "1".The product terms "joke smile × gender", "joke laughter × gender", "joke copy × gender" and "social cognition laboratory scores × gender", were entered on step three to examine any moderation effect (Baron & Kenny, 1986). There was no significant moderation effect at any set of analyses.

3.3.7 The relationship between social cognition and humour based on parental surveys

Lastly, we ran correlational analyses on parental surveys as a replication of Study 1 in Chapter 2. A Pearson product-moment correlation was run to determine the relationship between age in days and social cognition. There was a strong, positive correlation between age in days and social cognition, which was statistically significant (r = .724, N = 81, p < .01). Similarly, the same analysis was conducted to look at the

relationship between age in days and humour. There was a strong, positive correlation between age in days and humour, which was statistically significant (r = .701, N = 81, p < .01). Therefore, we ran a partial correlation while controlling for age to determine the relationship between social cognition and humour. The correlation remained still significant between social cognition and humour (r' = .603, N = 81, p < .001).

Figure 3.3 The relationship between the standardised residuals of social cognition and humour survey scores controlling for age



3.4 Discussion

It is the first study to investigate the relationship between social cognition and humour from 3 to 47 months in a laboratory setting. We found positive correlations between social cognition and smiling/laughter/copying scores both for the humour and control conditions. However, the regression model found that once age was accounted for, neither smiling, laughter, nor the production of jokes predicted social cognition, in either the control condition or the joke condition, or vice versa. There were no gender differences at any regression models. As we expected, children smiled/laughed more in humour trials than control trials, showing that children did appreciate the humour in the experiment. In terms of parental surveys, there was a positive relationship between social

cognition and humour scores between the surveys alone, even when accounting for age, but not between the surveys and the laboratory tasks. It suggests that the surveys and the laboratory tasks capture different aspects of socio-cognitive and humour skills.

Examining social cognition and humour together has received little attention so far. Undeniably, the findings on this particular topic remain complex. The laboratory findings both converge with an experimental study (Robison, 2000) and diverge with some previous studies (Bosacki, 2013), including Study 1 (see Chapter 2). However, there are experimental differences within these studies which need to be focused on carefully.

One possible explanation may be because we used different research settings to investigate this association. While Study 1 measured children's socio-cognitive and humour skills via parent-report survey, Study 2 looked at children's performance in the laboratory. Punch (2002) emphasised the sensitivity of the research context and settings in child studies. Child studies may have different sample sizes with limited demographics, may include different cultural backgrounds, and may use different measurements such as observations, surveys or laboratory tasks. However, the expected behaviour should be observed in a sample under any condition, which means that generalisation of behaviour is essential in child studies. Some studies have found no differences between research settings. For instance, 14-month-olds did not differentiate how they searched for information when they did so in either the home or the laboratory (Schieler, Koenig & Buttelmann, 2018). Likewise, 2-year-olds were good at copying new skills from a live model regardless of the research setting (home vs laboratory) (Strouse & Troseth, 2008). A recent case study showed that a child with ASD improved his communication skills using a speech-generating device regardless of whether he was at home, school, or the clinic (Waddington, van der Meer, Carnett & Sigafoos, 2017). However, other research has found some differences across research settings. While toddlers imitated from video clips in the laboratory, they did not do it at home from their television (Strouse & Troseth,

2008). A case study showed that many oppositional behaviours of a child decreased at home with his caregiver's appropriate attention, but not at school (Wahler, Vigilante & Strand, 2004). The generalisation of behaviour happens in some situations but fails in others. Children may demonstrate explicit behaviours, especially joking ones, to their parents in their naturalistic environment comfortably rather than to an experimenter in the laboratory. Therefore, parental surveys (Hoicka et al., under review; Tahiroglu et al., 2014) may be a better way to capture the relationship.

Another possible explanation may be due to the different and broader age range used in Study 2 compared to past research. Bosacki (2013) worked with 8-year-olds at time 1 and 10-year-olds at time 2, and Robison (2000) worked with 4- to 8-year-olds. We aimed to reveal this particular relationship from infants to pre-schoolers. Study 2 did not find any significant relationship between social cognition and humour, whereas Bosacki (2013) did. Robison (2000) found a partial relationship between the understanding of others' mental states and humour: others' knowledge was positively related to humour whereas desire understanding was not. That is, 10-year-olds showed a relationship, but the relationship was blurred among the younger ones (4-8). Maybe this relationship becomes clearer at an older age rather than an early age. The early competence account (Roth & Leslie, 1998) proposed that early competence at standard false-belief tasks is masked by demanding features of tasks in young children. For instance, children with ASD do well on false photograph tasks, whereas they fail on standard false-belief tasks, although these two tasks include similar problem-solving forms (Leekam & Perner, 1991). The social cognition tasks and humour test in Study 2 might be challenging for young children, but not for older children in Bosacki's study (2013). While socio-cognitive skills and humour still develop in early childhood, changes in age may affect the outcome of Study 2. If this is the case, the relationship between social cognition and humour might be better captured in later years.

Lastly, there may be individual differences in social skills; thus, it is essential to look at the literature on the relationship between social cognition, humour and, e.g., temperament. One study specifically investigated associations between temperament and social responsiveness in young children (Salley, Miller & Bell, 2013). They found that different negative dimensions of temperament were observed in different age groups, such as discomfort at 2 years, fear at 3 years, and sadness and less soothability at 4 years. One positive aspect of temperament, effortful control, did not appear until 4 years of age. Salley et al. (2013) concluded that negative dimensions of temperament inhibit children's responses. Discomfort may be a precursor to social unresponsiveness at an early age. Children may have preferred not to answer rather than failing in Study 2. Also, younger children might have been less adaptive to the tasks. They may not have come across direct questions before as "How does this boy feel?" while showing a happy face and that may have been difficult.

The studies which examined the link between social cognition and temperament directly in pre-schoolers found that ToM skills positively correlated with shyness, but not with fearfulness (LaBounty, Bosse, Savicki, King & Eisenstat, 2017; Lane et al., 2013). A temperament may lead to behaviorally inhibited, socially withdrawn and less responsive children in social cognition tasks in Study 2, especially when interacting with strangers. Correlational temperament-humour studies also draw the same picture. According to an fMRI study, shyness was negatively related to brain activity in humour processing among school-aged children (Vrticka, Black, Neely, Sheely & Reiss, 2013). Beyond that, while affiliative and self-enhancing humour styles were negatively associated with shyness, aggressive and self-defeating ones were positively associated with it in a Turkish undergraduate sample (Erozkan, 2009). Young children may be unresponsive in social cognition and humour tasks due to temperament traits rather than

failing. Young children may be shyer in general, and they may not openly laugh with a stranger.

Finally, although we used validated social cognition tasks, we prepared the humour appreciation and production test according to previous parental reports (Hoicka et al., under review; Hoicka & Akhtar, 2012). Indeed, parental reports and laboratory measures of social cognition showed a good correlation once age was accounted for, which was evidence of validity. One limitation of Study 2 may be a lack of validated humour measurements for young children. Indeed, parental reports and laboratory measures of humour were not correlated once age was accounted for. Nevertheless, Study 2 did give some validation within the conditions of jokes/normal actions. Children smiled and laughed more in-joke trials rather than control trials. Laboratory tasks have focused on group differences so far (Mireault et al., 2015; Mireault et al., 2014; Hoicka & Akhtar, 2011; Hoicka & Gattis, 2008), not individual differences. Thus, the problem may be the failure of capturing individual differences in humour in a laboratory setting. This explanation is consistent with previous studies (Mireault et al., 2012; Ruch, 1997). One study investigated whether humour appreciation from 3-to-6 months predicts attachment security at one year using two designs to measure humour appreciation in infants (Mireault et al., 2012). One of them was an observational design at home called "state humour" whereas the other one was a survey design called "trait humour." These two measurements were not correlated. Furthermore, only parent-reported humour predicted attachment security, not the researchers' observations. It suggests that parent reports and observational measures of early humour capture different things (Ruch & Kőhler, 1998).

Study 2 is important as it examines the relationship between social cognition and humour behaviourally with a good sample size. It suggests that this relationship does not hold in a laboratory setting, but it still holds in parental surveys. Therefore, future research should focus on heterogeneity among different research settings to make the findings

generalised. Because temperament is a valuable indicator of social responsiveness (Salley et al., 2013) and its negative dimensions (e.g. shyness) are closely related to social cognition (LaBounty et al., 2017; Lane et al., 2013) and humour (Vrticka et al., 2013) in children, it may have a role of children's engagement in socio-cognitive and humour tasks. Introvert or shy children may inhibit themselves to engage with experimenters whereas extrovert ones may be disposed to participate in the tasks. Future studies should consider temperament traits as moderators to reveal whether there is a causal pathway among social cognition, humour and temperament. Besides, there is a need to develop a humour task for young children to capture individual differences.

The relationship between social cognition and humour in young children is still complex based on Study 1 (Chapter 2) and Study 2 (Chapter 3). Different research designs (longitudinal parental reports vs laboratory-based experiment) reached different conclusions. Nevertheless, both Study 1 and Study 2 are important to show how social cognition and humour are related, the patterns of changes in social cognition and humour and how early life circumstances affect later outcomes (predictive relationships). For example, Study 1 is evidence that children who engage in humour more in their early life may develop a better understanding of their own and others' mental states later. However, correlational studies do not inform us about the causality between social cognition and humour. A training study with an active comparison group assigned quasi-randomly may provide information about a possible causal relationship between social cognition and humour in young children. According to the findings of Study 1 (Chapter 2), humour training would be much appropriate to improve socio-cognitive skills in young children since humour predicted social cognition over time. However, we designed a training study in the next chapter before we obtained the findings of the longitudinal study. The reasons for designing a social cognition training at the first place are: 1) social cognition at time 1 was positively associated with humour at time 2 in an older sample (Bosacki, 2013). 2)

Social cognition training improved humour skills in 4-and-5-year-olds (Lecce et al., 2014). 3) Social cognition training studies have been commonly used to improve other social and cognitive skills in children such as emotion (Grazzani-Gavazzi & Ornaghi, 2011), verbal deception (Ding, Wellman, Wang, Fu & Lee, 2015), social adjustment (Houssa & Nader-Grosbois, 2016), or metamemory (Lecce et al., 2014); on the contrary, there is no humour training study conducted with pre-schoolers to improve social or cognitive skills to date. Therefore, we conducted a social cognition training to learn a deeper understanding of the relationship between social cognition and humour in 3-year-olds. The next chapter will acknowledge whether any improvements in understanding others' mental states will cause a change in humour skills.

Chapter Four

Study 3: Testing a social cognition training programme to improve pre-schoolers' humour understanding

Study 3 was conducted to find out if there is a causal relationship between social cognition and humour in 3-year-olds. Half of 40 children were assigned to the experimental group and were trained in emotion understanding and false belief understanding. The other half was assigned to the control group, who were trained in Piagetian conservation tasks. All of the children completed three different versions of social cognition tasks at both baseline and post-test, and one humour appreciation and production test, including 11 jokes and 11 control actions. There was no significant training effect on humour skills in pre-schoolers. We suggest more research is necessary for replication and extension with broader sample size and a more extensive range of assessments.

4.1 Introduction

Humour is valuable due to its positive impact on physical health (Kimata 2004a; 2004b), psychological wellbeing (Martin & Lefcourt, 1983; Szabo et al., 2005), psychological adjustment (Fox, Hunter & Jones, 2016) and memory (Summerfelt, Lippman & Hyman, 2010). Humour can also function as a shared socio-cognitive interaction by child and parent (Hoicka & Butcher, 2016; Mireault et al., 2015; Mireault et al., 2012). Social cognition is defined as the social behaviour underlying cognitive processes consciously or unconsciously related to the social environment (Ric, 2015). In other words, social cognition is related to how people make sense of their behaviours and others' behaviours. Social cognition assists in grasping real meanings of different dimensions of cognition, such as emotions, beliefs or intentions. Past research suggests that social cognition might be necessary for developing humour in later life (Bosacki,

2013), but we do not know it is true in early development. If social cognition is a prerequisite of humour, training in socio-cognitive skills may causally influence children's humour development. Such social cognition training may also provide the underlying mechanisms of humour. For example, telling a joke intentionally creates a false belief for listeners and a joker's aim is that listeners should know that the joke is a false statement (Leekam, 1991). Mastering in false belief understanding in young children may improve their humour production (e.g., joke-telling behaviour), which is important because such training may enhance real-life outcomes.

Humour emerges from 3 months in a parental context (Mireault et al., 2012). The types of humour young children like changes throughout early development from clowning early on (Reddy, 2001) through to irony in later years (Angeleri & Airenti, 2014). One argument for why humour may involve social cognition is that understanding jokes requires understanding first-and-second-order intentions (Leekam, 1991). In particular, pre-schoolers distinguished mistakes (unintended falsehoods) from jokes (intended falsehoods), which is called as first-order mental states (Leekam, 1991; Hoicka & Gattis, 2008). Although there is a lack of studies that investigate social cognition and humour together in pre-schoolers, humour comprises sub-scales on several advanced social cognition tests (Happé, 1994; Muris et al., 1994; Tahiroglu et al., 2014). However, a few studies investigate the relationship between social cognition and humour experimentally, including Study 2 (see Chapter 3) (Bosacki, 2013; Robison 2000).

Many studies examine the effect of social cognition training on a wide range of social skills among typical and atypical children (Ding et al., 2015; Houssa & Nader-Grosbois, 2016; Gevers et al., 2006). Social cognition is malleable and can be trained as young as three years and can also have effects on other skills. For instance, pre-schoolers trained on a false belief, desire and perception showed a better understanding of false belief and other theory of mind tasks in comparison with their peers who were trained on

number conservation tasks (Slaughter & Gopnik, 1996). Similarly, 4-and-5-year-olds trained on first-order false belief understanding demonstrated improved advanced social cognition skills and metamemory compared to a control group (Lecce et al., 2014). Beyond pre-schoolers, school-aged children trained in social cognition exhibited better emotion comprehension, improved socio-cognitive skills and more empathy compared to a control group (Ornaghi, Brockmeier & Grazzani, 2014). The pre-schoolers also retained the skill gains six months after the training. Not only has social cognition training been used for developing social cognition itself, but it has also been used to improve social skills and desirable behaviours with typical and atypical children. Pre-schoolers who were not able to lie were more likely to lie after they were trained on false belief tasks and the appearance-reality task (Ding et al., 2015). However, the control group, who were trained on three Piagetian conservation tasks (Gelman, 1969), did not improve this social skill as much as the experimental group (Ding et al., 2015). Another social cognition training study improved emotion regulation, mental state understanding, social competence and social adjustment among pre-schoolers (Houssa & Nader-Grosbois, 2016), compared to a control group. Social cognition training also has an essential contribution to developing the social skills of children with ASD (Cappadocia & Weiss, 2011).

However, the effectiveness of social cognition training on humour skills have been neglected except for a few studies with atypical children and adolescents. For example, in one study, school-age children with pervasive developmental disorders were trained on a variety of social cognition tasks over 21 weeks (Gevers et al., 2006). Children improved significantly on perception/imitation, pretence, first-order belief, and humour/irony, but not on emotions, false-belief understanding, or second-order belief. Even though Gevers et al. had no control group and only had a small sample size, it did demonstrate that there was an improvement in the humour skills of atypical children. In contrast, adolescents with social communication deficits improved significantly on the

use of language, social attention, inferential language, and understanding intentions, but not humour, after a-12-week social cognition training programme (Lee et al., 2016). Researchers pointed out that the humour scale used by Lee et al. had low validity (.46 and .49 in pre- and post-training, respectively). No study has examined whether social cognition training improves humour understanding among typical children with a control group.

The findings of Study 1 (Chapter 2) and Study 2 (Chapter 3) in this thesis are not consistent: Study 1 found a positive correlation between humour and social cognition through parental surveys, but Study 2 did not find the same correlation based on children's laboratory performances. Nevertheless, the longitudinal element of Study 1 is promising to suggest a cause-and-effect relationship, such that developments in humour lead to developments in social cognition. However, there is a need to be cautious while drawing inferences about causality between humour and social cognition. The predictions of the longitudinal study may not be replicated in another sample due to the nature of the data. For example, parents may answer questions to show their children better in socio-cognitive and humour skills. On the contrary, the questions of parental surveys may not mean anything to parents if they rarely engage in humorous activities with their children. Those parents may simply report that their children cannot do several humorous skills, which may not true because both parents and children have a lack of experience in humour. Additionally, the measurements we used in Study 1 (Chapter 2) may lead to finding an association. As an example, observational measures of humour (e.g., smiles, laughter) did not predict secure attachment among infants whereas parental reports of humour did predict secure attachment 6 months later (Mireault, Sparrow et al., 2012). Therefore, the strongest study design to make a causal inference between these two constructs would be a controlled training study because it is comparative on a group level and may minimise bias and confounding factors. Controlled training studies give a chance

to children to engage with humorous activities and socio-cognitive skills regardless of experience.

The aim of Study 3 was to investigate whether social cognition training improved humour understanding in typically developing 3-year-olds. Study 2 showed that over half of 3-year-olds did not pass emotion perspective-taking and false belief understanding tasks, so pre-schoolers could be taught that people may have different feelings towards the similar situations or may have false beliefs about the world that contradicts with the reality.

The second aim of Study 3 was to find more evidence that social cognition training improves emotion and false belief understanding among pre-schoolers. In previous studies, children have been trained on emotions (Houssa & Nader-Grosbois, 2016; Ornaghi et al., 2014) and false beliefs (Ding et al., 2015; Lecce et al., 2014; Slaughter & Gopnik, 1996), but there has been no training on emotion-perspective taking task (Denham, 1986).

Based on Study 2, we recruited 3-year-olds as they were unlikely to do well at emotion perspective-taking and false belief understanding. Half of the children were assigned to the experimental group which involved social cognition training, while the other half were assigned to a control group which involved training on three Piagetian conservation tasks (Gelman, 1969). Conservation was defined as the cognition that properties (e.g. number, length, quantity) remain the same, although their shapes, parts in space or sections change (Flavell, 1963). Since this is cognitive training, not socio-cognitive training, children were not expected to improve on humour. Piagetian conservation tasks have been used before in some training studies as a control condition (Ding et al., 2015; Slaughter & Gopnik, 1996).

We expected that after the training, the group which received the social cognition training would show significantly more improvement (than the control group) in their humour skills, significantly more improvement (than the control group) in their emotion perspective-taking and significantly more improvement (than the control group) in their false belief understanding.

4.2 Method

4.2.1 Participants

A power analysis found 52 participants were needed for a large effect size (f = 0.40), with α = 0.05, power = 0.80 (Faul et al., 2007). Participants were 40 typically developing 3-year-olds: 20 in the Training group (*M* age = 42.35, *SD* age = 2.56, Range = 37 – 47 months; 11 males, 9 females), and 20 in the Control group (*M* age = 41.85, *SD* age = 2.52, Range = 38 – 47 months; 8 males, 12 females). The participants were White (*N* = 20), Arab (*N* = 6), of mixed ethnicity (*N* = 5), Pakistani (*N* = 3), Black (*N* = 2), Asian (*N* = 1), or did not report their ethnicity (*N* = 3). All children were exposed to English, but nine of them were exposed to one additional language, and three of them exposed to two additional languages. Children (*N* = 39) spent time in the nurseries between 11 and 45 hours in a week (*M* = 23.01, *SD* = 9.24). One parent did not report the hours his/her child spent in the nursery. Parents' highest level of education was a Postgraduate degree (15), Undergraduate degree (12), High School (9) or did not report their education level (4). Children did not have any known disabilities, and only seven of them had a sibling. Further children were excluded because they were unwilling to join in (10), missed training sessions/post-test (8), passed all social cognition tasks in the pre-test (4), did not speak English (3), and technical problems with the videos (1). Children were recruited in seven nurseries in England, which received a small donation for their participation. Study

3 received ethical approval from the University of Sheffield Psychology Department Ethics Committee.

4.2.2 Materials

The materials for the humour appreciation and production test in both the pre-test and post-test were a glove, two toy dogs, a toy donkey, a toy horse, a toy spoon, a child book, a toy palm tree, a toy cup, a toy rabbit, a toy pig, a toy sheep, a toy cow, a toy ball, a toy rubbish bin, and a crumpled piece of paper.

For the emotion labelling tasks in both pre-test and post-test conditions, there were eight different pictures of children showing four emotions (e.g., happy, sad, angry, scared).

For the emotion-perspective taking tasks in both pre-test and post-test conditions, there was a monkey puppet, an elephant puppet, a toy orange, a horse puppet, a rabbit puppet, pictures of an ice-cream, a chocolate bar, a video game, a broken toy, and a zoo.

For the false belief tasks in both pre-test and post-test conditions, there were two toy figures, two small boxes, a marble, a Smarties box, and two pencils.

For the social cognition training, there were 12 different children's pictures showing emotions for the emotion labelling task; pig, sheep, cow, tiger, giraffe, and elephant puppets; pictures of a slide, a puzzle, a bed, a funfair, a bike, broccoli, a balloon, a pallet and a brush to depict scenarios for the emotion perspective-taking task; a picture-based Maxi test, a plaster box, a plastic toy horse, two toy figures, the pictures of a backpack and a closet for the false belief tasks.

For the Piagetian Conversation training tasks, there were ten checkers pieces, two same-length pens and two identical balls that were made of Play-Doh.

Four SONY digital cameras were used to record each condition.

4.2.3 Design

To control for differences in socio-cognitive skills, humour appreciation (smiling) and humour production (copying) in the pre-test between the experimental group and control group, we used five between-subjects ANCOVAs to test group differences, with pre-test scores as the covariates.

4.2.4 Procedure

Pre-test and post-test were conducted by the same researchers. The training sessions were conducted by five different researchers. Testing and training were also double-blind. A seventh researcher quasi-randomly assigned participants to each condition, ensuring approximately equal numbers of boys and girls, equal mean ages, and equal social cognition scores at the pre-test, across the groups. Before the study, parents signed consent forms and were informed about the study. Children were tested and trained for up to four weeks, depending upon the nurseries' schedule. All sessions were video-recorded. At the end of each training or testing session, a sticker was given to the child. We had planned to include laughter scores in pre-test and post-test, but laughter was rare. Any Box-Cox transformations (Osborne, 2000) and the two-step approach (Templeton, 2011) did not work to normalise them. That is why we have avoided using all laughter scores as variables.

4.2.4.1. Pre-test. Children were tested on three social cognition tasks (emotion labelling task, emotion perspective-taking task, and Sally-Anne task). The social cognition tasks were chosen as in Study 2 (see Chapter 3, pages 78-82), just over half of 3-year-olds were not successful in understanding emotion perspective-taking and more than two-thirds of them did not pass a false-belief task. Children who passed all three social cognition tasks were dropped from the study because their social cognition scores could not be improved. A reliability coefficient of α = .29 was found with the

current sample for social cognition at pre-test. Due to the low reliability, each social cognition variable was analysed separately. Children were then tested on the humour appreciation and production test, which consisted of 11 jokes and 11 control actions. These jokes were chosen because fewer than 75% of 3-year-olds smiled at, laughed at, or produced these particular jokes in Study 2 (see Appendix B). Reliability coefficients of α = .94 and α = .94 were found with the current sample for smiling (humour appreciation) and copying (humour production) respectively at pre-test.

In the emotion labelling task (Denham, 1986), the experimenter (E) presented four pictures of children with happy, sad, angry and fearful faces in this order, and asked how the children in the pictures felt. If children did not answer within 10 seconds, E repeated the question.

In the emotion perspective-taking task (Denham, 1986), four puppet scenarios were presented to children. In two of them expressed compatible emotions towards the situation, the other two expressed opposite emotions towards the situation. This task was used to determine whether children understood that sometimes people have expected emotions, while sometimes they have unexpected ones. For instance, E used a monkey puppet and said, "I have got an ice-cream. Yay!" while showing an ice-cream picture, or E used an elephant puppet and said, "I have got chocolate. Oh no!" while showing a bar of chocolate. In the latter example, the emotion was unexpected but could be explained by the fact that the particular elephant did not like chocolate. Then, E asked how the puppets felt. If children did not answer within 10 seconds, E repeated the question.

In the Sally-Anne task (Baron-Cohen et al., 1985), E presented Sally and Anne, saying, "This is Sally, and this is Anne." E checked if children had learned the toy figures' names. Then E said, "Sally is putting the ball into her basket and is hiding behind me. Anne is moving the ball into her basket and leaves as well. When Sally returns, where

will she look for the ball?" If children did not answer within around 10 seconds, E repeated the question.

In the humour appreciation and production test, three blocks included 11 jokes and 11 control actions. Some examples of jokes were putting a glove on their foot, calling a dog a sheep, and making the wrong animal sound (e.g., The horse goes quack quack!). Some examples of normal actions were putting a glove on their hand, calling donkey a donkey, and saying the correct animal sound (e.g., The horse goes neigh neigh!) (see Appendix B for the full list). Pre-schoolers have often engaged with these kinds of object-based, label-based and conceptual jokes in past studies (Hoicka & Akhtar, 2012). The control actions matched to the jokes by correcting falsehood. Each block consisted of three or four control actions, and three or four matched humorous actions. E and the child sat face to face and then E said to the child: "I am going to show you some things!"

Each block started with the control trials first. Before showing each action, E said, "Look" to focus their attention. Each action was repeated twice. Each action/joke was followed with a small laugh to encourage children to make a joke. For consistency, this small laugh was also applied in the control condition. In the control trials, children were then told, "Now, you try!" In the joke trials, E said to the child, "Now, you joke!" If the child did not answer within around 10 seconds, E repeated the question. After the child's response, E said, "Okay!" regardless of the response.

4.2.4.2. Post-test. The procedure was the same as the pre-test with different materials, scenarios, and jokes/control actions in emotion labelling task, emotion perspective-taking task and humour appreciation and production test. The post-test was counterbalanced between the social cognition test and humour appreciation/production test (see Appendix C for jokes/control actions at post-test). A reliability coefficient of α = .46 was found with the current sample for social cognition at post-test. Similar to the

pre-test, each social cognition variable was analysed separately due to the low reliability. Reliability coefficients of α = .92 and α = .93 were found with the current sample for smiling (humour appreciation) and copying (humour production) respectively at post-test.

The only difference in social cognition tasks from the pre-test was the Smarties test (Hogrefe, Wimmer & Perner, 1986). E presented a Smarties box and asked what it contained. Then E showed that there were two pencils inside the box. Next, children were told that the headteacher was going to be asked what was in the box. Then E asked, "What do you think the headteacher will say?" If the child did not answer within 10 seconds, E repeated the question.

4.2.4.3. Social cognition training. Children in both groups were trained for three days. The procedure of the training was adapted from previous training studies (Slaughter & Gopnik, 1996; Ding et al., 2015).

Children were trained on emotion labelling, emotion-perspective-taking, and different false belief tasks. In the emotion labelling and emotion-perspective taking tasks, children were shown four different pictures, four different scenarios, and three different false belief tasks based on the primary tasks. This training aimed to give children feedback and reinforce correct answers.

Emotion labelling training. E showed happy, sad, angry, or scared faces to children and asked how each child felt. According to the child's answer, E gave feedback: "Yes, he feels happy" or "No. He feels happy." Then, E asked why the child thought he felt, e.g., happy. If the answer was appropriate, E reinforced the answer ("Yes, he is happy"). E first repeated what the child said and then gave another appropriate reason: "Maybe he is happy because he got a gift from his mum." If the answer was incorrect, E asked why they thought that: "I do not know about that. Why would [repeat what child

said] make him feel sad" and then, E gave the same appropriate reason: "Maybe he is happy because he got a gift from his mum" (see Appendix D for the full script).

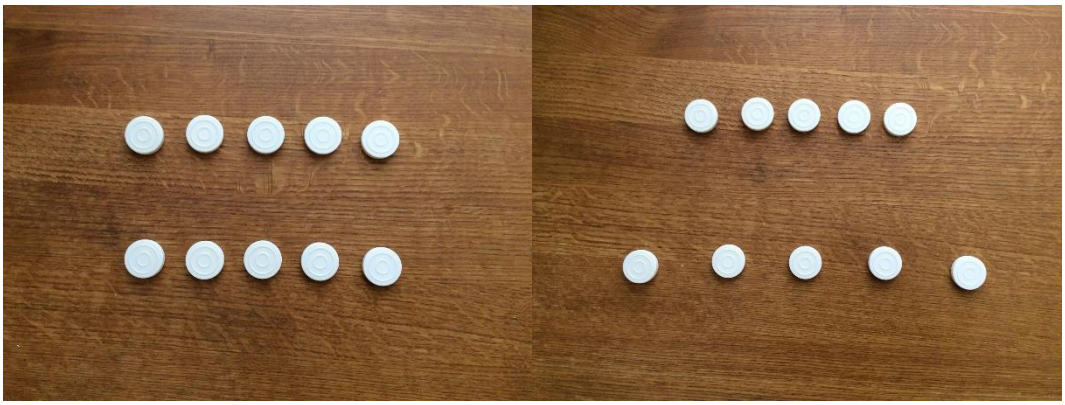
Emotion perspective-taking training. E presented four different puppet scenarios to children as in the pre-test, across three days. However, children were given feedback and possible reasons related to the scenarios. For instance, E used a pig puppet and said, "I am going down the slide. Yaaay!" while moving the puppet down a large paper slide. E asked, "How does the pig feel?" If the child did not respond or replied, "I do not know," E repeated the question. If they gave an appropriate response, then E said, "Yes, the pig is happy because [repeated what the child said]. If they gave an inappropriate response, E said, "I do not know about that. Why would [repeated what the child said] make it feel sad?" After the child responded, E gave an appropriate reason, "The pig is happy because it thinks slides are really fun" (see Appendix E for the full script).

False belief training. We used the Maxi test (Wimmer & Perner, 1983), the plaster box test (Wellman & Liu, 2004), and the explicit false belief task (Wellman & Liu, 2004). In the explicit false belief task, a toy figure (Scott), and pictures of a backpack and a closet were shown to the children. E said, "Here is Scott. Scott wants to find his mittens. His mittens might be in his backpack, or they might be in the closet. Really, Scott's mittens are in his backpack. But Scott thinks his mittens are in the closet. So, where will Scott look for his mittens? In his backpack or the closet?" According to the children's response, E said, "Yes, he will look in the closet" or "No. He will look in the closet". Then E asked, "Why will he look in the closet?" According to the child's response, E said, "Yes, that is right" or "No, that is not right" and said, "He will look in the closet because he thought his mittens were in the closet. He did not know his mittens were in his backpack." The structure of false belief training was the same in all three tests (see Appendix F for the full script).

4.2.4.4. Piagetian conservation training. Children in the control group were trained on three Piagetian conservation tasks: the number conservation task, the length conservation task, and the mass conservation task (Gelman, 1969). The control training aimed to have active training for the control group. Thanks to this training, children may learn reasoned psychological knowledge about features of physical objects as opposed to intuitive psychological knowledge. Children received appropriate feedback and learned the correct answers.

Number conservation task. E presented two sets of checkers in one-to-one-correspondence to the child and asked, "Do these have the same or a different number of checkers?" According to the children's response, E gave feedback, "Yes, they are the same" or "No. They are the same." Then, E spread them out, so one row looked longer and repeated the question. E gave appropriate feedback again and asked, "Why are they the same?" After the children responded, E said, "The number of checkers is still the same. Look," E counted the checkers. "It is the same because there is five in both groups." (see Figure 4.4).

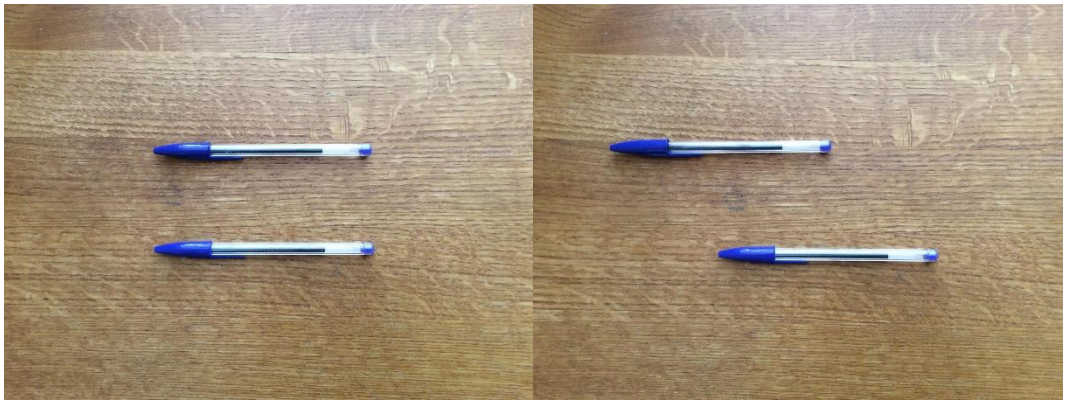
Figure 4.4 Number conservation task



Length conservation task. E presented two pens in parallel to the children and asked, "Do the pens have the same or different lengths?" According to the child's response, E gave feedback: "Yes, they are the same" or "No. They are the same." Then,

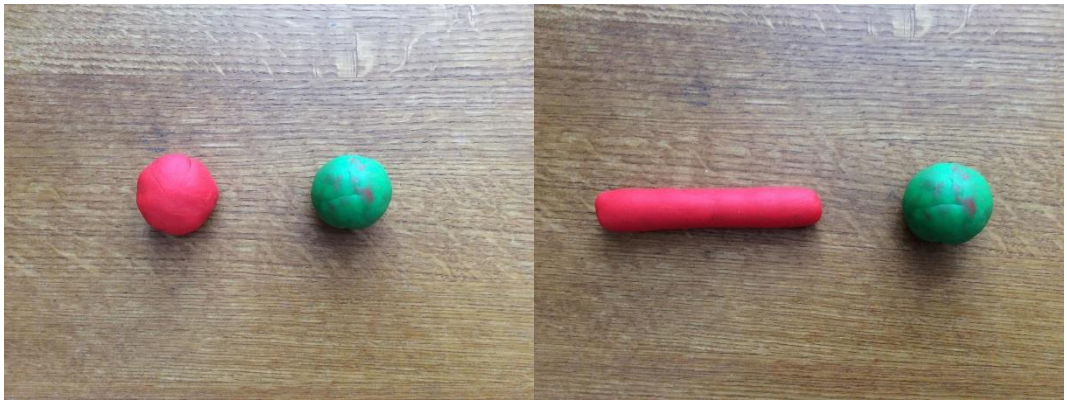
E moved one pen offset to the other and repeated the question. E gave appropriate feedback again and asked, “Why are they the same?” After the children responded, E said, “Their lengths are still the same. I used the same pens. When you change their places on the table, their lengths never change.” (see Figure 4.5).

Figure 4.5 Length conservation task



Mass conservation task. E presented two identical balls that were made of Play-Doh to the children and asked, “Are the balls the same size or different?” According to the child’s response, E gave feedback: “Yes, they are the same” or “No. They are the same.” Then, E rolled one ball to make it into a snake shape and repeated the question. E gave appropriate feedback again and asked, “Why are they the same?” After the children responded, E said, “They are exactly the same size because we used the ball to make a snake. Its shape changed, but its size did not change. We can make it a ball again.” (see Figure 4.6).

Figure 4.6 Mass conservation task



4.2.5 Coding

The tasks in the pre-test and post-test were coded just as Study 2 in Chapter 3 pages 82-84.

There were different measures for the Humour appreciation and production test: First, children scored 1 point for each joke they smiled at, culminating in a humour appreciation score. The maximum possible score for humour appreciation was 11 for each child. Second, children scored 1 point for each joke they copied, while smiling, culminating in a humour production score. The maximum possible score for humour production was 11 for each child. We used the same coding procedure for control actions to act as a control variable. A second coder coded 12 (30%) of the videos. At pre-test, the agreement was good, *ICC* = .76 for humour appreciation and was excellent, *ICC* = .93 for humour production. At post-test, the agreement was good, *ICC* = .84 for humour appreciation and *ICC* = .86 for humour production.

Children scored one point on the *Emotion labelling task* if children identified the correct emotions for at least three out of four pictures.

Children scored one point on the *Emotion perspective-taking task* if children correctly identified how the puppets felt for at least three out of four scenarios. For example, if the children said the puppet who went to the zoo expressed happiness; the

puppet who was ignored by friends expressed sadness; the puppet who played a video game expressed sadness (even though generally children like video games), and the puppet who broke his toy expressed happiness (even though the toy was useless).

Children scored one point on the *Sally-Anne task* if children pointed to the previous location of the ball or said the previous location. Children scored one point on the *Smarties task* if they said there must be smarties/chocolate/M&Ms in the box.

Cohen's (1960) kappa was used to calculate inter-and intra-observer agreement for social cognition tasks due to nominal data. At pre-test, scoring agreements for emotion labelling, emotion perspective-taking and false belief were very good, exceeding .90. At post-test, scoring agreements for the three tasks were very good, exceeding .83.

4.3 Result

Humour appreciation scores (smiling) at both pre-test and post-test were negatively skewed, therefore, they were normalised with the square root transformation after a reflection (Osborne, 2000). All final scores were within a level of skewness that is considered to be acceptable at ± 2 (George & Mallery, 2010).

For means and standard deviations of the variables for both groups, see Table 4.18. For point biserial correlations of the tasks among categorical and continuous variables at baseline, see Table 4.19. First, we looked at if there is a group difference at baseline on any of the tasks by running an independent sample t-test. There were no group differences at baseline on any of the tasks (all *p*s > .10).

Table 4.18 Summary of means, standard deviations and 95% confidence intervals by the group at pre-test and post-test

	Active Control Group		**Training Group**	
	Pre (T1)	**Post (T2)**	**Pre (T1)**	**Post (T2)**
Emotion Labelling	0.40 (0.50) [.16, .63]	0.50 (0.51) [.26, .74]	0.40 (0.50) [.16, .63]	0.60 (0.50) [.36, .83]
Emotion Perspective-Taking	0.20 (0.41) [.01, .39]	0.25 (0.44) [.04, .46]	0.15 (0.37) [-.02, .32]	0.30 (0.47) [.08, .52]
False Belief	0.15 (0.37) [-.02, .32]	0.10 (0.31) [-.04, .24]	0.10 (0.31) [-.04, .24]	0.25 (0.44) [.04, .45]
Humour Appreciation	2.03 (0.76) [1.67, 2.39]	2.14 (0.66) [1.83, 2.45]	1.78 (0.71) [1.45, 2.11]	1.89 (0.83) [1.50, 2.28]
Humour Production	4.70 (3.48) [3.07, 6.33]	4.75 (3.61) [3.06, 6.44]	6.20 (3.61) [4.51, 7.89]	4.75 (3.19) [3.26, 6.24]
Appreciation of Control Actions	6.45 (4.06) [4.55, 8.35]	7.25 (3.18) [5.76, 8.74]	7.15 (3.56) [5.48, 8.81]	7.05 (3.84) [5.25, 8.85]
Production of Control Actions	5.20 (3.71) [3.46, 6.94]	5.30 (3.95) [3.45, 7.15]	5.90 (3.70) [4.17, 7.63]	5.00 (3.46) [3.38, 6.62]

Note. Standard deviations are in parentheses and confidence intervals are in square brackets.

Table 4.19 Summary of point biserial correlations between the tasks at baseline

Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Age in days		.04	.18	.15	-.19	.02	.06	-.10	.06
2. Gender [a]			.06	.04	.06	.12	.22	.04	.19
3. Emotion Labelling				.29	.15	.17	.29	.30	.41**
4. Emotion Perspective-Taking					-.17	-.04	.24	.06	.33*
5. False Belief						.09	-.01	.06	.01
6. Humour Appreciation							.39*	.90**	.36*
7. Humour Production								.31	.91**
8. Appreciation of Control Acts									.39*
9. Production of Control Acts									

Note. [a] Gender was coded as 0 for boys and 1 for girls.
$p^{**} < .01$, $p^{*} < .05$, $N = 40$.

4.3.1 Effectiveness of social cognition training on socio-cognitive skills

The first ANCOVA was conducted to investigate potential pre-existing group differences in emotion understanding with emotion labelling scores at pre-test covaried. Emotion labelling scores at post-test were entered as a dependent variable and group (experimental vs control) as a fixed factor. Levene's test and normality checks were carried out, and the assumptions were met for the analysis. The ANCOVA analysis did not reveal a significant effect, $F(1,37) = 0.46$, $p > 0.05$, partial $\eta^2 = 0.01$ (Table 4.20). This suggests that children in the experimental group did not show any improvement in emotion understanding after social cognition training.

Table 4.20 Comparison of the two groups with pre-test emotion labelling covariate

Source	Sum of Squares	DF	Mean Square	*F*	*p*	partial η^2
Corrected Model	1.93 [a]	2	0.97	4.50	0.018	0.20
Intercept	3.37	1	3.37	15.68	0.000	0.30
EL (pre-test) [b]	1.84	1	1.84	8.54	0.006**	0.19
Group	0.10	1	0.10	0.46	0.500	0.01
Error	7.96	37	0.21			
Total	22.00	40				
Corrected Total	9.90	39				

Note. [a] $R^2 = 0.196$ (Adjusted $R^2 = 0.152$). [b] EL = Emotion labelling
**$p < .01$, $N = 40$.

The second ANCOVA was conducted to investigate potential pre-existing group differences in understanding of different causes of others' emotions with emotion perspective-taking scores at pre-test covaried. Emotion perspective-taking scores at post-test were entered as a dependent variable and group (experimental vs control) as a fixed

factor. Levene's test and normality checks were carried out, and the assumptions were met for the analysis. The ANCOVA analysis did not reveal a significant effect, $F(1,37) = 0.24$, $p > 0.05$, partial $\eta^2 = 0.01$ (Table 4.21). This suggests that children in the experimental group did not show any improvement in understanding of causes of others' emotions after social cognition training.

Table 4.21 Comparison of the two groups with pre-test emotion perspective-taking covariate

Source	Sum of Squares	DF	Mean Square	*F*	*p*	partial η^2
Corrected Model	0.79 [a]	2	0.40	2.04	0.144	0.10
Intercept	1.47	1	1.47	7.57	0.009	0.17
EP (pre-test) [b]	0.77	1	0.77	3.95	0.054	0.10
Group	0.05	1	0.05	0.24	0.628	0.01
Error	7.18	37	0.19			
Total	11.00	40				
Corrected Total	7.97	39				

Note. [a] $R^2 = 0.099$ (Adjusted $R^2 = 0.051$). [b] EP = Emotion perspective-taking

The last ANCOVA was conducted to investigate potential pre-existing group differences in false belief understanding with false belief scores at pre-test covaried. False belief scores at post-test were entered as a dependent variable and group (experimental vs control) as a fixed factor. However, Levene's test of equality of variance was violated, $F = 5.80$, $p < 0.05$. Although the Levene test does not matter when we have equal sample sizes per group, we calculated the variance ratio to double-check (Field, 2013). The variance ratio for these data is 0.1936/0.0961 = 2.01, which is less than 5, therefore, we

may accept that the group variances are homogenous (Field, 2013). The ANCOVA analysis did not reveal a significant effect, $F(1,37) = 1.35$, $p > 0.05$, partial $\eta^2 = 0.03$ (Table 4.22). This suggests that children in the experimental group did not show any improvement in false belief understanding after social cognition training.

Table 4.22 Comparison of the two groups with pre-test false belief covariate

Source	Sum of Squares	DF	Mean Square	*F*	*p*	partial η^2
Corrected Model	0.37 [a]	2	0.19	1.27	0.292	0.06
Intercept	1.37	1	1.37	9.39	0.004	0.20
FB (pre-test) [b]	0.15	1	0.15	1.01	0.322	0.03
Group	0.20	1	0.20	1.35	0.252	0.03
Error	5.40	37	0.15			
Total	7.00	40				
Corrected Total	5.77	39				

Note. [a] $R^2 = 0.064$ (Adjusted $R^2 = 0.014$). [b] FB = False belief

4.3.2 Effectiveness of social cognition training on humour appreciation and humour production

The first ANCOVA was conducted to investigate potential pre-existing group differences in humour appreciation with smiling scores in both joke and control trials and copying scores in both joke and control trials at pre-test covaried. Smiling scores at post-test were entered as a dependent variable and group (experimental vs control) as a fixed factor. Levene's test and normality checks were carried out, and the assumptions were met for the analysis. The ANCOVA analysis did not reveal a significant effect, $F(1,34) = 0.46$, $p > 0.05$, partial $\eta^2 = 0.01$ (Table 4.23). This suggests that children in the

experimental group did not show any improvement in humour appreciation after social cognition training.

Table 4.23 Comparison of the two groups in humour appreciation with pre-test smiling in-joke and control trials and copying in-joke and control trials covariates

Source	Sum of Squares	DF	Mean Square	*F*	*p*	partial η^2
Corrected Model	12.72 [a]	5	2.54	9.17	0.000	0.57
Intercept	0.37	1	0.37	1.33	0.257	0.04
Smiling (joke)	0.81	1	0.81	2.92	0.097	0.08
Smiling (control)	0.06	1	0.06	0.23	0.631	0.01
Copying (joke)	0.19	1	0.19	0.68	0.415	0.02
Copying (control)	0.31	1	0.31	1.13	0.295	0.03
Group	0.13	1	0.13	0.46	0.503	0.01
Error	9.42	34	0.28			
Total	185.00	40				
Corrected Total	22.14	39				

Note. [a] $R^2 = 0.575$ (Adjusted $R^2 = 0.512$).

The second ANCOVA was conducted to investigate potential pre-existing group differences in humour production with smiling scores in both joke and control trials and copying scores in both joke and control trials at pre-test covaried. Copying scores at post-test were entered as a dependent variable and group (experimental vs control) as a fixed factor. Levene's test and normality checks were carried out, and the assumptions were met for the analysis. The ANCOVA analysis did not reveal a significant effect, $F(1,34) = 2.06$, $p > 0.05$, partial $\eta^2 = 0.06$ (Table 4.24). This suggests that children in the

experimental group did not show any improvement in humour production after social cognition training.

Table 4.24 Comparison of the two groups in humour production with pre-test smiling in-joke and control trials and copying in-joke and control trials covariates

Source	Sum of Squares	DF	Mean Square	*F*	*p*	partial η^2
Corrected Model	320.40 [a]	5	64.08	17.99	0.000	0.73
Intercept	3.62	1	3.62	1.02	0.320	0.03
Smiling (joke)	3.91	1	3.91	1.01	0.302	0.03
Smiling (control)	1.36	1	1.36	0.38	0.540	0.01
Copying (joke)	2.05	1	2.05	0.58	0.453	0.02
Copying (control)	17.56	1	17.56	4.93	0.033*	0.13
Group	7.35	1	7.35	2.06	0.160	0.06
Error	121.10	34	3.56			
Total	1344.00	40				
Corrected Total	441.50	39				

Note. [a] $R^2 = 0.726$ (Adjusted $R^2 = 0.685$).
*$p < .05$, $N = 40$.

4.4 Discussion

Study 3 was conducted to investigate the effectiveness of social cognition training on humour development in typically developing children. The social cognition training did not improve either children's humour appreciation or humour production. Unexpectedly, there was no difference in the improvement of any socio-cognitive skills between the groups. Age and gender were not correlated with any of the variables at baseline. As in Study 2 (see Chapter 3), there was no relationship between social cognition and humour. These findings correspond with some of the previous studies (Lee

et al., 2016; Begeer et al., 2011) which did not find an improvement on humour after social cognition training the findings are different from Gevers et al. (2006)'s study which had no control group. It is noted that these compared studies were conducted with an atypical and older sample. Overall, since social cognition did not improve with training, we would not expect humour to improve; therefore, it remains unclear whether social cognition improvements cause humour improvements in typically developing pre-schoolers or not.

Study 3 chose emotion and false belief training to improve socio-cognitive and humour skills because 3-year-olds mostly struggled with those skills in Study 2 (see Chapter 3). However, previous socio-cognitive or ToM-based training studies with typically developing pre-schoolers focused on mental state language training in addition to false belief training (Grazzani & Ornaghi, 2014; 2011; Ornaghi, Brockmeier & Grazzani-Gavazzi, 2011; Lohmann & Tomasello, 2003; Hale & Tager-Flusberg, 2003). Studies that trained pre-schoolers in only mental states languages, such as reading stories enriched with mental states and emotions, found that 3-year-olds gained greater language comprehension and emotion understanding, but not false belief comprehension (Grazzani & Ornaghi, 2014; 2011; Ornaghi et al., 2011). Studies that trained pre-schoolers in both mental state or everyday language and false belief comprehension showed that linguistic experiences, the use of mental states, and versions of false belief tasks improved false belief understanding (Lohmann & Tomasello, 2003; Hale & Tager-Flusberg, 2003). Therefore, if children had been trained in mental states language as well as emotion and false belief comprehension, that might have improved their socio-cognitive skills, and then perhaps their humour skills. However, there are some social cognition training studies which showed improvements in socio-cognitive skills that did not use mental state language training (Ding et al., 2015; Slaughter & Gopnik, 1996).

The most interesting debate at this point is why social cognition training improves pre-schoolers' lying behaviour (Ding et al., 2015) because both lying and joking are intended falsehoods that call second-order mental states (Leekam 1991). In other words, lying and joking are similar due to including others' intentions but are different due to the purpose of these intentions. Ding et al. (2015)'s training study is similar to Study 3 in terms of targeted age group, sample size (N = 42), the number of tasks in social cognition training and the identical training for the control group, but it is different to Study 3 in terms of the numbers of training. Ding et al. included six sessions in training rather than three. Ding et al. used two types of false belief training (false-content and false-location) and one appearance-reality task for their research. The 3-year-olds in the experimental group successfully deceived the experimenter. Social cognition training studies aiming to improve socio-cognitive skills or language experiences in pre-schoolers have been successful with two or three training sessions (Lohmann & Tomasello, 2003; Hale & Tager-Flusberg, 2003; Clements, Rustin & McCallum, 2000; Slaughter & Gopnik, 1996). However, Ding et al. and Study 3 aimed to improve other cognitive skills that include others' intentions as verbal deception and humour. Ding et al. may have an advantage in the number of training sessions. Increasing training sessions could change the findings. Indeed, longer sessions, but shorter training periods of social cognition training have found more effective to improve children's socio-cognitive skills in a meta-analysis (Hoffmann et al., 2016).

Age comparisons among all studies that examine the relationship between social cognition and humour could be informative to show which age group should be targeted in a training study. Study 2 in Chapter 3 ascertain that the relationship partly occurred: it disappeared in a laboratory setting if children between 3 months and 47 months interacted with experimenters. While Robison (2000) did find only a partial relationship between some socio-cognitive skills (e.g. knowledge, but not desire) and humour in children

between 4 and 8 years of age, Bosacki (2013) revealed a clearer relationship in older children (10 years of age). Future studies should consider which age group will be targeted. The causality between social cognition and humour could occur in later ages when second-order false beliefs and intentions are included in the training. Also, future studies may include more intensive training if younger age groups (3-year-olds) will be targeted.

Nevertheless, an essential strength of Study 3 is to apply a social cognition training that focused on using positive corrective feedback and appropriate explanations for the actions for emotion and false belief training. Clements et al. (2000) provided evidence of how much social cognition training are useful when that training included explanations rather than just correcting children's responses. The condition in which children received appropriate explanations in training improved their false belief understanding, but the condition in which children received only correct positive feedback did not. Another essential strength of Study 3 is to have an active control training group. Hoffman et al. (2016) provided evidence that social cognition training is more effective if the studies have a control group which participate in control tasks. Consequently, Study 3 should have been able to improve social cognition.

Study 3 draws a similar picture with Study 2 (see Chapter 3) in terms of the primary relationship between social and humour, but not with Study 1 (see Chapter 2). There was no relationship between social cognition and humour at baseline in 3-year-olds in Study 3. Study 3 suggests that there is no clear picture in the causality of social cognition and humour. Future studies should use broader training on advanced levels of social cognition, including mental state language and second-order intentions. We hope that Study 3 will be a promising attempt to conduct similar studies on this topic with a different methodology by considering limitations in typically developing children.

Chapter Five

General Discussion

The studies presented in this thesis were conducted to examine whether there are predictive relationships and causal relationships between social cognition and humour from 1 month through the preschool period. I particularly focused on an early age group for a few reasons. First, social cognition and humour may be functionally intertwined and contribute to each other under 4 years of age, which is beyond solely developing in parallel together (Mireault, Sparrow et al., 2012; Hoicka & Gattis, 2008). Second, even if Leekam (1991) proposes that only a few socio-cognitive skills, understanding others' intentions and beliefs, are a prerequisite for humour appreciation and production focusing on over 4 years of age, the socio-cognitive theory of humour has been enhanced to suggest that the younger age groups may also understand others' mental states which helps to appreciate and produce humour (Hoicka, 2016; Reddy, 2001). Third, this early age group has been neglected in terms of the relationship between the two constructs. Three different research designs were used to address these questions including longitudinal parental surveys, laboratory-based experimental study and social cognition training study undertaken in the nurseries.

In the first developmental study (Chapter 2), we aimed to discover the longitudinal associations between social cognition and humour in typically developing children from 1 month to 47 months via parental surveys. English-speaking parents from different countries completed two surveys, the Early Social Cognition Inventory (Hoicka et al., under review) and the Early Humour Survey (Hoicka et al., in prep), at two-time points. The findings at baseline showed that there was a positive relationship between social cognition and humour in young children controlling for age. Then, we examined whether social cognition and humour will predict each other in 6-month-interval. The findings at

second-time point showed that humour predicted social cognition whereas social cognition did not predict humour. Together, Chapter 2 suggests that increasing social cognition scores were associated with increasing humour scores or vice versa at baseline, however, only early humour skills predicted later socio-cognitive skills in young children 6 months later.

The next study (Chapter 3) replicated Chapter 2 and built on these promising findings to examine the same relationship in children from 3 to 47 months of age in a laboratory setting. First, parents filled the surveys we used in Chapter 2 for a replication. Then, children completed 11 social cognition tasks such as joint engagement, declarative pointing, or desire understanding etc. and one humour appreciation and production test including 21 jokes and 21 control actions. The findings of parental survey replication showed that there was a positive relationship between social cognition and humour controlling for age. However, social cognition and humour relationship did not hold significant once age was controlled in this laboratory study. Chapter 3 suggests that positive relationship between social cognition and humour occurs when children engage with their parents in their natural settings whereas this relationship does not occur in the laboratory-based experiment when children engage with experimenters.

Finally, the study presented in Chapter 4 aimed to examine this relationship causally in 3-year-olds by using social cognition training over four weeks. Children first completed two emotion tasks, one false belief task and one humour appreciation and production task covering 11 jokes and 11 control actions at baseline. Children were quasi-randomly assigned to either a social cognition training group or an active control group. While the training group was trained on emotion understanding and false belief understanding, the control group was trained on Piagetian conservation tasks. At least one day break was given after each training for the post-test. All children were assessed on different versions of emotion, false belief and humour tasks at the post-test. Surprisingly,

social cognition training did not work on either a better emotion understanding or a better false belief understanding. In sum, our sample did not show any causal relationship between social cognition and humour in 3-year-olds and it remains unclear whether the social cognition training improves humour skills in pre-schoolers.

5.1 Contribution to the relationship between social cognition and humour at early development

The findings presented in this thesis contribute to the relationship between social cognition and humour in young children. Taken together, the studies in this thesis (Chapter 2, 3 & 4) reached inconsistent findings. The contributions of these findings will be discussed here in terms of existing empirical studies and theoretical frameworks related to social cognition and humour.

The findings of all three studies challenge to support each other as well as existing empirical studies which suggest that better socio-cognitive skills may lead to better humour appreciation and production 2 years later (Bosacki, 2013), understanding others' knowledge, but not desires may be closely associated with children's humour production (Robison, 2000), and appropriate social cognition training may improve humour understanding among pre-schoolers (Lee et al., 2016). There are several possible explanations for these different findings. First, one possibility for different findings may occur since a clearer relationship between these two constructs may develop in later ages, especially after 4 years of age (Robison, 2000; Lee et al., 2016, Bosacki, 2013). Some socio-cognitive skills which emerge in later ages such as emotion, knowledge or beliefs may be related to humour. In contrast, other socio-cognitive skills emerge in younger ages such as joint attention, imitation, desire understanding may not contribute to humour development. The present research does not allow us to find out which socio-cognitive

skills were related to humour, but such an investigation would be a good start to learn more about this relationship.

Contrary to the first possible explanation, Study 1 (Chapter 2) revealed a positive relationship between social cognition and humour in younger children and showed that humour may be a prerequisite for social cognition relying on parental reports. This finding was also supported with further parental data in Study 2 (Chapter 3). Such opposing findings in comparison with other laboratory-based studies in this thesis (Study 2 & 3) and the existing empirical literature (Bosacki, 2013; Lee et al., 2016) shows that the relationship between social cognition and humour are sensitive to different research designs in younger age group, which is the second possible explanation of the inconsistent findings. In other words, a longitudinal survey design uncovers this relationship whereas laboratory-based design does not. At this point, one question would be whether the relationship between social cognition and humour based on parental reports represent a true association. Parental reports have some limitations such as social desirability (Miller, 1986), however, the present research discovered the same findings with two different data sets with larger sample sizes (Study 1 & 2) rather than smaller ones (Bosacki, 2013; Robison, 2000). Furthermore, the reliabilities of parental reports were considerably high within both sample (Study 1 & 2), which is evidence of internal validity.

Yet, there is one concern related to the validity of the measurements we used in the present research that needs to be considered here. Study 2 (Chapter 3) provided evidence of concurrent validity between the social cognition parental survey and children's laboratory measures of social cognition whereas humour measures (survey and laboratory) failed to provide such validity. Such a problem has been revealed in another humour study (Mireault, Sparrow et al., 2012) since measuring humour in young children brings some challenges. The lack of concurrent validity in humour measures in this thesis suggests that they capture different aspects of humour. Parents have evaluated their

children's humour skills as to whether children can make certain types of jokes in the present research. However, we do not know how parents evaluated their children's humour skills (e. g. duration, intensity, frequency or onset of smiling/laughter). On the other hand, we evaluated children's humour skills according to the onset of smiling/laughter across the jokes for humour appreciation in Study 2 (Chapter 3), which captures the humour in children on the group level in the existing literature (Hoicka & Wang, 2012; Hoicka & Akhtar, 2011). The onset of smiling/laughter may not be adequate to capture individual differences in humour in Study 2 (Chapter 3), namely, other criteria of humour evaluation (e. g. duration, intensity, frequency) should be considered in laboratory-based designs. Indeed, humour showed high correlation with duration and intensity of smiling/laughter, but not frequency in adults (Ruch, 1997).

The final possible explanation of inconsistent findings may be that humour is dependent on social cognition in young children through socialisation. For example, parental engagement may help children to reveal their humorous activities that may be related to the understanding of others' mental states later. There is some other evidence that parents provide cues to help children understand and practice humour skills (Hoicka, 2016; Hoicka & Butcher, 2016; Mireault et al., 2015; Hoicka & Akhtar, 2012; Mireault et al., 2012). Not only parental engagement may reveal more explicit humorous actions, but it may also reduce children's social unresponsiveness. Moreover, parental practises help children to develop better socio-cognitive skills (Pavarini, de Hollanda Souza & Hawk, 2013). Pavarini et al. (2013) reviewed 78 studies and found that parents accept their children as intentional agents, use mental state language in interaction and express a broad range of emotions. This explanation provides some support to the second-person theory which emphasises the importance of engagement between children and others (Reddy, 2018; Reddy 2001), but this does not transfer to engagement with experimenters. In other words, socialisation through familiar people may be a necessity for the

relationship between social cognition and humour. However, there is a need to be cautious for this explanation, because the present research has not been designed to distinguish differences in socio-cognitive and humour skills across familiar and unfamiliar people.

Another theoretical framework that is questioned by the present findings is the intentionality of humour (Leekam, 1991; Hoicka, 2016). The laboratory-based study (Chapter 3) and the social cognition training study (Chapter 4) have not shown any apparent relationship between social cognition and humour, which does not challenge Leekam's (1991) theory ultimately. This is because Leekam's theory does not claim that the relation between socio-cognitive skills and intended falsehoods (e.g. jokes and lies) develops under 4-year-olds. Leekam (1991) pointed out that there may be a possible relationship between social cognition and humour or deception because both intended falsehoods are based on first-order intentions. There is some evidence that both humour (Hoicka & Akhtar, 2012; Hoicka & Gattis, 2008) and deception (Evans & Lee, 2013; Talwar & Lee, 2008) emerge under 4-year-olds. The surprising point is that while social cognition and verbal deception are concerned each other casually in 3-year-olds (Ding et al., 2015), it is unclear that whether there is a causal relationship between social cognition and humour. These findings suggest two arguments: First, the relation between social cognition and verbal deception may emerge earlier than the relation with humour at early cognitive development, thus, the similar social cognition training may be effective to improve lying behaviour (Ding et al., 2015). Second, deception studies may work in laboratory settings because they are rewarded, such as candies or toys, while humour studies may require more naturalistic settings and engagement with familiar people.

In sum, the present research challenges the notion that there is a positive relationship between social cognition and humour from early development due to the inconsistent findings. There are several possible explanations of this inconsistency across three studies which focused on above. Only one significant finding (Chapter 2) is far from

being false positive due to powerful sample size, replication with other parental data (Chapter 3) and high reliabilities and internal consistency within both data (Chapter 2 & 3).

5.2 Implications

The present research has some implications for the field of social cognition and humour. All studies in this thesis have been designed to determine the type of relationship between these two domains, for the first time, with different methodologies at early development. One implication of the present research is that joking with children may facilitate improving children's socio-cognitive skills and reinforcing parent-child humour interaction. This may also be implemented in educational settings. Teachers in the nurseries may benefit from humour as reading more humorous books to facilitate children's understanding of others' mental states later.

Another implication is that appreciation or production of humour may tell us about the development of socio-cognitive skills in both typically and atypically developing children. Study 1 found that humour is a significant predictor of social cognition in young children. This prediction of humour in social cognition may also be evidence for social cognition scales that include humour as a subscale (Tahiroglu et al., 2014; Muris et al. 1999; Happé, 1994). In other words, humour may be a reliable measurement of showing typical socio-cognitive development in children.

The present research is also well-supplied in terms of methodologies that were used. We used three different approaches to study the possible relationship between social cognition and humour: longitudinal surveys, a laboratory study and a training study. This is one of the strengths of the present research since these approaches enabled us to investigate this relationship comprehensively with different perspectives. Because our findings in the laboratory and training studies were not able to capture this possible

relationship, correlational survey methodology might be more appropriate to investigate it in young children. Children might require more flexibility, which is usually supported in multiple naturalistic settings such as home, nurseries or outdoors, for showing their humorous or socio-cognitive skills. This research suggests that survey studies might be more appropriate for this purpose. Furthermore, home setting studies that allow parent-child interactions might be another viable option.

5.3 Limitations

The most important limitation of the studies in this thesis is the reliability and validity of social cognition and humour measures. There is no concern related to social cognition measures (parent report and experimental tasks) since both measures reached high internal consistency and concurrent validity controlling for age. This suggests that both social cognition assessments measure the same construct. On the other hand, humour measures did not reach concurrent validity, in other words, the findings of parent reports were not correlated to the findings of the experimental test in humour. This suggests that it is doubtful that both humour assessments measure the same construct. Besides, one study in this thesis (Chapter 2) has suffered from the nature of parent-report measures. It is impossible to tell whether parents reported children's socio-cognitive and humour skills accurately. Also, it remains unclear which customs parents used while evaluating these skills (e.g., the onset, frequency, duration or intensity of a behaviour). Nevertheless, it is important to determine such reports are commonly used and found valid (Tahiroglu et al., 2014; Hutchins, Prelock & Bonazinga, 2012; Hoicka & Akhtar, 2012; Reddy, 2001).

Another limitation relates to the training study presented in Chapter 4. Our training study did not manage to reach the desired sample size, even for a large effect. Therefore, it is impossible to draw firm conclusions related to the effectiveness of social cognition training in humour. For example, it is challenging to make sure whether a better

understanding of one's and others' emotions and false beliefs improved (a) humour appreciation and production, or (b) emotions and false beliefs themselves.

5.4 Future research

Although the present research has reached inconsistent findings across all studies in this thesis, the most interesting further research would be to examine which specific socio-cognitive skills are related to which dimensions of humour rather than examining social cognition and humour as a whole. Such an examination may provide more information concerns the relationship between social cognition and humour. Some socio-cognitive skills such as desire, knowledge, intention and emotion specifically have been examined whether they were associated with humour (Bosacki, 2013; Kielar-Turska & Białecka-Pikul, 2009; Robison, 2000), however, some others have been neglected. For example, what is the role of joint attention in humour appreciation? If there is a role, does this role last through the pre-school period or does it lose its function when children grow up? Just as in joint attention, we do not know whether imitation and mental state language are associated with humour. Furthermore, the relationship between social cognition and humour may depend upon the types of jokes such as clowning (Reddy & Mireault, 2015), nonsense or incongruity-resolution jokes (Pien & Rothbart, 1976; Shultz, 1972). Future research should target to break down social cognition and humour into their components to examine the relationship between some certain types of joke and understanding of one's and others' minds. Such examinations may explain why social cognition did not predict humour over time (Chapter 2) and the null findings of other studies (Chapter 3 & 4).

An alternative way to examine this relationship is to run observational studies with parent-child dyads, especially if non-verbal children are included as participants. There is some evidence of social cognition studies that non-verbal children are good at using

social-emotional cues such as eye contact or smiling to imitate an action (Fukuyama & Myowa-Yamakoshi, 2013), to follow eye gaze properly and understand what it means (Senju, Csibra & Johnson, 2008), and to understand communicative intentions (Behne et al., 2005). The important mutual features of these studies are being conducted in the laboratories and that experimenters provide cues. It suggests that social cognition may be examined with laboratory-based techniques with even infants. On the contrary, the humour studies that are conducted with infants use parental cues as laughter to capture infants' smiling/laughter (Mireault et al., 2018; Mireault et al., 2015). Moreover, parents also help toddlers to understand the difference between joking and pretending by using more belief-based language (Hoicka, 2016; Hoicka & Butcher, 2016). It may be expected that parental engagement would show more humour in young children. Other humour studies in young children do find positive findings with experimenters, but only on a group level (Hoicka & Wang, 2012; Hoicka & Akhtar, 2011). This suggests that humour laboratory-based techniques might not capture individual differences. Therefore, observing parent-child dyads on socio-cognitive and humour skills may reveal an overlap with the findings of parental survey designs (Chapter 2 & 3). Such an approach may be more ecologically valid and give more real-world messages rather than laboratory-based techniques.

Another methodological suggestion that future research should consider is which measurements will be used. The current humour laboratory test (Chapter 3) has been developed based on previous parental reports (Hoicka & Akhtar, 2012). It has given some validity in group-level performance in the laboratory study as children appreciate and produce humorous actions more than the control ones. However, this test may not have captured individual differences. The same concern previously appeared in a humour study, which has demonstrated that behavioural measures of humour (smiling/laughing) did not capture individual differences while they did capture group differences (Mireault

et al., 2012). Therefore, there is a need to improve the current humour laboratory test or develop a novel validated humour task which can capture both group and individual differences. To manage this, multiple short tasks may be used to attain convergent validity, or the laboratory tasks may be repeated on the same sample to ensure if consistent findings attain (Boogert, Madden, Morand-Ferron & Thornton, 2018).

Future research should aim to reveal a causal relationship between social cognition and humour in young children with humour training rather than a social cognition training since humour was a good predictor of social cognition (Chapter 2). To the best of our knowledge, there are no humour training studies in children under 4 years of age, but it is important to discover which aspects of humour (e.g. state vs trait humour, nonsense vs incongruity-resolution jokes) should be focused on to improve socio-cognitive skills for future research. The present research does not allow us to distinguish which type of jokes truly predicted social cognition.

Future research should also consider expanding social cognition training across older age groups, including second-order mental states since training on first-order mental states was not effective to improve humour skills in 3-year-olds (Chapter 4). There have been large numbers of studies that were conducted since Wimmer and Perner (1983) on both first-order mental states and second-order mental states, and it is considered robust to say that understanding first-order mental states emerge between 3 and 5 years of age while understanding second-order mental states emerge after 5 or 6 years of age (Miller, 2009). One study has promising findings that first-order false belief understanding fostered humour appreciation in 4-and-5-year-olds (Lecce et al., 2014). Thus, it would be worth for future research to address the causality between social cognition and humour in an older sample.

Finally, future research should ask parents about the word acquisition of children or implement verbal control tasks to make sure whether children can understand and respond to questions. The use of mental state language by parents was causally related to developing a better theory of mind over the first year of life (Ruffman, Slade & Crowe, 2016). Likewise, parents also preferred to use high abstraction and belief-based language when they read humorous books to children (Hoicka et al., 2008). Parental mental states language or children's language acquisition itself may play a mediator role in the findings because language skills are both closely related to social cognition (Carpenter et al., 1998) and humour (Hoicka, 2014).

5.5 Conclusion

In sum, the present research in this thesis addresses reciprocal relationships and their directions between social cognition and humour from infancy through the preschool years which has been examined for the first time. The present research contributes to the relationship between social cognition and humour in young children in two ways. First, it shows that there is no consistency in terms of the relationship between the two constructs across the studies. It suggests that the present research suffers from a lack of ecological validity. Second, the findings of the present research show that the relationship between two constructs in young children depends upon the research designs. The relationship shows up when children engaged with their parents in naturalistic settings when measured by parental reports, even over time; however, a laboratory-based design was not evidenced to demonstrate it. It suggests that the theories, which claim that social cognition and humour are related to younger ages, need to be modified considering research designs. Alternative methods are needed to establish whether there is a relationship between social cognition and humour in young children. Possibly, observational studies that allow parent-child interactions in familiar settings might be promising to better understand this relationship. Besides, different humour measures may

be developed and used in laboratory-based studies. We do not still know whether there is a causal relationship between two constructs in 3-year-olds, but the best start would implement a humour training rather than a social cognition one.

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Appendix A

Instructions:

We want to know about your child's learning, social skills, and play!

There are 2 short surveys covering social skills and humour. It should take 10 minutes to complete. You will receive feedback on your child at the end of the survey.

In order for us to find out whether there are changes in child development, it is very important that you repeat the survey in 6 months time. We will send you a reminder email. If you complete it in 6 months, we will donate £2 to UNICEF. You will be able to see how your child has changed over 6 months.

There are no wrong or right answers to any of the questions. The questionnaires were designed to assess children from birth to 4 years. This is a very wide age range, so do not worry if you skip a lot of questions because the answer is "No". Every child is different and develops differently and this is a big part of what interests us, so please be as honest as you can when completing the questionnaires.

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If you have any questions you would like to ask before filling out the survey, contact Dr Elena Hoicka at [university email address]

Social Skills. For the following, tick Yes if your child has the skill. You can save time by leaving the item blank if the answer is No.

- Does your child follow where you look to look at the same things as you?
- Is your child aware of other people's motives? E.g., that they might give someone a gift in order to make them happy.

- Is your child aware of their own desires) E.g., prefer chocolate over broccoli.
- Is your child aware that other people may know the same information they do? E.g., they know where a certain book is kept, and they know their dad knows where that book is kept too.
- Is your child aware of others' perspectives, e.g. could they tell sometimes they can see something, but someone else can't, because it's not in their line of sight?
- Is your child aware of his/her own mistakes? E.g., if s/he drops something by accident.
- Does your child perform actions intentionally? E.g., stack blocks on purpose, instead of by trial and error.
- Does your child follow where you point to look at the same thing as you?
- Does your child look back and forth between you and objects, instead of only looking at you or an object?
- Does your child understand that sometimes things aren't as they appear? E.g., something that looks hard might feel soft.
- Does your child copy others in order to achieve the same goal? E.g., copying pressing a button to make a song play on a toy.
- Is your child aware that sometimes other people don't have the same beliefs as them? E.g., your child might think dogs are the best animals, but they understand that their sister thinks cats are the best animals.
- Is your child aware of their own emotions? E.g., happy, sad, angry, etc.
- Does your child point to get information from you? E.g., to get a toy that is out of reach.
- Does your child understand that sometimes other people have different desires to themselves? E.g., other people might like broccoli, even if they don't.

- Does your child point to share information with you? E.g., point to show you a dog in the park.
- Is your child aware of other people's emotions? E.g., happy, sad, angry, etc.
- Is your child aware that other people have the same beliefs as them? E.g. that dogs are the best animals.
- Does your child copy others for no clear reason? E.g., raises arm because someone else did, with no clear goal (other than to raise one's arms).
- Is your child aware that sometimes other people don't know the same information they do? E.g., child might know where a toy is, but dad might not.
- Does your child understand what it means for others to make mistakes? E.g., that they dropped a plate by accident.
- Does your child perform actions with specific goals in mind? E.g., stacking blocks specifically to make a house.

<u>Humour. For the following, tick Yes if your child finds it funny when others make this joke type and/or makes this joke type him/herself to be funny. You can save time by leaving the item blank if the answer is No.</u>

- Making strange voices (not just strange noises)
- Making fun of others, e.g., calling someone a poopoohead
- Strange actions with objects, e.g., use the wrong end of a spoon, put cup on head
- Saying strange things/mixing up concepts/nonsense (e.g., dinosaurs eat the wall; cats have five legs; dogs say moo), including nonsense variations of knock-knock/why did the chicken cross the road jokes
- Referring to gross things, e.g., poo, sneezing, smelly feet, etc.

- Mislabelling objects/events, e.g., calling a car a banana; could be in song, or intentionally giving you the wrong answer
- Aggressive acts, e.g., spitting out water, throwing things, pushing people, etc.
- Tickling, including variations, e.g., using objects to tickle, e.g., stick or feather
- Peekaboo/ hide & seek, including variations, e.g., hiding objects in bags and revealing them
- Strange body movements, e.g., head through legs, kicking legs in the air
- Scaring people, e.g., jumping out at them, or yelling
- Chasing, including variations, e.g., making toys chase each other
- Socially unacceptable situations, e.g., putting a cat on the dining table, saying naughty words, etc.
- Playing tricks on people, e.g., putting salt in the sugar bowl
- Acting like something else, e.g., an animal, another person, etc.
- Inventing words, e.g., schmoogly
- Pulling/making silly faces, e.g., scrunching up face
- Showing normally hidden body parts, e.g., lifting shirt to reveal tummy; taking off clothes
- Teasing, e.g., offering an object and taking it away
- Making puns, that is, jokes where words have double meanings, e.g., Why are fish so smart? Because they live in schools

Appendix B

Jokes	**Normal actions**
*Making a (kind of) monkey squawk	Humming ‘twinkle twinkle little star’ tune
*Peekaboo	Waving
Tickling teddy bear's tummy and saying 'tickle, tickle, tickle!'	Cuddling teddy bear
*Pulling mouth to sides with fingers and sticking out tongue	Scratching face
*Humorously waggling arms	Clapping hands
*Putting glove on a foot	Putting glove on a hand
Making a toy pig chase a toy cow and saying, 'I’m gonna get you!'	Making the toy pig and the toy cow walk side by side and saying, 'We’re going for a walk!'
*Speaking in a humorous high voice to say 'The dog is crossing the road.'	Using a normal voice to say “The dog is crossing the road” whilst making a toy dog walk along with the table
Getting down on all 4s, mimicking a dog and saying, ‘Woof! Woof!’	Walking around the room and saying, 'I like walking!'
Humorously teasing by offering and withdrawing feather ball from parent	Offering to gives feather ball toy to parent, letting parent take the toy
Yelling 'boo!' at parent whilst their back is turned (parents react scared)	Saying 'hello!' to parent
Humorously lifting the top of a doll and showing stomach, saying, ‘Look! Her tummy!’	Covering the doll over with a small towel, like putting a blanket over it, saying, ‘Look, a blanket!’

Smelling the doll's bum and saying, 'Ewww! It's smelly!'	Holding the doll out in front of them, looking at the doll and saying, 'I like this doll!'
*Holding a hat and saying, 'This is a sheep!'	Holding a toy sheep and saying, 'This is a sheep!'
Parent builds a tower using toy bricks, and then E knocks it over (parent looks surprised)	Building a tower using toy bricks
Dropping straws on parent's head (parent looks surprised)	Putting a hat on the parent's head
*Holding a toy horse and saying, 'The horse goes Quack! Quack Quack!'	Holding the toy horse and saying, 'The horse goes Neigh! Neigh!'
*Holding a spoon and saying, 'This is a schmoogly!'	Holding the spoon and saying, 'This is a spoon.'
*Leaning back and putting feet on the table	Holding a book and putting it on the table
Saying to parent, 'I've got you a nice gift!'. E hands the gift (crumpled paper) (parent looks disappointed)	Saying to parent,'I've got you a nice gift!', whilst covering hands. E hands the gift to the parent (parent looks happy)
*Why are teddy bears never hungry? Because they're always stuffed!	Why are teddy bears never hungry? Because they eat a lot!

Note. Marked jokes and their control actions were also used at the pre-test in Chapter 4.

Appendix C

Jokes	**Normal actions**
Making a fake sneezing 'Achoo!'	Humming 'Old MacDonald' tune
Quickly hiding under the table and showing face, saying, 'boo!'	Picking the toy palm up from under the table
Sticking out lower lip and pulling out ears	Yawning
Humorously squashing head into the neck	Shaking index finger
Bringing a cup to ear	Bringing the cup to mouth
Speaking in a humorous high voice to say, 'The rabbit is jumping!'	Using a normal voice to say, 'The rabbit is jumping!' whilst making a toy rabbit walk along with the table
Holding a toy cow and saying, 'This is a pig!'	Holding a toy pig and saying, 'This is a pig!'
Holding a toy sheep and saying, 'The sheep goes Mooo! Mooo!'	Holding a toy sheep and saying, 'The sheep go Baa! Baa!'
Showing a ball and saying, 'It's a wagga woo!'	Showing the ball and saying, 'This is a ball!'
Throwing rubbish on the floor	Throwing rubbish in a toy bin
What do you do when you see an ocean wave? Wave back!'	What do you do when you see an ocean wave? Just watch it.'

Appendix D

Day 1 (Other scenarios): All scenarios followed the same structure with different possible reasons for emotions. Only possible reasons reported rather than repeating the same structure after the first example.

- E showed a sad face to children and asked how the child felt. According to the child's answer, E gave feedback: "Yes, he feels sad" or "No. He feels sad." Then, E asked why the child thought he felt, e.g., sad. If the answer was appropriate, E reinforced the answer ("Yes, he is sad"). E first repeated what the child said and then gave another appropriate reason: "Maybe he is sad because he argued with his mum." If the answer was incorrect, E asked why they thought that: "I do not know about that. Why would [repeat what the child said] make him feel…" and then, E gave the same appropriate reason: "Maybe he is sad because he argued with his mum."
- The possible reason for an angry face: "Maybe she is angry because she fought with her brother."
- The possible reason for a scared face: "Maybe she is scared because she had a nightmare."

Day 2:

- The possible reason for an angry face: "Maybe he is angry because his friend refused to let him play."
- The possible reason for a scared face: "Maybe she is scared because she watched a horror film."
- The possible reason for a happy face: "Maybe she is happy because she has a new toy."
- The possible reason for a sad face: "Maybe he is sad because he missed the school bus."

Day 3:

- The possible reason for a scared face: "Maybe she is scared because she is alone at home."
- The possible reason for an angry face: "Maybe she is angry because her friend played a trick on her."

- The possible reason for a sad face: “Maybe he is sad because his parents fought.”
- The possible reason for a happy face: “Yes, maybe he is happy because he gets to play with his doggy.”

Appendix E

Day 1 (Other scenarios)

- E used a pig puppet and said, “I have lost my toy. Oh, no!” E asked, “How does the pig feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the pig is sad because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The pig is sad because he has lost his favourite toy.”
- E used a sheep puppet and said, “I have got a new puzzle. Oh no!” while showing a puzzle pic. E asked, “How does the sheep feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the sheep is sad because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The sheep is sad because even though most children like having a new puzzle, he does not want one. He wanted a toy car.”
- E used a sheep puppet and said, “I am lost now. Yaay!” E asked, “How does the sheep feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the sheep is happy because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The sheep is happy because he thinks getting lost is adventurous. Also, he can discover new places, so there is no reason to be sad.”

Day 2

- E used a cow puppet and said, “I have to go to bed now. Oh, no!” E asked, “How does the cow feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the cow is sad because [repeated what the child said]. If they

gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The cow is sad because he does not want to go to bed because he wants to watch cartoons.”

- E used a cow puppet and said, “I am going to the funfair. Yaay!” E asked, “How does the cow feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the cow is happy because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The cow is happy because it will have lots of fun on the rides.”
- E used a tiger puppet and said, “I have got a cold. Yaay!” E asked, “How does the tiger feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the tiger is happy because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The tiger is happy because he has a good excuse not to go to school.”
- E used a tiger puppet and said, “I have got a bike. Oh no!” while showing a bike pic. E asked, “How does the tiger feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the tiger is sad because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The tiger is sad because even though most children enjoy riding bikes, he does not enjoy it. He thinks he might hurt himself.”

Day 3

- E used a giraffe puppet and said, “I have broccoli. Yaay!” while showing a broccoli pic. E asked, “How does the giraffe feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the giraffe is happy because

[repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The giraffe is happy because he thinks broccoli is delicious even though most children do not like it.”

- E used a giraffe puppet and said, “I will have a balloon. Oh no!” while showing a balloon pic. E asked, “How does the giraffe feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the giraffe is sad because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The giraffe is sad, because even though most children like balloons, he does not like balloons. He is worried it will pop.”
- E used an elephant puppet and said, “I have to have a time-out. Oh, no!” E asked, “How does the elephant feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the elephant is sad because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The elephant is sad because he is in trouble.”
- E used an elephant puppet and said, “I am painting a picture. Yaay!” while showing painting and paintbrush. E asked, “How does the elephant feel?” If the child did not respond or replied, “I do not know”, E repeated the question. If they gave an appropriate response, then E said, “Yes, the elephant is happy because [repeated what the child said]. If they gave an inappropriate response, E said, “I do not know about that. Why would [repeated what the child said] make it feel….?” After the child responded, E gave an appropriate reason, “The elephant is happy because it loves to paint.”

Appendix F

The Maxi test (Wimmer & Perner, 1983)

E introduced Maxi, said, “This is Maxi. Maxi puts chocolate into a cupboard. When he is gone, his mother moves the chocolate to the drawer. When Maxi returns, where will he look for the chocolate?” E waited for a response. If there was no response after 5 seconds, E repeated the question. According to the child respond, E said, “Yes, he will look in the cupboard.” Alternatively, “No, he will look in the cupboard.” E asked, “Why will he look there?” and waited for a response. According to the response, E said, “Yes, that is right” or “No, that is not right” and said, “He will look in the cupboard because he did not know his mum moved the chocolate. Maxi was not here when his mum moved the chocolate.”

The plaster box test (Wellman & Liu, 2004)

E presented a Plaster box with a plastic toy horse inside. “Here is a Plaster box. What do you think is inside the Plaster box?” If there was no response after 5 seconds, E repeated the question. E opened the box and said, “Let’s see... it is really a horse inside!” E introduced Peter (a toy) and said, “Peter has never seen inside this Plaster box. Now here comes Peter. So, what does Peter think is in the box? Plasters or a horse?” E waited for a response. If there was no response after 5 seconds, E repeated the question. According to the child’s response, E said, “Yes, he will say there are Plasters inside.” Alternatively, “No, he will say there are Plasters inside.” E asked, “Why will he say there are Plasters inside?” and waited for a response. According to the response, E said, “Yes, that is right” or “No, that is not right” and said, “Peter will think that there are Plasters inside the box because he has not seen inside it, and normally there are Plasters in a Plaster box.”