Maternal sensitivity and the monitoring pattern of social interactions of one year old infants:

An eye-tracking experiment

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Thesis:

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1. Foreword

By the beginning of December last year I chose the subject of my thesis and I came up with some research questions. However, it was not until the end May before I sent in the first version of the introduction and method section. An introduction and method section that were not to my satisfaction. Now, almost four months later, I write this foreword with pride. I loved the whole process, from data collection and analyzing till putting it all on paper. This project and writing my thesis were a learning process and the most interesting part of my master studies. Furthermore, I would like to use this foreword to thank the research team including my fellow bachelor and master students and the supervisors, especially Dr. Szilvia Biro, for her guidance throughout the masterproject and for her help with writing this thesis.

2. Abstract

In this present study the monitoring pattern of social interactions of one year old infants of more sensitive mothers and less sensitive mothers is investigated. The study is guided by the following main question: 'Is maternal sensitivity related to the monitoring pattern of social interactions of one year old infants?' The sample consisted of thirty-eight 12-month-old infants and their mothers. An eye-tracking experiment was carried out in which we measured infants' monitoring pattern of social interactions. The eye-tracking stimuli consisted of an animated movies in which a social interaction between two geometric figures, a small and a big oval shape, is showed. The animated movies consisted of four segments, which are start, uphill, separation and response. In the first segment 'start', the small and the big oval shape are standing together. In the second segment 'uphill', the big shape moves up, away from the small shape on a hill. In the third segment 'separation', the small and the big shape are separated, the small shape is still standing at the foot of the hill while the big shape is standing on top. In half of the movies a crying sound can be heard, while in the other half of the movies a laughing sound can be heard. In the last segment

‘response’, the big shape either returns, which is a responsive reaction, or the big shape moves further away, which is an unresponsive reaction. There are four different animated movies, the responsive crying movie, the responsive laughing movie, the unresponsive crying movie and the unresponsive laughing movie. Supported by the sensitivity theory of Ainsworth and colleagues (1978), which states that mothers’ responses to their infants’ signals influence children’s development and supported by Bowlby’s theory of internal working models (1969), in which the relationship with a primary caregiver influence how we understand the social world around us, it is hypothesized that infants of more sensitive mothers may show differences in their monitoring pattern of social interactions, while infants of less sensitive mothers do not show similar differences. Thus, it is hypothesized that maternal sensitivity can influence infants processing of social interactions. Maternal sensitivity was measured based on three different episodes, a break episode, a competing demands episode and a play episode, using the Ainsworth Sensitivity Scale. Results suggested that, in the separation part of the observed movies, the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive movies but not during the responsive movies. Furthermore, infants of less sensitive mothers looked longer at the first four movies than infants of more sensitive mothers, while in the second four movies there was no such difference. We also found in the response part of the observed movies, that the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive crying and responsive crying movies, while infants of more sensitive mothers did not show this decline. Limitations, strong aspects and recommendation for further research are discussed.

3. Introduction

Many years ago, Bowlby (1969) suggested that early social-emotional experiences with a caregiver influence how we understand the social world around us. Bowlby (1969) suggested that children form internal working models about the social world that influences children’s behavior and their interpretation of others’ social behavior and guide social interactions with others. It has been widely documented that infants of twelve months old have a sophisticated representation of social interactions. However, little is known about the quality of these early experiences in relation to the representation of social interactions. To date, only Johnson and colleagues (2007; 2010) have investigated and found evidence for a relationship between infants’ representations

and the security of their attachment to their mothers. Since one of the 'core ingredients' of infant's attachment security is maternal sensitivity (Bakermans-Kranenburg et al., 2003; De Wolff & Van IJzendoorn, 1997; Goldsmith & Alansky, 1987) the present study therefore investigates the relationship between infants' representation of social interactions and maternal sensitivity. Investigating this relationship may tell us something about the possible influence of maternal sensitivity on the development of infants' representation of social interactions.

Maternal sensitivity

The importance of maternal sensitivity has been demonstrated in several studies**.** Sensitivity is the ability of the parent to perceive the child's signals in an accurate way and to interpret those signals correctly and respond in an adequate and prompt way (Ainsworth, Blehar, Waters & Wall, 1978). Research has shown the relationship between maternal sensitivity and infants' attachment security and between maternal sensitivity and children's development.

Maternal sensitivity and attachment

Several studies have demonstrated that maternal sensitivity plays an important role in the development of infants' attachment security (Bakermans-Kranenburg, Van IJzendoorn & Juffer, 2003; De Wolff & Van IJzendoorn, 1997; Goldsmith & Alansky, 1987). Mothers of securely attached infants are sensitive to the infants' signals especially when it comes to feeding, making eye contact and holding the infant (Ainsworth et al., 1978). Furthermore, these mothers are available for the infant and show affection. Securely attached infants show a balance between exploring the environment and seeking proximity of the mother (Siegler, DeLoache & Eisenberg, 2010). Mothers of insecure-avoidant infants are insensitive to the infants' signals (Ainsworth et al., 1978). These mothers show more anger, irritation and rejection towards their infants. Their behavior towards the infants is often compulsive and stiff and they show less emotion. Insecure-avoidant infants seek less proximity of the mother because of fear for rejection (Siegler et al., 2010). Mothers of insecure-resistant/ambivalent infants are inconsequent in their sensitivity to the infants' signals, but these mothers are less rejecting than mothers of insecure-avoidant infants (Ainsworth et al., 1978). Mothers of insecure-resistant/ambivalent infants show no aversion to physical contact with the infant, but are clumsy and show little affection when holding the infant. Most of the time holding the infant is for daily routines. Insecure-resistant/ambivalent infants seek more proximity of the mother instead of exploring the environment (Siegler, DeLoache &

Eisenberg, 2010). Due to mother's unpredictable behavior the infant asks for mother's physical contact but at the same time reacts defensive towards the mother due to anger and disappointment.

Maternal sensitivity and children's development

Besides that maternal sensitivity is proven to be the empirically documented determinant of infants' attachment security (De Wolff & Van IJzendoorn, 1997), it's also known that maternal sensitivity plays an important role in the individual development of children with respect to social, personality and cognitive development as well as to the presence of behavioral problems.

Social development

Several studies have demonstrated the association between maternal sensitivity and a child's social development (Denham, Renwick & Holt, 1991; Darling & Steinberg, 1993; Freitag, Belsky, Grossmann, Grossmann & Scheuerer-Englisch, 1996; Kivijarvi, Voeten, Niemela, Riaha, Lertola & Piha, 2001; Early, Rimm-Kaufman, Cox, Saluja, Pianta & Bradley, 2002; NICHD, 2003; McElwain & Volling, 2004; Landry, Smith & Swank, 2006; Szabo, Dekovic, van Aken, Verhoven, van Aken & Junger, 2008; Leerkes, Blankson & O'Brien, 2009; Cabrera, Fagan, Wight & Schadler, 2011). As young as twelve months old, infants of sensitive mothers show more social play behavior, more visual contact (Kivijarvi et al., 2001) and show higher social competence (Leerkes et al., 2009; NICHD, 2003). More specifically, Early and colleagues (2002) found that higher levels of maternal sensitivity were related to more active engagement with other children in kindergarten. McElwain and Volling (2004) found a similar association. They found that higher maternal sensitivity during infancy was related to more positive and less negative peer interactions at the age of four years. Children who experienced sensitive mothers during the first year of their life, showed better competence in forming close friendships at the age of ten years (Freitag et al., 1996). In addition, when looking at mother-child interaction, lower levels of sensitivity were related to more negative behavior of the children in interacting with their mothers (Szabo et al., 2008). The association between maternal sensitivity and child's social competence is according to Darling and Steinberg (1993) and Denham and colleagues (1991) due to the fact that sensitive parents serve as positive role models. By being a positive role model, parents teach their children better social skills and teach their children how to interact with peers. However,

according to Landry and colleagues (2006) the association between maternal sensitivity and child's social competence is due to the fact that sensitive mothers emphasize the rules of socialization within the interaction, and thus promote children's social development. While cause of the association between maternal sensitivity and a child's social development is still various, the existence of the association is demonstrated in several studies.

Personality development

With respect to the child's personality development, children who experienced high maternal sensitivity during infancy were more compliant in toddlerhood (Belsky, Woodworth & Crnic, 1996; Feldman, Greenbaum, & Yirmiya, 1999) and children who experienced low maternal sensitivity during infancy were less compliant in toddlerhood (Kemppinen, Kumpulainen, Raite-Hasu, Moilanen & Ebeling, 2006). In addition, high maternal sensitivity was related to a more positive mood during the first year after birth (Kivijarvi et al., 2001) and to more positive self-esteem in early adolescence (Beckwith, Rodning & Cohen, 1992). It is also shown that maternal sensitivity behavior has a positive influence on children's feeling of control, self-efficacy and self-competence (Risken-Walraven, 1978; van Aken & Riksen-Walraven, 1992; Egeland, Carlson & Sroufe, 1993) and on the development of children's ego-control and ego-resiliency (Block & Block, 1980). Ego-control is the child's ability to control their impulses, wishes and desires and ego-resiliency is the child's ability to respond flexibly to changing demands (Sroufe, 1979).

Many researchers have investigated the association between maternal sensitivity and children's regulation of behaviors and emotions. The ability to regulate behavior and emotions is an important aspect of the personality development (Sroufe, 1996; Hane & Philbrook, 2012). According to de Wolff and van IJzendoorn (1997) and Crockenberg and Leerkes (2000), maternal sensitivity is an important caregiver characteristic in the development of emotion regulation. High maternal sensitivity is related to better emotion regulation skills in infancy (Calkins, 1994; Axia & Bonichini, 2005; Din, Pillai Riddell & Gordner, 2009; Braungart-Rieker, Hill-Soderlund & Karrass, 2010; Feldman, Dollberg & Nadam, 2011) and low maternal sensitivity is related to less emotion regulation skills in infancy (Feldman, Eidelman & Rotenberg, 2004). Through the sensitive reactions to the infant signals, children develop effective self-regulation skills (Calkin & Fox, 2002; Gianino & Tronick, 1988; Tronick, 2007). When looking at the timing of the development effective self-regulation skills, the more sensitive the mother is, the quicker the infant develops effective self-regulation skills (Fish, Stifter & Belsky, 1991; van den Boom &

Hoeksma, 1994). It has been found that maternal sensitivity is already related to the development of self-regulation in toddlerhood (Belsky, Woodworth & Crnic, 1996; Kochanska, Aksan, Prisco & Adams, 2008). The relation between maternal sensitivity and infant's emotion regulation is according to McElwain & Booth-LaForce (2006) due to the fact that children use their mother as a model in regulating their emotions.

The association between maternal sensitivity and infants' emotion regulation is also demonstrated physiologically (Pendry & Adam, 2007; Spangler, Schieche, Ilg, Maier & Ackermann, 1994; Albers, Riksen-Walraven, Sweep & de Weerth, 2008; Kaplan, Evans & Monk, 2008; Haley & Stansbury, 2003). Maternal sensitive behavior is associated with overall lower levels of adrenocortical arousal (Pendry & Adam, 2007), lower levels of cortisol reactivity (Spangler, Schieche, Ilg, Maier & Ackermann, 1994), greater cortisol recovery (Albers, Riksen-Walraven, Sweep & de Weerth, 2008) and better heart rate regulation (Kaplan, Evans & Monk, 2008; Haley & Stansbury, 2003).

Thus, the association between maternal sensitivity and children's personality development has been showed both behavioral and physiological and several studies demonstrated the important role of maternal sensitivity on the child's emotion regulation.

Behavioral problems

Research has shown that maternal sensitivity is associated with the child's behavior problems (Beckwith, Rodning & Cohen, 1992; Deater-Deckard & Petrill, 2004; Leerkes, Blankson & O'Brien, 2009; Miner & Clarke-Stewart, 2008; NICHD, 2003; 2004; Bradley & Corwyn, 2008; NICHD, 2003; NICHD, 2004; Miner & Clark-Stewart, 2008; Bradley & Corwyn, 2008). Higher levels of maternal sensitivity are for example related to lower levels of behavior problems (Beckwith, Rodning & Cohen, 1992; Deater-Deckard & Petrill, 2004; Leerkes, Blankson & O'Brien, 2009). More specifically, when looking at externalizing behavior, higher levels of maternal sensitivity, measured early in life, were related to less externalizing behavior later on in life (Miner & Clarke-Stewart, 2008; NICHD, 2003; 2004; Bradley & Corwyn, 2008). The NICHD study (2003) found that mothers who were more sensitive towards their child had children with fewer externalizing problems. One year later, the NICHD study (2004) found that sensitive parenting during infancy predicted fewer externalizing behavior symptoms in early childhood. Miner and Clark-Stewart (2008) found a similar prediction. They found that higher levels of externalizing behavior reported at nine years of age, predicted lower levels of maternal

sensitivity, especially for boys. In attention, Bradley and Corwyn (2008) found that high maternal sensitivity during early childhood and middle childhood buffers the development of externalizing problems at school age, especially for children with difficult temperament. Thus, several studies have proven the association between maternal sensitivity and the child's behavior development, especially the development of externalizing problem behavior.

Cognitive development

It is also shown that maternal sensitivity is associated with the child's cognitive development (Lewis & Goldberg, 1969; Rogoff, 1990; Schaffer, 1992; Stams, Juffer & van IJzendoorn, 2002; Bornstein & Tamis-LeMonda, 1997; Mein, Fernyhough, Wainwright, Das Gupta, Fradley & Tuckey, 2002; Mein, Fernyhough, Wainwright, Clark-Carter, Das Gupta, Fradley & Tuckey, 2003; Ereky-Stevens, 2008; Beckwith, Rodning & Cohen, 1992). It has been shown that maternal sensitivity stimulates cognitive development by providing children social support (Lewis & Goldberg, 1969), structuring learning activities through scaffolding (Rogoff, 1990) and joint problem solving (Schaffer, 1992). By providing this, children are offered with the opportunity to experience the effects of their own behavior, which stimulates their cognitive development. Bornstein and Tamis-LeMonda (1997) found that maternal sensitivity at the age of five months, predicted infants' attention span and symbolic play and they found that maternal sensitivity at the age of thirteen months was, although not significantly, associated with infants' attention span, symbolic play and language comprehension. Furthermore, maternal sensitivity was related to a better understanding of mind at the age of five years (Mein, Fernyhough, Wainwright, Das Gupta, Fradley & Tuckey, 2002; Mein, Fernyhough, Wainwright, Clark-Carter, Das Gupta, Fradley & Tuckey, 2003; Ereky-Stevens, 2008) and at the age of twelve, children whose mothers were consistently sensitive during both infancy and early adolescence, achieved higher IQ and mathematic scores (Beckwith, Rodning & Cohen, 1992). Thus, several studies have proven the association between maternal sensitivity and the child's cognitive development.

In sum, maternal sensitivity plays an important role in the development of infants' attachment security and in the individual development of children with respect to social development, personality development, including emotion regulation, behavior problems, especially externalizing behavior problems, and cognitive development.

Infants' representation of social interactions

Many years of research have demonstrated that by twelve months, infants have quite an understanding of the social world. Soon after birth infants show sensitivity to social stimuli. After a few months, infants engage in social interactions with others. In the second half of infants' first year, they start to be able to represent and generate expectations about others' behavior and begin to form representations of third part interactions. The latter means that the infant has a representation of an interaction between others.

Sensitivity to social stimuli

Newborns show interest in people and social stimulation (Rochat, 2001). Infants' attention can easily be drawn by human faces and voices. Newborns prefer to look at those who make direct eye contact (Farroni, Csibra, Simion & Johnson, 2002) while talking (Guellai & Streri, 2011). Furthermore, it is shown that infants show preference for attractive faces over unattractive faces (Slater, von der Schulenburg, Brown, Badenoch, 1998), for familiar faces, for example their mother's face, over unfamiliar faces (Field, Cohen, Garcia & Greenberg, 1984; Bushnell, Sai & Mullin, 1989; Walton, Bower & Bower, 1992; Pascalis & de Schonen, 1994), own-race faces over a face of another race (Kelley et al., 2005; Bar-Heim Ziv, Lamy & Hodes, 2006) and happy faces over sad faces (D'Entremont & Muir, 1999). In addition, infants' preferences for faces is influenced by the gender of the primary caregiver (Quinn, Yahr, Kuhn, Slater & Pascalis, 2002). Infants show preferences for female faces over male faces when raised by a female primary caregiver. Infants raised by a male primary caregiver prefer male faces over female faces.

With respect to voices, infants prefer people who use infant-directed speech over adult-directed speech (Schachner & Hannon, 2011) and prefer singers who sing familiar songs over singers who sing unfamiliar songs (Gaye, 2012). In addition, at the age from five to six months, infants show preference to people who speak in the same language or accent over people who speak in a foreign language or accent (Kinzler, Dupoux & Spelke, 2007) and also prefer to accept toys from people who speak in the same language or accent rather than in a foreign language or accent (Kinzler and Spelke, 2011).

Infants own social interactions with others

Soon after birth, infants start to move their arms, legs and head, make sounds (Rochat & Striano 1999) and use their body and face to communicate with others (Reddy, 2008). They are able to

engage in simple social interactions with others such as imitation (Meltzoff & Moore, 1977; Field, Vega-Lahar Scafidi & Goldstein, 1986; von Hofsten & Siddiqui, 1993; Collie & Hayne, 1999; Meltzoff, 2004). Newborns are capable to imitate bodily movements, for example, sticking out the tongue and opening the mouth (Meltzoff & Moore, 1977; Meltzoff, 2004). At the age of two months, infants can imitate facial expressions (Field, Vega-Lahar, Scafidi & Goldstein, 1986). They can imitate happy, sad and surprised faces. Four months later, at the age of six months, infants are able to imitate movements involving objects (von Hofsten & Siddiqui, 1993; Collie & Hayne, 1999). Infants imitate actions after seeing their mothers perform those actions on specific toys. Also at the age of six months, infants begin to follow an adults gaze (Butterworth & Cochran, 1980) and a few months later, at the age of eight to ten months, infants turn their head in the same direction as their mother, while sitting in front of her (Scaife & Bruner, 1975; Butterworth & Grover, 1998). This imitation will eventually lead to joint attention at the age of twelve months. Joint attention is the ability to follow someone's gaze to eventually looking at the same object or event (Moore & Dunham, 1995). Next to joint attention, infants also begin to show social referencing (Hornik, Risenhoover & Gunnar, 1987; Striano & Rochat, 1999; 2000). Social referencing is the ability to use someone's interpretation of an object or event to form one's own understanding of that object or event (Feinman, 1982; Walden & Ogan, 1988).

Representation and expectation of others' behavior

Infants can detect the goals that underlie others' action. Several studies demonstrated this understanding in infancy with experiments in which a human hand reaches or an agent acts towards an object (Gergely, Nadasdy, Csibra & Biro, 1995; Csibra, Gergely, Biro, Koos & Brockbank, 1999; Sodian & Thoermer, 2004; Phillips & Wellman, 2005; Sommerville & Woodward, 2005), in which an object is displaced (Kiraly, Jovanovic, Prinz, Aschersleben & Gergely, 2003), in which a human hand points to an object (Sodian & Thoermer, 2004; Woodward, & Guajardo, 2002; Biro & Leslie, 2007) or experiments in which a human looks at an object (Woodward, 2003; Sodian & Thoermeer, 2004; Johnson, Ok & Luo, 2007). For example, when looking at experiments in which an object is displaced, Kiraly and colleagues (2003) found that six month old infants interpret the action of a human hand as goal-directed even when the positions of the toys were changed. In addition, when looking at experiments in which a human looks at an object, Johnson, Ok and Luo (2007) found that infants interpret gaze as a goal-directed action.

At the age of three to five months old, infants understand that an agent can have a preference for a specific object (Woodward, 1998; Luo & Baillargeon, 2005; Luo, 2011). This understanding is demonstrated using an experiment in which an agent is presented with two objects (A) and (B) while the agent repeatedly acts towards one object (A). Even when the positions of the objects change, infants expect the agent to act towards the same object. In addition, around twelve months olds, infants understand that when one object is hidden for the agent, the agent is unable to see the hidden object and thus infants can rely on the agent's representation of the physical setting to interpret the agent's actions (Luo & Baillargeon, 2007; Sodian, Thoemer & Metz, 2007; Luo & Johnson, 2009). The latter experiment is also called a false beliefs task. Luo (2011) found that infants as young as ten months old seems to interpret a person's choice of toys based on her true or false beliefs about which toys were present. However, there are mixed results and views about the existence of false beliefs in infancy (Caron, 2009).

Research has shown that infants are also able to detect unfulfilled goals that underlie an agent's action (Hamlin, Hallinan & Woodward, 2008; Daum, Prinz & Aschersleben, 2008). Thus despite the failed action, infants still interpret the action as goal-directed. Hamlin and colleagues (2008) presented seven month old infants a situation in which an experimenter tried to grasp a toy, while presented with two toys, but failed because the toy was out of reach. Next, they presented the infant with both toys and asked the infant to choose one of the two. Infants tended to choose the same toy the experimenter had reached for. Another study of Daum and colleagues (2008) presented six and nine month old infants a situation in which a hand reaches for a toy but grasps another toy. Infants showed increased attention when they saw the hand grasping the other toy while first reaching for another. These studies suggest that infants understand an agent's goal despite the failed reach.

Infants are not only able to detect goal-directed actions, but they also have expectations about the way the agent should act towards its goal (Gergely, Nadasdy, Csibra & Biro, 1995, Csibra, Gergely, Biro, Koos & Brockbank, 1999; Sodian, Schoeppner & Metz, 2004, Phillips & Wellman, 2005). Gergely and colleagues (1995) and Csibra and colleagues (1999) for example showed infants an animated movie in which a ball repeatedly jumped over an obstacle to reach another ball. After the obstacle was removed, infants expected the ball to move straight to the other ball instead of repeating its jumping behavior. A similar experiment is done with human agents instead of an animated ball (Sodian, Schoeppner & Metz, 2004). Sodian and colleagues (2004) also found that when an obstacle was removed, infants expected, in this case a girl, to

walk straight to a boy instead of repeating its jumping behavior. Phillips and Wellman (2005) found that infants expected a human arm to reach through a direct way instead of an indirect way towards a ball after removing an obstacle. These studies suggest that infants have the expectations that the agent will move in the most efficient way towards its goal. These studies also suggest that even when the physical setting changes, infants recognize that the same goal-directed behavior still will occur (Gergely, Nadasdy, Csibra & Biro, 1995, Woodward, 1998).

Representing third party interactions

Research has demonstrated that by the end of their first year, infants are able to represent third party interactions. This means that infants understand interactions between others. Several studies carried out experiments to measure the understanding of third party interactions in which an agent chases another agent (Schlotterman, & Surian, 1999; Csibra, Biro, Koos & Gergely, 2003; Rochat, Striano & Morgan, 2004) and in which an agent helps or hinders another agent (Kuhlmeier, Wynn & Bloom, 2003; Hamlin, Wynn & Bloom, 2007; 2010).

Schlotterman and Surian (1999) performed an experiment in which a green square chases a red square. Using an experiment in which an agent chases another agent they found that infants are sensitive to causation-at-a-distance. Csibra and colleagues (2003) performed an experiment in which a red circle chases a yellow circle through a gap. They found that infants understand that the red circle has a goal, chasing the yellow circle through a gap, even though the red circle didn't reach the yellow circle. Infants thus understand an unfulfilled goal as mentioned earlier. At last, Rochat, Striano and Morgan (2004) performed an experiment in which a red and a blue disc were chasing each other. They found that eight to ten month old infants are able to discriminate the role reversal, chaser or chasee, of the two discs.

With respect to experiments in which an agent helps or hinders another agent, Hamlin, Wynn and Bloom (2007) carried out an experiment with positive, negative and neutral social actions. In the positive and negative actions, a figure tried to climb up a hill and another figure either helped or hindered the figure. In the neutral action, a figure climbed up a hill to sit next to another figure. They found that infants at the age of six months are capable to evaluate individuals by their social actions. Infants are able to see the difference between positive, negative and neutral social actions. Infants prefer positive actions over negative and neutral actions and prefer neutral actions over negative actions. Three years later, Hamlin, Wynn and Bloom (2010) found that even three month old infants can evaluate individuals by their social

actions. Infants are able to discriminate an agent who helps another agents from an agents who hinders another agents and prefer neutral actions over negative actions. In addition, in a similar experiment, twelve months old infants can interpret future actions of an individual based on the previous actions of an individual in another context (Kuhlmeier, Wynn & Bloom, 2003). Infants expect an agent to approach another agent who previously helped him or her, instead of an agent who previously hindered him or her.

Although these experiments measured different things they all include an interaction between others in animated movies and infants seem to understand these interactions.

Showing sensitivity to social stimuli, having social interactions with others, developing expectations about others' behavior and able to evaluate third party interactions are examples of infants' social cognition and these examples show that infants possess a remarkable social understanding the end of their first year. Given that infants have this remarkable ability we can ask the question whether early experiences can influence infants processing of social interactions.

Maternal sensitivity and infants' representation of social interactions

Only two studies by Johnson and colleagues (2007; 2010) have investigated the relationship between infants' attachment security and infants' representation of social interactions. In the latter study of Johnson and colleagues (Johnson, Dweck, Chen, Stern, Ok & Barth, 2010) infants were habituated to animated movies in which a social interaction between two geometric figures, a small and a big circle, was shown. In the animated movies, the small and the big circle are standing together and then the big circle moves away from the small circle upon a hill. Then there is a crying sound. Then two test events are presented. The bigger circle either returns or the bigger circle moves further away. The patterns of looking times in the test events suggested that secure infants expected the bigger circle to return when the small circle started to cry. In contrast, insecure infants had no expectations. This study suggests that infants' attachment security is already reflected in infants' representation of social interactions. Until now, no research has been done to investigate the relationship between maternal sensitivity and infants' representation of social interactions. However, since maternal sensitivity and infant's attachment security are related (Bakermans-Kranenburg et al., 2003; De Wolff & Van IJzendoorn, 1997; Goldsmith & Alansky, 1987) and since Bowlby (1969) suggested that the relationship with a primary caregiver

influences how we understand the social world around us, it is possible that there is a relationship between maternal sensitivity and infants' representation of social interactions.

The present study

Therefore, the focus in this present study is infants' representation of social interactions in relation to maternal sensitivity. More specifically, the monitoring pattern of social interactions of one year old infants of more sensitive and less sensitive mothers is investigated. To investigate infants' monitoring pattern of social interactions an eye-tracking experiment is carried out with a stimuli that is quite similar to the animated movies of Johnson and colleagues (2010), in which a social interaction between two geometric figures, a small and a big circle, was shown. In the present study, infants are also presented with animated movies in which social interaction between two geometric figures, a small (19x14 mm) and a big (34x22 mm) oval shape, is showed. The animated movies consisted of four segments, which are start, uphill, separation and response. In the first segment 'start', the small and the big oval shape are standing and moving together. In the second segment 'uphill', the big shape moves up, away from the small shape on a hill. In the third segment 'separation', the small and the big shape are separated, the small shape is still standing at the foot of the hill while the big shape is standing on top. In half of the movies a crying sound can be heard, while in the other half of the movies a laughing sound can be heard. In the last segment 'response' the big shape either returns, which is a responsive reaction, or the big shape moves further away, which is an unresponsive reaction. There are four different animated movies, the responsive crying movie, the responsive laughing movie, the unresponsive crying movie and the unresponsive laughing movie (see figure 1 for the different segments and movies). The infant is presented to these different movies twice, thus the infant is presented with eight movies in total. This is different from the research of Johnson and colleagues (2010), in which the infants were habituated to the first three segments and then the infants were presented with two movies in which the responsive segment was showed. The infants in the present study were shown all the four segments in one continuous movie. Also in the present study the geometric figures are oval shapes instead of circles. Furthermore, Johnson and colleagues (2010) used only a crying emotion. The present study was interested in other emotions that might influence infants monitoring and therefore decided to include not only a crying emotions, but also a laughing emotion.

The present study is guided by the following main question: 'Is maternal sensitivity related to the monitoring pattern of social interactions of one year old infants?'

Since it has been proven that maternal sensitive behaviour towards the child helps infants to regulate their emotions, the present study investigated if there are any monitoring differences between crying and laughing movies during the separation part of the movies for infants with more sensitive mothers and infants with less sensitive mothers. The first research question of the study is therefore the following:

1. Are there any monitoring differences between crying and laughing movies for infants with more sensitive mothers and infants with less sensitive mothers?

Bowlby (1969) suggested that children form internal working models about the social world, which are influenced by the relationship with a primary caregiver. Thus, when presented with the movies, infants of more sensitive and less sensitive mothers may show differences in their monitoring pattern while watching the crying and laughing movies, based on their representation of social interactions. However, infants of more sensitive and less sensitive mothers may also show differences in their monitoring pattern while hearing the crying and laughing emotions, based on their emotional state and their effective self-regulation skills. It is therefore hypothesised that infants of more sensitive mothers may show differences in their monitoring pattern of social interactions between animations with crying emotions and animations with laughing emotions, while infants of less sensitive mothers do not show similar differences.

Since responsiveness, the promptness of response to the infant's signals, is a component of sensitivity (De Wolff & Van IJzendoorn, 1997) and since it has been proven that infants have a sophisticated representation of social interactions and that this representation is influenced by maternal behaviour, like attachment (Johnson et al., 2010), we investigated whether there are any monitoring differences between responsive and unresponsive movies for infants with more sensitive mothers and infants with less sensitive mothers. The study is therefore also investigated the following second research question:

2. Are there any monitoring differences between responsive crying and unresponsive crying movies for infants with more sensitive mothers and infants with less sensitive mothers?

Supported by the sensitivity theory of Ainsworth and colleagues (1978), which states that mothers' responses to their infants' signals influence children's development and supported by Bowlby's theory of internal working models (1969), in which the relationship with a primary caregiver influence how we understand the social world around us, it is hypothesized that infants of more sensitive mothers may show differences in their monitoring pattern of social interactions

between responsive crying and unresponsive crying movies, while infants of less sensitive mothers do not show similar differences.

4. Method

Participants

Thirty-eight 12-month-old infants participated in the present study with their mothers (*mean age of infants* = 12,23 months, *SD* = 0,32, *mean age of mothers* = 33,96 years, *SD* = 4,31). 17 infants were girls and 21 infants were boys. For this present study a dataset is used from a larger study which investigates the relationship between infants' representation of social interactions, their attachment security, maternal sensitivity and infant temperament. The participants were recruited using the database of the Babylab of Leiden University. Parents who signed up for the Babylab received a phone call when their infant was approximately twelve months old and they were asked if they would like to participate in the research.

Design and procedure

The data of the larger study was collected during a visit of approximately eighty minutes in the infant labs at the Faculty of Social Sciences of Leiden University. The visit started with informing the mother about the details of the visit and asking her to sign a consent form for participation. We have emphasized to the mother that all the information about her and her infant is confidential and that individual results will not be published. The visit consisted of several parts, including an eye-tracking experiment, the Strange Situation Procedure, infants' temperament measurements and maternal sensitivity measurements. The visit ended with the infant receiving a present and a diploma. The mother was thanked for her participation and was offered reimbursement for travel expenses. This present study focuses only on infants' monitoring pattern of social interactions and maternal sensitivity, thus only these procedures and measurements will be discussed below.

Eye-tracking

The first part of the session consisted of an eye-tracking experiment in which the monitoring pattern of the infants was measured. The mother and the infant were seated in a small closed space of approximately 1 to 2 meters. The infant was placed on the lap of the mother, approximately 0,5 meter in front of the eye-tracker screen. The mother was asked to wear blinded glasses, so that she could not see the movies herself and to make sure that the infant's eyes were measured. After the mother and her infant were seated and the light was dimmed, the calibration started, in which the eye-tracker locates the infant's eyes. The calibration consisted of little animations of a bear dancing on music that was showed in every corner and in the middle of the screen. These little animations were showed one after another in slow speed to make sure the infant was looking at them. When an animation appeared and the infant was not looking, an attention getter, which consisted of a baby dancing on music, was showed to attract the infant's attention again. Only when the infant's eyes were recognized in all the five locations, the calibration was accepted. If not, the calibration had to be done again. After the calibration the infant was presented with eight animated movies. Before and between every movie an attention getter, which consists of a rocking toy with sound, appears in the middle of the screen to attract the infant's attention. The whole eye-tracking experiment took about 5 minutes.

Maternal sensitivity

Break

The mother and her infant had a break for approximately 6 minutes. The mother was given her own bag and offered coffee or tea and she could feed her infant if necessary. There were a lot of toys in the room and the mother could make use of a little chair and table for the infant.

Competing demands

During the competing demands task the experimenter gave a questionnaire to the mother for her to fill out during the next 5 minutes. The mother filled out the questionnaire with the infant in the same empty room without any distraction for the infant. This situation asked the mother to divide her attention between the infant and filling out the questionnaire. This situation is based on the theoretical model 'competing demands' (Klinkman, 1997). The two demands, taking care of her infant and filling out the questionnaire, are competing with each other. The mother is unable to do both demands at the same time.

Play

Mother and infant were playing together with a lot of toys for approximately 5 minutes. Mother was asked to play with her infant together and it was emphasized that nothing special was expected from them.

Eye-tracking stimuli

Infants are presented with animated movies in which a social interaction between two geometric figures, a small (19x14 mm) and a big (34x22 mm) oval shape, is showed. The animated movies consisted of four segments, which are start, uphill, separation and response. In the first segment 'start', the small and the big oval shape are standing together. In the second segment 'uphill', the big shape moves up, away from the small shape on a hill. In the third segment 'separation', the small and the big shape are separated, the small shape is still standing at the foot of the hill while the big shape is standing on top. In half of the movies a crying sound can be heard, while in the other half of the movies a laughing sound can be heard. In the last segment 'response', the big shape either returns, which is a responsive reaction, or the big shape moves further away, which is an unresponsive reaction. There are four different animated movies, the responsive crying movie, the responsive laughing movie, the unresponsive crying movie and the unresponsive laughing movie. Figure 1 illustrates the different movies and the four segments.

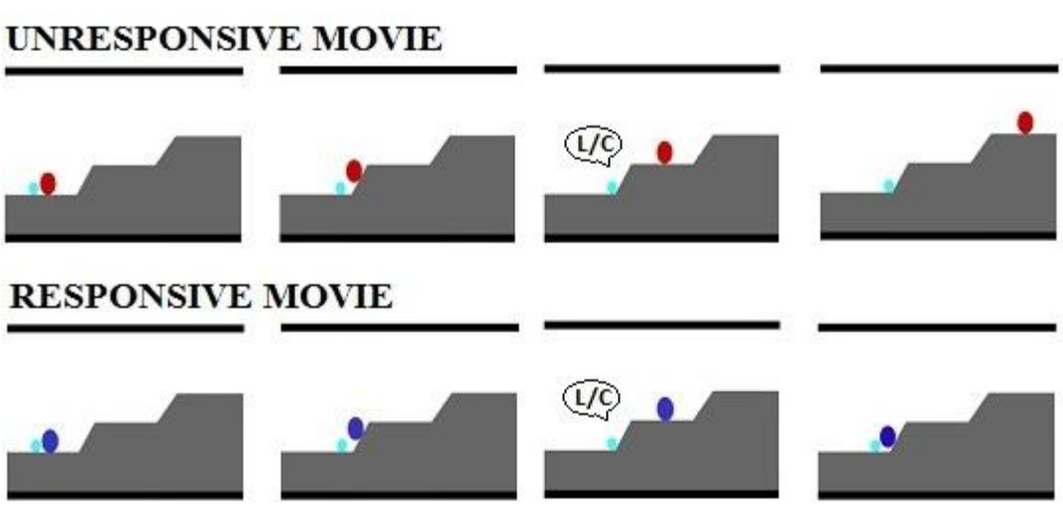

Figure 1: The different movies and the four segments, start, uphill, separation, response. L/C = laughing or crying.

The infant was presented twice with these different movies, thus the infant was presented with eight movies in total. The color of the small oval shape was light blue. The color of the responsive and the unresponsive bigger shape in the movies were always different, either red and blue or blue and red, respectively. There were eight different conditions to counterbalance for the color of the big shapes, the order of responsive and unresponsive movies and for the order of the laughing and crying sounds. Before and between every movie an attention getter, which consists of a rocking toy with sound, appears in the middle of the screen to attract the infant's attention. The start, uphill, separation and response segments all had different durations, respectively three, two, eleven and four seconds. Every movie thus had a duration of twenty seconds and every attention getter had a duration of approximately four seconds, thus the stimuli lasted for approximately three minutes.

Maternal sensitivity measure

To measure maternal sensitivity the Ainsworth Sensitivity scale (Ainsworth, Bell & Stayton, 1974) was used. The Ainsworth Sensitivity scale is a well validated scale developed by Ainsworth to score maternal sensitivity on a 9-point scale, with 1 meaning 'highly insensitive' and 9 meaning 'highly sensitive'. All three episode were coded separately and then an overall score was given. Because not all the episode evoke the same amount of sensitive behavior of the mother, this overall score was not an average of the three episode scores, but was based on the overall behavior of the mother during all the three episodes. A well trained research assistant coded all 38 mothers. Inter-coder reliability based on 15 cases was .83 for the overall score. We created two groups based on the distribution of the maternal sensitivity overall scores, using a median split. The median of the sensitivity overall scores was 6, which made a distribution of 19 more sensitive and 19 less sensitive mothers. Mothers with an overall score of 5,5 or lower on the Ainsworth Sensitivity scale were coded as less sensitive (M = 4.95, SD = .64) and mothers with an overall score of 6,5 or higher on the Ainsworth Sensitivity scale were coded as more sensitive (M = 6.90, SD = .46). The difference between the two groups was not significant, $t(36) = -10.74$, $p < .398$.

Eye-tracking data processing

For the eye-tracking data processing, we used Tobii Studio software to first define the different segments for each animation. We used four segments, which are start, uphill, separation and response. After making these segments we defined areas of interest of the big oval shape and the small oval shape for the separation segment. These areas of interest are areas surrounding the big and the small oval shape. These areas are used to calculate when the infant's eyes are fixated on the big shape, the small shape or somewhere else. After defining these areas, the Tobii Studio software program calculated the *total fixation duration* in the response and separation segments and for the area of interest of the big shape and the area of interest of the small shape in the separation segment for each movie. Then we calculated a *fixation duration ratio* for the two areas of interest (the duration of fixation in the areas was divided by the total fixation duration in the separation segment). The fixation duration ratios were used in the analysis to compare the monitoring patterns of the infants. Last, because of the different order and color conditions, the data was reorganised before starting with the analysis.

For the data analysis, we used total fixation duration measure in the separation segment and the response segment and the fixation duration ratio measures in the separation segment. In the separation segment all eight movies were used in the analysis. In the response segment, only the crying unresponsive and crying responsive movies were used.

5. Results

Preliminary analysis showed that there was no effect of gender, order condition and the color of the big oval shape in any of the monitoring measures. Therefore, these variables were omitted from further analysis.

To answer the first research question '*Are there any monitoring differences between crying and laughing movies for infants with more sensitive mothers and infants with less sensitive mothers?'* we analysed two fixation measures: the total fixation duration and the area of interest specific fixation duration ratio during the separation segment of the animation. To answer the second research question '*Are there any monitoring differences between responsive crying and unresponsive crying movies for infants with more sensitive mothers and infants with less sensitive mothers?*' we analysed the total duration of fixation during the response episode of the crying movies.

Separation episode

Total fixation duration measure

A repeated measures ANOVA for the total fixation duration with the within subject factors 'response' (2, responsive vs. unresponsive), 'emotion' (2, cry vs. laughter) and 'block' (2, 1st block vs. 2nd block) and the between subject factor 'maternal sensitivity' (2, less vss. more) was carried out. The analysis showed an emotion effect, $F(1,36) = 14.31$, $p < .001$, $\eta_p^2 = .28$. Infants fixated longer at the crying movies ($M = 7.03$, $SE = .35$) than at the laughing movies ($M = 6.16$, $SE = .38$). The analysis also showed a block effect, $F(1,36) = 9.00$, $p < .005$, $\eta_p^2 = .20$. Infants fixated longer in the first block ($M = 7.06$, $SE = .37$) than in the second block ($M = 6.14$, $SE = .38$). Furthermore, results showed an interaction effect of emotion and block, $F(1,36) = 5.55$, $p < .024$, $\eta_p^2 = .13$. Further separate ANOVAs in the two blocks showed that infants fixated longer at the crying movies ($M = 6.88$, $SE = .43$) than the laughing movies ($M = 5.41$, $SE = .41$) in the second block, $F(1,36) = 16.79$, $p < .001$, $\eta_p^2 = .32$, but not in the first block, $F(1,36) = .73$, $p < .399$, $\eta_p^2 = .02$. Separate ANOVAs for the two types of emotions showed that infants fixated longer in the first block ($M = 6.92$, $SE = .41$) than in the second block ($M = 5.41$, $SE = .41$) during the laughing movies $F(1,36) = 19.60$, $p < .001$, $\eta_p^2 = .35$, but not during the crying movies $F(1,36) = .52$, $p < .477$, $\eta_p^2 = .01$. At last, the ANOVA showed a strong tendency to an interaction effect between response, block and sensitivity, $F(1,36) = 4.01$, $p < .053$, $\eta_p^2 = .10$. Exploring this interaction separate analyses were carried out in the less and more maternal sensitive group: a strong tendency of a response and block interaction effect in the less maternal sensitive group was found, $F(1,18) = 3.94$, $p < .063$, $\eta_p^2 = .18$, but not in the more maternal sensitive group $F(1,18) = .69$, $p < .418$, $\eta_p^2 = .04$. Paired-sample T-tests revealed that infants of less sensitive mothers fixated longer at the first block ($M = 7.50$, $SE = .57$) than the second block ($M = 5.86$, $SE = .56$) during the unresponsive movies, $t(18) = 3.24$, $p < .005$, but not during the responsive movies, $t(18) = .36$, $p < .725$. See figure 2 for this response, block and sensitivity interaction effect.

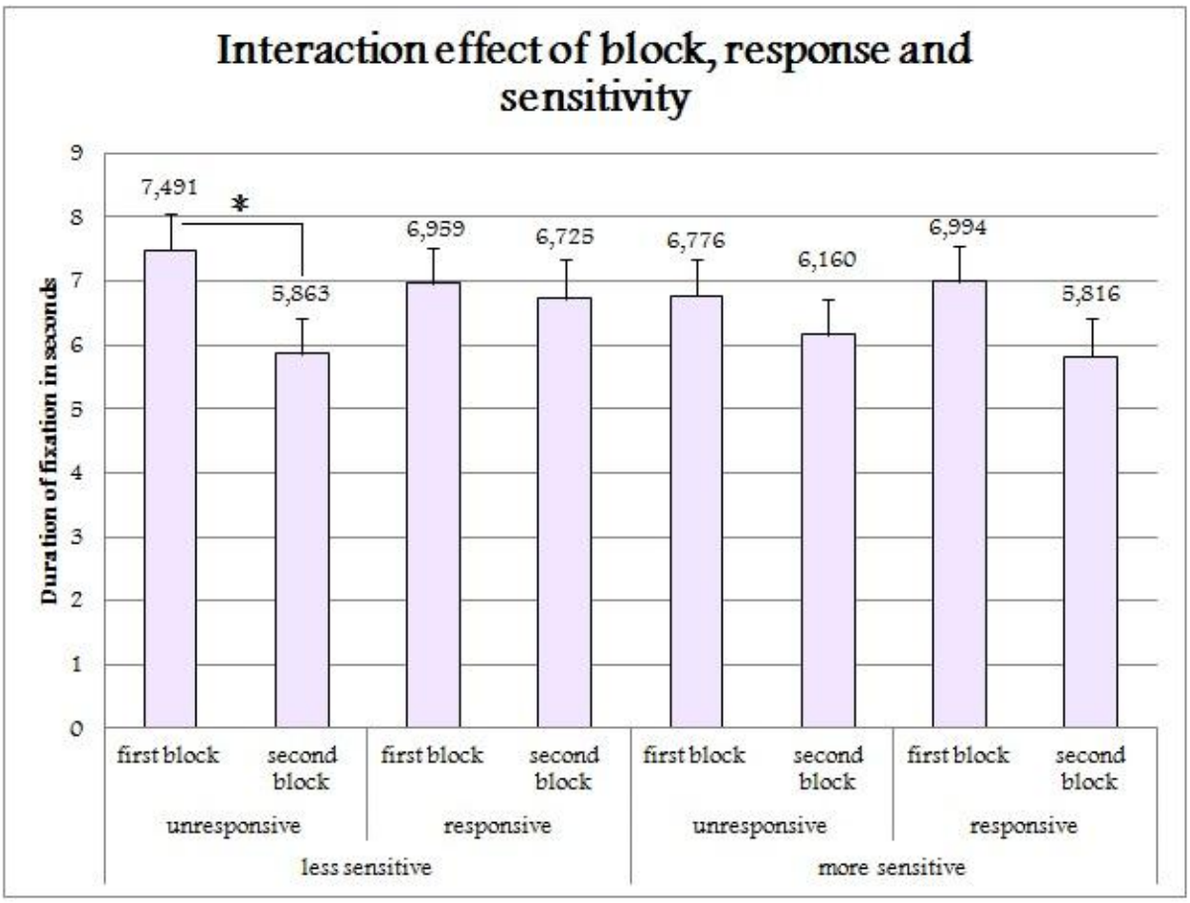

Figure 2: Interaction effect of response, block and sensitivity.

Areas of interest fixation duration ratio measure

A repeated measures ANOVA for the areas of interest fixation duration with the within subject factors 'area of interest' (2, big oval shape vs. small oval shape), 'response' (2, responsive vs. unresponsive), 'emotion' (2, cry vs. laughter) and 'block' (2, 1st block vs. 2nd block) and the between subject factor 'maternal sensitivity' (2, less vs. more) was carried out. The analysis showed an area of interest effect $F(1,36) = 103.41$, $p <. 001$, $\eta_p^2 = .742$. Infants fixated longer at the bigger shape ($M = .58$, $SE = .03$) than the smaller shape ($M = .24$, $SE = .02$). Results also showed a block effect $F(1,36) = 6.91$, $p < .013$, $\eta_p^2 = .161$. Infants fixated longer at the bigger and smaller shape in the first block ($M = .42$, $SE = .02$) than in the second block ($M = .40$, $SE = .02$). At last, results showed a strong tendency to an emotion effect $F(1,36) = 3.72$, $p < .062$, $\eta_p^2 = .094$. Infants fixated longer at the bigger and smaller shape in the crying movies ($M = .42$, $SE = .02$) than in the laughing movies ($M = .40$, $SE = .02$). Maternal sensitivity had no main or interaction effect, $F(1,36) = 2.54$, $p < .120$, $\eta_p^2 = .07$ (see figure 3).

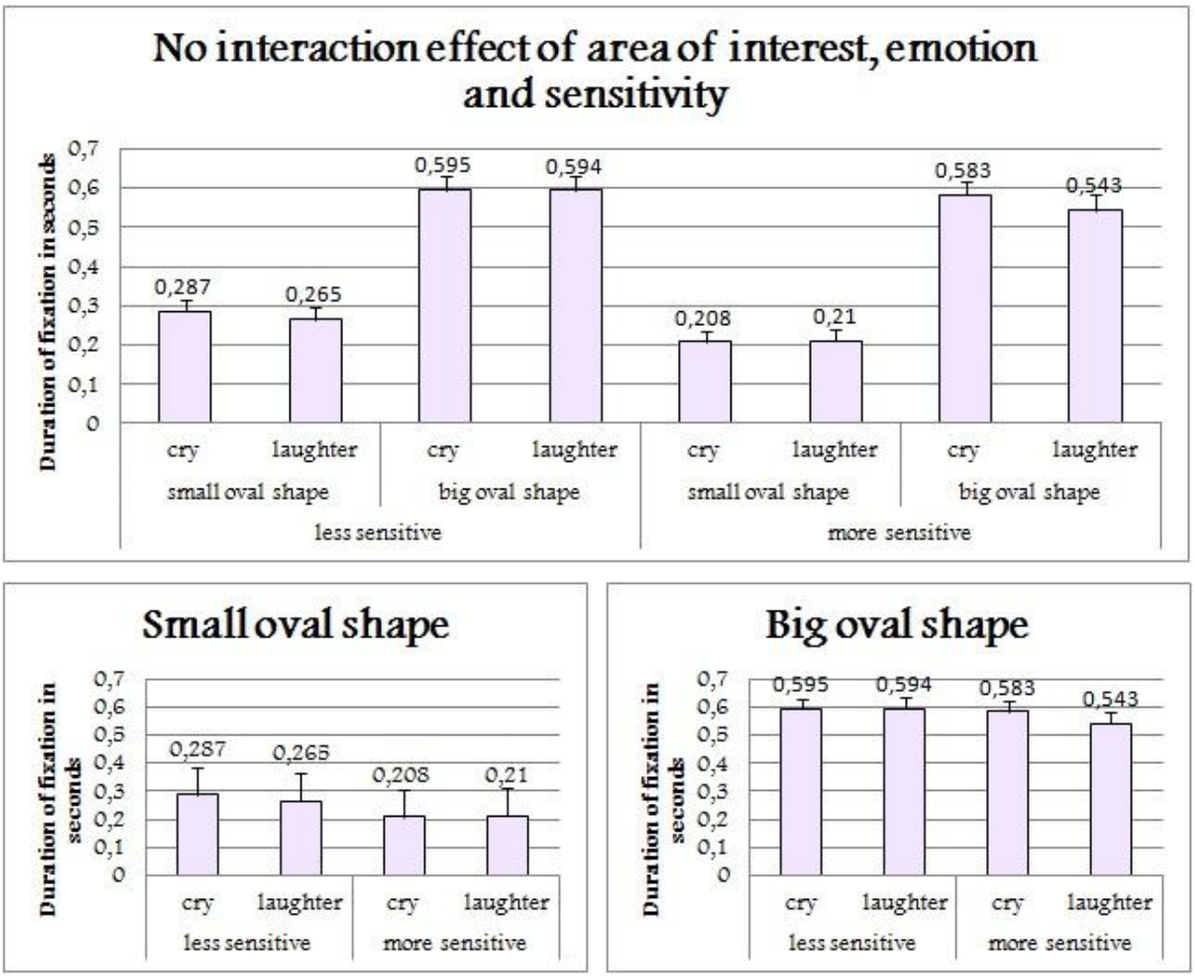

Figure 3:Maternal sensitivity did not affect the way in which infants' allocated their attention to the two figures during the two emotional separations.

Response episode

Total fixation duration measure

A repeated measures ANOVA for the total fixation duration with the within subject factors 'response' (2, responsive vs. unresponsive) and 'block' (2, 1st block vs. 2nd block) and the between subject factor 'maternal sensitivity' (2, less vs. more) was carried out during the response segment of the animations with crying. Results showed a block and maternal sensitivity interaction effect $F(1,36) = 7.14$, $p < .011$, $\eta_p^2 = .17$. Further analyses in the two block separately, the ANOVA showed that, infants of less sensitive mothers fixated longer ($M = 3.29$, $SE = .30$)

than infants of more sensitive mothers (M = 2.24, SE = .30), in the first block $F(1,36) = 6.10$, p <.018, η_p^2 = .15, while in the second block there was no such difference, $F(1,36) = .31$, p < .579, η_p^2 = .01. Separate ANOVAs for the two types of maternal sensitivity showed that infants of less sensitive mothers fixated longer in the first block (M = 3.29, SE = .28) than in the second block (M = 2.47, SE = .30), $F(1,18) = 7.99$, p < .011, η_p^2 = .31, while infants of more sensitive mothers did not show this difference, $F(1,18) = 1.41$, p < .251, η_p^2 = .07. See figure 4 for this block and sensitivity interaction effect. The response factor had not main effect, $F(1,36) = .13$, p < .720, η_p^2 = .01, or was not in interaction with the maternal sensitivity factor, $F(1,36) = 1.386$, p < .247, η_p^2 = .04.

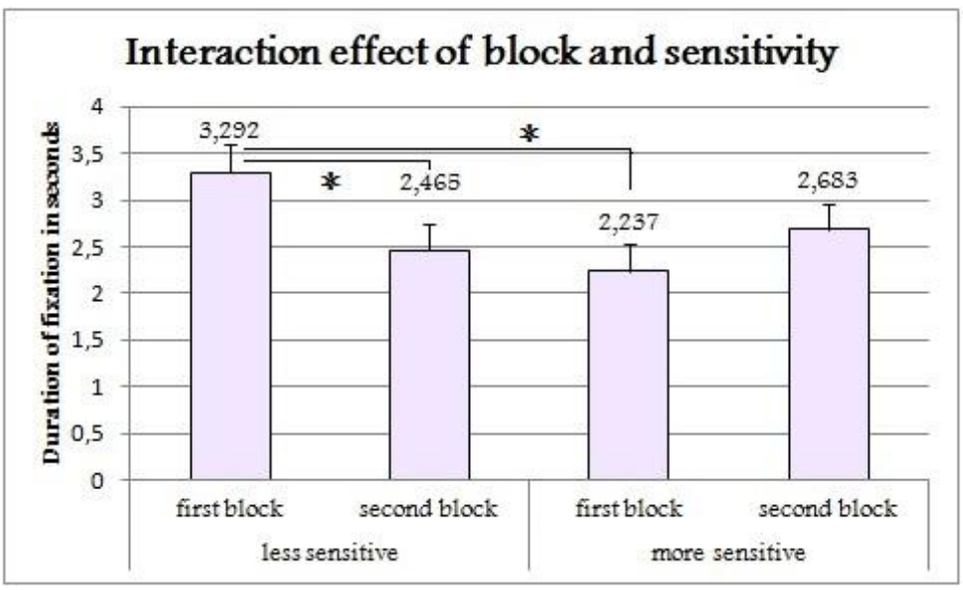

Figure 4: Interaction effect of block and sensitivity.

6. Discussion

The present study investigates the monitoring pattern of social interactions of one year old infants of more sensitive and less sensitive mothers. In particular we investigated whether there were any monitoring differences between crying and laughing movies for infants with more sensitive mothers and infants with less sensitive mothers as well as differences between responsive and unresponsive movies.

When investigating the first research question '*Are there any monitoring differences between crying and laughing movies for infants with more sensitive mothers and infants with less sensitive*

mothers?', we found that maternal sensitivity did influence infants' monitoring of the separation part of the observed movies, but not the way in which infants differentiated between these movies with the two types of accompanying sound. In general we found that infants of less sensitive mothers and more sensitive mothers both looked longer at the crying movies than at the laughing movies. Thus, maternal sensitivity does not influence infants' monitoring of the crying and laughing movies. However, the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive movies but not during the responsive movies. This could be explained by the sensitivity theory of Ainsworth and colleagues (1978) which states that mothers' responses to their infants' signals influence children's development and by Bowlby's theory of internal working models (1969) which claims that the relationship with a primary caregiver influences how we understand the social world around us. Infants of less sensitive mothers look less at the unresponsive movies presumably because they are already familiar with these types of interactions due to their own history with their primary caregiver. However, in the separation part of the movies there is not yet a responsive or unresponsive reaction of the big oval shape. It might be that infants learn, on the basis of the color of the bigger shape in the first four movies, that they will see a responsive or unresponsive outcome in the second four movies and thus they look less. It is however debatable whether infants as young as twelve months could learn so quickly after seeing only four movies of twenty seconds. Furthermore, we found that infants in general look longer in the first block than in the second block. This could also be explained by a learning effect of the first four movies, but it is more likely that infants just needed less time to process what is going on after seeing the first four movies. We also found that in general infants look longer at the crying movies than the laughing movies during the separation part of the movie. And more specifically, we found that infants look longer at the crying movies than the laughing in the second block, but not in the first block and we found that infants' overall attention declined across the repetition of the presentation during the laughing movies, but not during the crying movies. The attention in the second block during the crying movies and the decline during the laughing movies could be explained by the fact that the crying movies might attract the infants' attention in the second block, because crying sounds arouse humans more than neutral or laughing sounds (Seifritz, Esposito, Neuhoff, Lüthi, Mustovic, Dammann, von Bardeleben, Radue, Cirillo, Tedeschi & Di Salle, 2003; Lorberbaum, Newman, Dubno, Horwitz, Nahas & Teneback, 1999; Lorberbaum, Newman, Horwitz, Dubno, Lydiard & Hamner, 2002). Thus although infants in general looked less in the second block, the crying sounds may have captured their attention in the second block.

When looking at infants' monitoring of the different oval shapes in the crying and laughing movies, we found that infants looked longer at the bigger and smaller shape in the crying movies than in the laughing movies. This could also be explained by the fact that crying sounds arouse humans more than neutral or laughing sounds (Seifritz, Esposito, Neuhoff, Lüthi, Mustovic, Dammann, von Bardeleben, Radue, Cirillo, Tedeschi & Di Salle, 2003; Lorberbaum, Newman, Dubno, Horwitz, Nahas & Teneback, 1999; Lorberbaum, Newman, Horwitz, Dubno, Lydiard & Hamner, 2002). However, it's more likely that because of the fact that infants focused more on the oval shapes than elsewhere on the screen, the type of sound influence how much time infants need to process and represent the interaction. Crying indicates distress which may be a more complex situation which may need more time. Furthermore, we found that infants looked longer at the bigger and smaller oval shape in the first block than in the second block. This could also be explained by a learning effect of the first four movies or by the fact that infants needed less time to process what is going on after seeing the first four movies. At last, we found that infants looked longer at the bigger shape than the smaller shape. This could be explained by the fact that the bigger shape is bigger than the smaller shape and that in addition, the area of interest of the bigger shape is bigger than the area of interest of the smaller shape. It could also be due to the fact that the big oval shape moves and the small oval shape does not. Infants' attention could be automatically attracted to the moving shape and infants may find a moving shape more interesting to look at.

When investigating the second research question '*Are there any monitoring differences between responsive crying and unresponsive crying movies for infants with more sensitive mothers and infants with less sensitive mothers?'*, we found that maternal sensitivity did influence infants' monitoring of the response part of the observed movies, but not the way in which infants differentiated between the responsive crying versus the unresponsive crying movies. We found that infants of less sensitive mothers looked longer in the first block than infants of more sensitive mothers, while in the second block there was no such difference. Furthermore, we found that the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive crying and responsive crying movies, while infants of more sensitive mothers did not show this decline. It might be that infants of less sensitive mothers needed less time to process what is going on after seeing the first four movies However, it might also be that infants of less sensitive mothers had enough or were bored after seeing the first four movies. In addition, Bornstein and Tamis-LeMonda (1997) did find that maternal sensitivity at the age of five months, predicted infants' attention span and that maternal

sensitivity at the age of thirteen months was, although not significant, associated with infants' attention span. It might therefore be that infants of less sensitive mothers have a shorter attention span.

Although the hypotheses of the present research were not confirmed, the present research did find a relationship between maternal sensitivity and the monitoring pattern of social interactions of one year old infants. When looking at the separation part of the observed movies, the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive movies but not during the responsive movies. Furthermore, when looking at the response part of the observed movies, we found that infants of less sensitive mothers looked longer at the first four movies than infants of more sensitive mothers, while in the second four movies there was no such difference. We also found in the response part of the observed movies, that the overall attention of infants of less sensitive mothers declined across the repetition of the presentation during the unresponsive crying and responsive crying movies, while infants of more sensitive mothers did not show this decline.

This research is not without limitations. First, the sample consisted of only 38 mother-infant pairs which is not enough to generalize the results to a larger population. In addition, all mother-infant pairs were from the Leiden area and the sample consisted mostly of higher educated mothers. Second, the categories of less sensitive and more sensitive were unevenly distributed. Mothers with an overall score between 3,5 and 5,5 on the Ainsworth Sensitivity scale were coded as less sensitive and mothers with an overall score between 6,5 and 7,5 on the Ainsworth Sensitivity scale were coded as more sensitive. So even though there was an equal number of less sensitive and more sensitive mothers, the distribution of the categories was unequal. Third, the analysis of the response part of the movie only looked at the crying movies. It could be that the laughing movies, which the infants also saw, influence their monitoring. However, the analysis including both the crying and laughing movies showed the same results. It therefore could be concluded that the laughing movies did not influence the monitoring of the crying movies. At last, this research investigated infants' duration of fixation. Although infants seem to look longer at a new or unexpected event than a familiar or expected event (Spelke, 1985), it is still the question whether duration of fixation truly shows infants' representation of social interactions.

Besides the limitations, this research also has strong aspects. For instance, the research is the first research to investigate the relationship between maternal sensitivity and infants' representation of social interactions. The sample consisted of an approximately equal number of boys and girls. Furthermore, the sensitivity score were based on three different episodes, which

gives a more reliable score of maternal sensitivity and in addition, maternal sensitivity is coded using the Ainsworth sensitivity scale (Ainsworth et al., 1978), which is a reliable and valid coding scale. At last, the research made use of an eye-tracker which measures the eye movements more accurate than for example using a video recording.

Further research with a larger sample and a better distribution of maternal sensitivity is needed to investigate the relationship between maternal sensitivity and infants' representation of social interactions. A larger sample may confirm the hypotheses and allows a generalization to a large population. A better distribution of maternal sensitivity may show significant differences between the infants of less sensitive and more sensitive mothers. Investigating the relationship between maternal sensitivity and the monitoring pattern of social interactions of one year old infants may tell us something about the possible influence of maternal sensitivity on the development of infants' representation of social interactions.

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