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Title: 'Maternal reflective functioning as predictor of maternal and infant behavior during the Still-Face Paradigm'

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REFLECTIVE FUNCTIONING AND THE STILL FACE PARADIGM

Abstract

The present study was the first to investigate the association between mothers' ability to reflect upon the relationship with her (unborn) infant during pregnancy and maternal and infant behavior during the Still-Face Paradigm (SFP). The sample consisted of 52 mother-infant dyads, from both high (HR, N = 22)- and low (LR, N = 29) risk backgrounds, as defined by the presence/absence of unemployment, poverty or financial problems, housing problems, limited or instable social support network, being single or having changing partners, (subclinical) psychiatric problems (such as depression, anxiety, borderline, aggression), or substance abuse (smoking, alcohol, or drugs). High-risk (HR)-mothers had lower levels of reflective functioning than LR-mothers and showed less sensitive and more intrusive behavior in interaction with their infants. Infants from high risk backgrounds showed more negative affect during play and less gaze towards mother during the still-face episode of the SFP. Reflective functioning during pregnancy predicted maternal sensitive and intrusive behavior during play, but only for LR-mothers. In general, maternal reflective functioning predicted infant display of minimal positive affect during the still-face episode, an association that was not mediated by maternal behavior during the SFP. These results indicate that mothers' reflective abilities predict later maternal sensitive and intrusive behavior, and even some infant behavior independently from maternal behavior. Future studies should further clarify the role of maternal reflective capacities in the development of children's emotion regulation abilities, and its potential role in prenatal coaching and interventions.

Keywords: still-face paradigm, infant, emotion regulation, maternal, behavior, sensitivity, intrusiveness, temperament, high risk.

Maternal reflective functioning as predictor of maternal and infant behavior during the Still-Face Paradigm

The Still-Face Paradigm (SFP) was designed by Tronick, Als, Adamson, Wise, and Brazelton (1978) to investigate interactions between mothers and their infants. In the procedure mothers are first asked to play with their infant as they are used to, followed by an episode in which the mothers do not interact with their infant and remain still-faced. The procedure is ended by a reunion episode in which interaction with the infant is resumed. The SFP has been widely studied, and the still-face effect, involving increased negative affect, reduced gaze and a decrease of positive affect, has been replicated in numerous studies (Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2009). Moreover, studies consistently report a carry-over effect from the still-face episode into the reunion episode, which consists of reduced positive and increased negative affect in the reunion episode compared to the baseline episode (Adamson & Frick, 2003; Mesman et al., 2009). Studies using the SFP try to explain differences in maternal behavior as well as infant behavioral and physiological reactivity by examining differences in outcomes on the basis of factors such as gender, age, social and economic adversity, familiarity of the adult, temperament, and maternal psychopathology. Furthermore, maternal behavior and infant reactivity in the SFP have been used to predict later outcomes such as social competence, problem behaviors, and attachment security (Mesman et al., 2009). The SFP involves distressing as well as non-distressing interactions, which is an important advantage of the procedure, since sensitivity to distress is related to the prediction of secure attachment, higher competence and lower behavioral problems (Leerkes, Blankson, & O'Brien, 2009; McElwain & Booth-LaForce, 2006).

SFP and infant attachment

Infant attachment security is widely recognized as an important predictor of positive infant development (Thompson, 2008). A meta-analysis by Mesman et al. (2009) has shown

that high maternal sensitive behavior during the SFP predicts higher rates of infant positive affect. In turn, infant positive affect predicts higher rates of secure attachment in one-year olds. Researchers have tried to establish which factors contribute to the intergenerational transmission of attachment. One of the ways through which the mental representation of attachment as measured with the Adult Attachment Interview is transmitted from mother to infant is through maternal behavior. A meta-analytic study demonstrated that sensitive responding to infant cues in free play as well as instructional settings is an important factor in the transmission of maternal attachment representation and infant attachment quality (Van IJzendoorn, 1995). However, maternal sensitive behavior does not fully explain the association between maternal attachment representation and infant attachment security, and thus a transmission gap remains. It was proposed that correlated measurement errors, genetic influences, and interactive transmission mechanisms that have not yet been established could play a role in explaining the transmission gap. Fonagy et al. (1995, as cited in Slade, Grienenberger, Bernbach, Levy, & Locker, 2005) argued that rather than cognitive appraisal of attachment relationships with parents, reflective functioning about feelings and behaviors might play a role in the transmission gap.

Reflective functioning

Reflective functioning refers to psychological processes or mental functions that enable an individual to form mental constructs and thereby organizing one's own and other's behavior (Fonagy, Target, Steele, & Steele, 1998). It is the capacity of a mother to understand her own and her infant's behavior in terms of her own and her infants developing internal experience, and to reflect upon these underlying mental states and intentions of herself and her infant (Slade et al., 2005). Individuals differ in their capacity to use this higher order cognitive function. Reflective functioning involves knowledge about the relations between experiences, behaviors, emotions, beliefs, feelings and desires. It is not characterized by the

ability to theoretically describe the relations between these concepts, but by the extent to which individuals are able to describe their own and others' actions by providing information in terms of beliefs, feelings, plans et cetera, beyond the obvious facts (Fonagy et al., 1998). Closely related to reflective functioning is the concept of maternal mind-mindedness. These concepts differ from each other in that maternal mind-mindedness refers to the quality of a mother's mind-related comments in interaction with her infant, while reflective functioning refers to the metacognitive representation that a mother conveys about the relationship with her infant (Sharp & Fonagy, 2008). Slade et al. (2005) proposed that reflective functioning is a possible mechanism in the intergenerational transmission of attachment. They found support for this assumption by establishing a relationship between parental reflective functioning and adult attachment in a relatively small sample. Moreover, they found that reflective functioning fully mediated the association between adult and infant attachment classification. The authors argued that reflective functioning, that is, the mother's capacity to reflect on the internal experiences of her child as well as herself as a parent, might be more relevant in explaining the transmission gap than experiences of her own attachment relationship with her parents. Furthermore, Fonagy et al. (1998) reported that infants of mothers who show higher rates of reflective functioning are more likely to be securely attached to their mothers, and mentalizing in children at five years old is predicted by parental reflective functioning. Infant mentalizing behaviors in turn, are thought to play a role crucial in the development of emotion regulation capacities (Sharp & Fonagy, 2008). It can thus be concluded that high reflective functioning seems to promote attachment security.

Reflective functioning and maternal behavior

As previously discussed, maternal sensitive behavior does play a role in promoting attachment security. Since high reflective functioning seems to promote attachment security the question remains if high reflective functioning is also related to caregiving behaviors in

mothers. Slade et al. (2005) argue that reflective functioning capacity might play an important role in predicting maternal caregiving behavior. In favor if this notion (Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002) found that mothers with a more balanced representation of the relationship with their 7-month old infant displayed more positive affect during the reunion episode of the SFP than mothers with a disengaged representation. They also reported that mothers with a distorted representation showed more rejecting behavior during the reunion episode than mothers with a balanced or disengaged representation. Likewise Rosenblum, McDonough, Sameroff, and Muzik (2008) reported that high maternal reflective functioning was associated with more sensitive and less, rejecting/angry, anxious and intrusive maternal behavior during interaction in free play and teaching tasks with their 7-month-old infants. As well, maternal reflective functioning was found to be negatively correlated with caregiving behaviors as measured by disrupted affective communication (Grienenberger, Kelly, & Slade, 2005). Mothers who score high on reflective functioning are less likely to show disrupted affective communication. Additionally, they established that negative caregiving behavior partially mediated the relation between maternal reflective functioning and infant attachment security, with negative caregiving behavior remaining significant when accounting for maternal reflective functioning. In a study by Lok and McMahon (2006) it was reported that mothers who show greater mind-mindedness tend to be less hostile in interaction with their children. However, they did not find an association between mind-mindedness and maternal sensitive behavior. Likewise, Lundy (2003) reported that interactional synchrony mediated the association between maternal thought-related comments and infant attachment security. From these results it can be concluded that maternal reflective capacity and maternal caregiving behaviors are closely related.

Reflective functioning and infant behavior

REFLECTIVE FUNCTIONING AND THE STILL FACE PARADIGM

To date, little is known about the relation between reflective functioning and infant behavior. More research into the relationship between maternal reflective capacity and infant emotion regulation is needed (Sharp & Fonagy, 2008). Rosenblum et al. (2002) conducted a study in which they related maternal representations about their relationship with their infant to infant behavior during the SFP. They found that maternal representational typology interacted with infant behavior, such that infants of mothers with a disengaged representation showed more negative affect during the play episode compared to infants of mothers with a balanced or distorted representation. As discussed before, maternal reflective functioning has been found to predict children's mentalizing abilities at age five (Fonagy et al., 1998). Furthermore, it was found that adoptive mothers who scored high on reflective functioning tend to rate their children as showing less externalizing problem behavior (Priel, Melamed-Hass, Besser, & Kantor, 2000). Also, data associated with meta-emotion philosophy, a concept similar to reflective functioning that focuses more on parental emotion-regulation strategies, revealed that children of parents who score higher on emotion-coaching show, among other things, less physiological stress and better physiological regulatory abilities (Gottman, Katz, & Hooven, 1996). It can be concluded that absent or poor maternal reflective functioning is thought to have a detrimental influence on infant's behavioral and emotional regulation and might play a role in the development of psychopathology (Slade, 2005). High maternal reflective functioning is expected to be associated with more favorable infant behavioral reactions in the Still-Face (Rosenblum et al., 2002). Furthermore, since maternal caregiving behavior and infant reactivity are related it is expected that maternal behavior might play a mediation role in the association between maternal reflective functioning and infant behavioral reactivity in the SFP. In favor of this notion, Rosenblum et al. (2002) found that maternal positive affect mediated the association between maternal representation of the relationship with her infant and infant positive affect during the reunion episode.

The role of adverse environment

Infants who are at specific risk for the early development of aggressive and anti-social behavior patterns are infants from high adversity backgrounds, with a combination of risk factors such as low socio-economic background, maternal psychopathology, family conflict, being a single caregiver and coercive parenting (Hermanns, Öry, & Schrijvers, 2005; Moffit & Caspi, 2001). Infants who have a genetic predisposition for the development of emotion regulation problems are thought to profit from a good quality rearing environment, but also to be at extra risk for developing problems when raised in a less supportive environment (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007). The sample of the current study comprises mothers from high as well as low risk backgrounds. Studying children from both high and low adversity backgrounds in their reactions in response to the SFP allows for early detection of differences in behavioral and emotional regulation in infants. Gunning, Halligan, and Murray (2013) reported that mothers from a high adversity group show less sensitive behavior in the play episode of the SFP. They also found that infants in the high adversity group showed more behavioral dysregulation during the play episode, an effect that was mediated by lower maternal sensitivity of the mothers in this group. Furthermore, Feldman (2007) found that mothers from a high risk background showed more intrusive behavior in interaction with their 4-month old infant than mothers from a low risk background.

The role of infant temperament

Besides the role of maternal reflective functioning and maternal interactive behavior infant characteristics are also thought to play a role in infant behavioral reactivity in response to stressful situations, such as the SFP (Braungart-Rieker, Garwood, Powers, & Notaro, 1998; Gunning et al., 2013; Mesman et al., 2009). Infant temperament is thought to be largely biologically based and genetically linked with individual differences in infant emotional,

motor, and attentional reactivity (Posner, Rothbart, & Sheese, 2007; Rothbart, 2007). The development of the infant's capacity to regulate behavioral and physiological responses is associated with important conditions for satisfactory emotional and behavioral development, such as empathy, conscience, and a low incidence of problem behavior (Rothbart, 2007). Infants with difficult temperaments are at risk for developing early aggressive and anti-social behaviors (Moffit & Caspi, 2001). Therefore, it is important to consider the contribution of temperamental traits in the behavioral response of infants in the SFP. To date however, no direct relation between temperament and infant reactivity in the SFP was established in a meta-analysis (Mesman et al., 2009), and current findings on temperament and mother and infant behavior in the SFP are mixed. Some studies report associations between infant temperament and infant reactivity or maternal behavior (Fuertes, Beeghly, Lopes dos Santos, & Tronick, 2011; Gunning et al., 2013; Mesman, Linting, Joosen, Bakermans-Kranenburg, & van IJzendoorn, 2013; Tarabulsy et al., 2003; Yoo & Reeb-Sutherland, 2013), while others did not (Conradt & Ablow, 2010; Haley & Stansbury, 2003; Joosen, Mesman, Bakermans-Kranenburg, & van IJzendoorn, 2012).

Relevance

To date no studies have investigated links between prenatal maternal reflective functioning , maternal behavior, and infant behavioral reactivity in the SFP. Promoting maternal reflective functioning might be an effective way to improve the mother's experience of the relationship with her child as well as the interactive behavior with her child (Rosenblum et al., 2008). Early intervention aimed at preventing the development of anti-social behavior are more effective when they are started early in development (Hermanns et al., 2005). Intervention programs such as 'Minding the Baby' might be targeted to specific high risk populations, since reflective capacities are underdeveloped in mothers who experience high rates of adversities (Slade, 2007).

Research questions and hypotheses

First it will be established if the classic Still-Face effect is present in the current sample and if differences exist in behavioral reactivity between infants from high and low adversity groups. Additionally, it will be investigated whether maternal reflective functioning is predictive of maternal sensitive and intrusiveness behavior as displayed during the play and reunion episodes of the SFP and if this association is difficult for high risk than for low risk mothers. Furthermore, it will be explored whether maternal reflective functioning and maternal sensitivity and intrusiveness as displayed in the Still-Faced Paradigm play a role in the prediction of infant reactivity in the SFP. Moreover we will consider the role of infant temperament in maternal and infant behavior during the SFP.

It is hypothesized that infants show reduced positive and increased negative affect during the still-episode compared to the play episode. For negative affect and positive affect it is expected that a carryover effect from the still-face to the reunion episode is present. Also, a decline in gaze towards mother is expected from play to the still-face episode. It is expected that infants from the high adversity group show more negative affect in response to the still-face episode. Mothers from the high adversity group are expected to display less sensitive, and more intrusive behavior during the SFP. It is hypothesized that higher reflective functioning predicts more sensitive and less intrusive maternal behavior in the SFP. Furthermore, we hypothesize that higher reflective functioning is associated with more favorable infant behavioral reactions in the SFP, and that this association might be mediated by maternal sensitive and intrusive behavior in the SFP. Regarding temperament no direct relation between infant temperament and infant and maternal behavior during the SFP is expected.

Method

Sample and procedure

Participants were recruited in the context of an ongoing longitudinal study in which young mothers and their infant are followed from pregnancy up to when the infant is 2.5 years old. This study is aimed at evaluating factors that contribute to a positive development of the mother-infant relationship and identifying early patterns of emerging aggressive behavior in infants**,** by relating behavior patterns during development to neurocognitive and environmental factors (National Initiative Brain & Cognition, 2013). The data for the current study were collected during home visits at 27 weeks of pregnancy and when the infant was six months old. The participants were recruited before or during the third trimester of pregnancy at hospitals, through midwifery practices, at a pregnancy and baby fair held in The Netherlands, via advertisements on websites and through personal contacts of workers and students on the project. Mothers between 17 and 25 year of age, pregnant of their first infant, below 27 weeks of pregnancy who had sufficient proficiency in speaking and reading the Dutch language were eligible for participation in the project. Exclusion criteria were severe drug addiction or severe psychiatric problems with a formal diagnosis, estimated intelligence quotient below 70, and mothers of whom the infant was expected to have a deviant development because of identified birth defects or severe medical problems. Informed consent was obtained prior to participation of the project. Mothers received a gift card and a present for their infant with each visit. The Ethics Review Board of the Institute of Education and Child Studies at the Faculty of Social and Behavioral Sciences of Leiden University as well as the Medical Ethical Committee of the Leiden University Medical Center approved of all procedures and measures that were applied in this study. The participants were assigned to the low risk group, the high risk control group, or de high risk intervention group after the home visit around 27 weeks of pregnancy. Mothers were assigned to the high risk group in when

mother's self-reliance was thought to be limited, with the current presence of one or more of the following risk factors; unemployment, poverty or financial problems, housing problems, limited or instable social support network, being single or having changing partners, psychiatric problems (such as depression, anxiety, borderline, aggression), substance abuse (smoking, alcohol, or drugs). When the infant was approximately 6 months old a 2,5-hour home visit was conducted by two trained PhD-candidates or graduate students. The sample for the current study consisted of 52 mothers aged 16 to 22 (M = 22, SD = 2.52) and their approximately 6-month-old infant (Mean age 5.96 months, SD = 0.44; 24 boys), with 29 mothers being part of the low risk group and 23 mothers being part of the high risk group. Half of the mothers in the high risk group received coaching visits every two weeks, the other half received care as usual.

Measurement Instruments

Still-Face Paradigm. The Still-Face Paradigm (SFP) (Mesman et al., 2009; Tronick et al., 1978) was administered to the mother-infant dyads during a 2.5 hour long home-visit. The mother was asked to place her infant in a car seat on a table, in between a wooden frame with a mirror attached to it. Mothers were seated in front of the infant seat. A camera was placed behind the mother, so that the infant was filmed directly, while the mother was filmed via the mirror. Mothers were instructed to play with their infants as they were used to for two minutes (play), followed by a two minutes episode in which the mother was asked to look in the direction of the infant with a neutral or 'still' face without touching or vocalizing at the infant (still-face). After the still-face episode a two-minute reunion episode followed in which the mothers were asked to resume interacting with their infant (reunion).

Coding of infant behaviors. Infant behaviors during the SFP were coded according to the criteria of Mesman (2010), which are adapted from the coding system of Miller and Sameroff (1998). For each episode scores are assigned for infant reactivity (positive and

negative affect) and regulation (gaze). Behaviors were scored on a 4-point scale ranging from 0 (behavior not present) to 3 (behavior predominantly present). For the infant variables the play episode was coded as a whole (2 minutes), while the scores for the still-face and reunion episode were assigned separately for the first and second minute of the episode. The episodes of the SFP were independently coded by two trained coders. A total of 20 videos were coded by a second rater, resulting in moderate to almost perfect agreement with intraclass correlations ranging from .83 (gaze) to .92 (positive affect). Differences in assigned ratings were discussed and consensus scores were ascribed. For the positive affect scale the number of infant smiles (not necessarily toward mother) were coded. For the scale negative affect the number of times an infant displayed fussy or crying behaviors was coded. The scale gaze scored the amount of time an infant gazed at mother's face or made eye contact with the mother (independent of affect).

Coding of maternal behavior. Maternal sensitivity and intrusiveness during the SFP were coded according to the criteria of Mesman (2010) that are adapted from the coding system of Miller and Sameroff (1998). Maternal behavior is coded in the play and reunion episode only; codes were assigned for both episodes as a whole (2 minutes). Behaviors were scored on a 4-point scale ranging from 0 (behavior not present) to 3 (behavior predominantly present). The mother variables received separate scores for the play and reunion episode. The same coding procedure as for the infant variables was followed for coding the mother variables, yielding intraclass correlations of .61 for sensitivity and .65 for intrusiveness. The sensitivity scale coded the appropriateness and sensitivity of the mother in play and general interaction. The scale intrusiveness coded how roughly the mother handled the infant and to which degree she interfered with the infant's needs, interests and behaviors.

Coding of maternal reflective functioning. A Dutch translation of the Pregnancy Interview (PI; Suurland & Smaling, 2011) was administered to the participants by extensively

trained interviewers during a home-visit around 27 weeks of pregnancy. The PI is a semi-structured clinical interview that takes about an hour to administer and is used to code the extent of maternal reflective functioning (Slade, Patterson, & Miller, 2007). The PI consists of 22 questions aimed at eliciting a variety of aspects of the mother's experiences of pregnancy, and her fantasies and expectations about the future relationship with her unborn child. Scoring of the PI was done using the Addendum to the Reflective Functioning Scoring Manual for use with the PI, and the original Reflective Functioning manual (Fonagy et al., 1998; Slade et al., 2007). Reflective functioning is coded on a continuum from low to high reflective capacities, ranging from -1 (negative reflectiveness) to 9 (full or exceptional reflective functioning). Scores for reflective functioning in the current sample ranged between 2 (vague or implicit references to mental states) and 6 (between definite and marked reflective functioning).

Infant temperament. A short version of the Infant Behavior Questionnaire-Revised (IBQ-R) was administered to the mother during the home visit when the infant was 6 months old (Gartstein & Rothbart, 2003). For the purpose of the current study a short form of the IBQ-R was used, in which the items of the Surgency/Extraversion dimension are excluded. The IBQ-R short form contains 51 items measuring the dimensions Negative Affectivity and Orienting/Regulation. The dimension Negative Affectivity includes of the scales Sadness, Distress to Limitations, Fear and Falling Reactivity/Rate of Recovery from Distress. The dimension Orienting/Regulation measures regulatory functioning and includes the scales Low Intensity Pleasure, Cuddliness/Affiliation, Duration of Orienting, Soothability, and Smiling and Laughter. In order to complete the IBQ-R short version mothers were asked to read descriptions of infant behavior, and to indicate how often their infant engaged in those behaviors during the last week. Examples of such descriptions are "Did the baby seem sad when the caregiver was gone for an unusually long period of time" and "When frustrated with something, how often did the baby calm down within 5 min?" Answers were recorded on a 7-

point Likert-type scale (never, very rarely, less than half the time, more than half the time, almost always, always). Adequate reliability and validity of the IBQ-R has been demonstrated in different samples from a number of different cultures (Gartstein & Rothbart, 2003; Montirosso, Cozzi, Putnam, Gartstein, & Borgatti, 2011; Parade & Leerkes, 2008). Cronbach's alpha values for the subscales ranged from **.**43 (Low Intensity Pleasure) to .78 (Fear and Falling Reactivity and Duration of Orienting) in the current sample.

Background variables. Correlations of background variables maternal and infant age, and maternal and infant intellectual functioning with the predictor and outcome variables were computed, and if significant correlations with background variables and predictor and outcome variables were present, these variables were taken into account in subsequent analyses. Indices of maternal intellectual functioning were estimated from the subtests Vocabulary, Matrix Reasoning and Digit-Span Backwards of the WAIS-III (Wechsler, 2001). Infant mental development was measured using the Dutch version of the Bayley's Scales of Infant Development-II (BSID-II-NL; Meulen, Ruiter, Lutje Spelberg, and Smrkovsky (2002). Both the WAIS-III subtests and the BSID-II-NL were administered during the home-visit around 6 months.

Data analysis

Prior to data-analysis data-inspection was carried out on all variables of interest and background variables to check for violations of normality. Prior to conducting the main analyses it was established whether significant correlations existed between the variables of interest, as well as the variables of interest and background variables. *T*-test were conducted to look for high- and low risk group differences. In order to investigate if the classic Still-Face effect was present in the current sample a repeated measures analysis of variance (Repeated measures ANOVA) was executed with infant behavior for each episode of the SFP as within-subject variable (positive affect, negative affect, and gaze) and risk status (group) as between-

subjects factor. Repeated contrasts were used since the infant behavior variables were assessed at consecutive points in time and Bonferroni adjustments were used for reporting pairwise comparisons (Field, 2009). For the mother variables that were significantly correlated with maternal reflective functioning linear regression analyses were carried out for high risk and low risk mothers separately as well as the entire sample. In order to investigate if maternal reflective functioning played a role in the prediction of infant behavior logistic regression analyses were executed. Logistic regression was applied because the two variables for which significant correlations were present were nominal; infant displayed no or only limited positive affect during the still-face episode. A mediation model of the relation between maternal reflective functioning and infant positive affect in the second part of the still-face by maternal intrusiveness during play was tested using the adapted steps of Baron and Kenny (1986) for testing mediation with nominal variables (Iacobucci, 2012). A moderation analysis using analysis of covariance (ANCOVA) was used to establish if the association between infant regulation and infant gaze during the second part of the still-face was moderated by risk status, since these variables were different for both groups. Linear regression analyses were carried out to investigate if infant temperament plays a role in the prediction of maternal and infant behavior during the SFP.

Results

Preliminary analyses

Listwise deletion was applied to missing data. Reflective functioning was coded for 50 of the 52 mothers who completed the Still-Face Paradigm (SFP) with their infant at the 6 months home visit. One of the files was lost due to technical difficulties and for one file coding was not completed at the time of writing. The SFP was completed for a 51 of 52 mother-infant dyads were the 6-months home-visit was conducted, due to refusal of the mother to continue with the experiment. The BSID-II-NL was not completed for four infants,

due to fussiness or tired behavior. The IBQ-R questionnaires were not completed for four infants because the questionnaires were not returned. Table 1 shows descriptive statistics of background, infant, and mother variables for the entire sample, as well as the low and high risk group separately. Categories with only one observation were merged with the category below, this was done for positive affect in the first part of the still face, and for gaze in the play and still-face. There were no severe violations of normality for any of the variables of interest, with skewness and kurtosis values between -2 and 2. Two-sided *t*-tests revealed that mothers from the high risk group scored lower on vocabulary than mothers from the low risk group, $p = .001$. Furthermore, mothers from the low risk group displayed higher levels of reflective functioning ($p = .001$) and sensitivity during play ($p = .001$) and reunion ($p < .05$). Mothers from the low risk group showed less intrusive behavior during play ($p < .05$) but not the reunion episode. Infants of high risk mothers displayed more negative affect during play ($p < .05$) and less gaze towards mother in the second part of the still-face, $p < .05$. Moreover, mothers from the low risk group rated their infants as having better regulatory abilities, $p < .05$. Infants from both groups did not differ on any of the other temperamental or behavioral indices. Correlations among the study variables are shown in Table 2.

Results Still-Face effect

Repeated measures ANOVA's were conducted to investigate if the classic still-face effect occurred in the present sample. Mauchly's test was significant for all infant behavior variables (<.05) with $\varepsilon > .75$ for all dependent variables except negative affect ($\varepsilon = .74$), which indicated that the assumption of sphericity was violated. The Huynh-Feldt correction was used to determine the degrees of freedom when $\varepsilon > .75$, and the Greenhouse-Geisser correction was used when $\varepsilon < .75$ (Field, 2009). Figure 1 depicts infant positive and negative

Table 1

Means and standard deviations of raw scores for background and study variables.

	All (N = 52)		Low risk (n = 29)		High risk (n = 22)		t (df)
	Mean	*SD*	Mean	*SD*	Mean	*SD*	χ^2 (df)
Background variables							
BSID Developmental index	99.09	19.31	98.46	19.73	99.95	19.19	-0.26 (46)
WAIS Digit Span raw score	7.23	2.36	07.83	2.24	6.48	2.33	2.12 (50)
WAIS Vocabulary	8.59	3.40	10.00	3.08	6.73	2.91	3.84 (49)**
WAIS Matrix Reasoning	9.98	2.67	10.28	3.03	9.61	2.13	0.89 (50)
Mother variables							
Reflective functioning	3.67	0.93	4.00	0.78	3.22	0.85	3.38 (48)**
Sensitivity play	1.92	0.62	2.17	0.60	1.59	0.50	3.66 (49)**
Sensitivity reunion	1.67	0.71	1.93	0.75	1.36	0.49	3.07 (49)*
Intrusiveness play	2.17	0.76	1.90	0.77	2.50	0.60	-3.04 (49)*
Intrusiveness reunion	2.21	0.72	2.03	0.68	2.41	0.73	-1.88 (49)
Infant variables							
Negativity	2.62	0.67	2.50	0.54	2.80	0.79	-1.55 (46)
Regulation	5.13	0.61	5.30	0.65	4.88	0.45	2.51 (46)*
Positive affect play	1.65	0.95	1.62	0.86	1.68	1.09	-0.22 (49)
Positive affect SF 1	0.21	0.41	0.24	0.44	.14	0.35	0.88 (1)
Positive affect SF 2	0.17	0.38	0.24	0.44	.09	0.29	1.95 (1)
Positive affect reunion1	1.15	0.87	1.07	0.75	1.27	1.03	-0.82 (49)
Positive affect reunion 2	0.96	0.95	0.90	0.82	1.05	1.13	-0.55 (49)
Negative affect play	0.81	0.91	0.55	0.78	1.09	0.97	-.2.20 (49)*
Negative affect SF1	1.08	1.01	0.90	0.86	1.27	1.16	-1.33 (59)
Negative affect SF2	1.17	1.23	1.03	1.18	1.36	1.33	-0.93 (49)
Negative affect reunion1	1.31	1.11	1.14	1.06	1.50	1.19	-1.15 (49)
Negative affect reunion 2	1.27	1.14	1.03	1.05	1.55	1.22	-1.60 (49)
Gaze play	1.73	0.77	1.86	0.83	1.55	0.67	1.46 (49)
Gaze SF 1	1.04	0.59	1.14	0.58	.86	0.56	1.70 (49)
Gaze SF 2	0.88	0.58	1.00	0.60	.68	0.48	2.05 (49)*
Gaze reunion 1	1.46	0.85	1.48	0.83	1.41	0.91	0.30 (49)
Gaze reunion 2	1.42	0.94	1.48	0.95	1.32	0.95	0.61 (49)

Note. Underlined numbers in right column indicate χ^2 statistic.

* = $p < .05$; ** = $p = .001$

affect and gaze over the course of the successive episodes of the SFP. There was a significant main effect of episode on positive affect, $F(3.39,166.32) = 51.36$, $p < .001$, $\eta_p^2 = .51$. Pairwise comparisons indicated that positive affect decreased significantly for both groups from play to still face, and increased significantly from the still face to the reunion episode. Furthermore, positive affect decreased significantly from play to the reunion episode. There was no interaction between risk status and Still Face episode, $F(3.39,166.32) = .74$, $p = .54$. Moreover, there was no main effect of risk status on positive affect, $F(1,49) = .05$, $p = .83$.

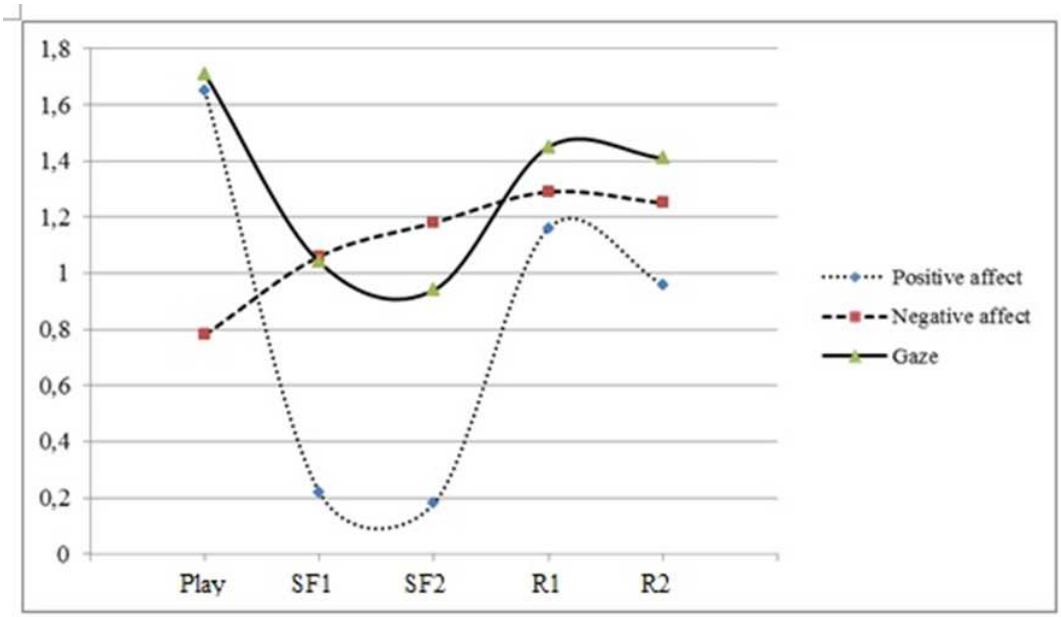

Figure 1. Infant positive and negative affect and gaze over the successive episodes of the SFP.

There was a significant main effect of episode on negative affect, $F(2.96,145.08) = 3.93$, $p < .05$, $\eta_p^2 = .07$. Pairwise comparisons revealed that negative affect did not increase significantly from play to still face, but negative affect did increase from play to both reunion

Table 2

Correlations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Reflective functioning	-																					
2. WAIS Vocabulary	.48**																					
3. Negative reactivity	-.02	-.13																				
4. Regulation	.22	.19	-.23																			
5. Sensitivity play	.51**	.30*	-.13	.05																		
6. Sensitivity reunion	.26	.39**	-.32*	.07	.57**																	
7. Intrusiveness play	-.28*	-.31*	.21	.01	-.47**	-.59**																
8. Intrusiveness reunion	-.01	-.26	.07	.05	-.27	-.51**	.65**															
9. Positive affect play	.23	.03	.11	-.04	.32*	.03	>.01	.11														
10. Positive affect SF 1	.34*	.09	.19	<.01	.14	.18	-.24	-.09	.29*													
11. Positive affect SF 2	.40**	.22	.01	.08	.14	.07	-.38**	-.21	.28*	.26												
12. Positive affect reunion1	.06	-.07	-.18	-.09	.06	.12	-.04	.04	.35*	.18	.33*											
13. Positive affect reunion 2	-.17	-.25	.05	-.04	-.01	.01	.01	.04	.46**	.17	.13	.62**										
14. Negative affect play	-.21	-.26	-.06	-.24	-.51**	-.37**	.28*	.24	-.42**	-.10	-.24	-.18	-.19									
15. Negative affect SF1	-.16	-.15	.11	-.21	-.24	-.41**	.24	.19	-.22	-.09	-.34*	-.37**	-.33*	.68**								
16. Negative affect SF2	-.12	-.15	.35*	-.16	-.19	-.34*	.37**	.27	.14	.04	-.40**	-.30*	-.11	.35*	.70**							
17. Negative affect reunion1	-.12	-.07	.20	-.11	-.19	-.27	.14	.19	-.08	-.02	-.31*	-.54**	-.42**	.41**	.66**	.68**						
18. Negative affect reunion 2	-.04	-.08	.19	-.14	-.19	-.33*	.15	.22	-.20	-.12	-.24	-.44**	-.53**	.45**	.61**	.45**	.77**					
19. Gaze play	.06	-.05	-.15	.10	.28*	.05	.05	-.07	.43**	.06	.10	.09	.25	-.10	< .01	.07	.03	-.05				
20. Gaze SF 1	.05	.10	.04	-.15	.06	.12	.03	-.11	.23	.37**	.14	.25	.21	.12	.09	.23	.04	-.05	.32*			
21. Gaze SF 2	.20	.20	-.04	-.31*	.14	.10	-.04	-.03	.18	.02	.18	.19	.06	.07	.02	.08	-.01	-.01	.19	.64**		
22. Gaze reunion 1	-.02	.07	-.02	-.30*	.07	-.01	.09	.13	.37**	.05	.17	.46**	.39**	.02	-.11	.07	-.13	-.11	.25	.63**	.55**	
23. Gaze reunion 2	.03	.08	-.01	-.12	.12	.07	.20	.13	.37**	.02	.07	.33*	.57**	.03	-.10	.16	-.20	.33*	.38**	.50**	.42**	.69**

** = $p < .001$, * = $p < .05$

episodes. There was no interaction between risk status and negative affect, $F(2.92, 145.08) = .22$, $p = .88$. Furthermore, there was no main effect of risk status on negative affect, $F(1,49) = 2.99$, $p = .09$. Results indicate that there is a significant main effect of episode for gaze, $F(3.40,166.74) = 18.56$, $p < .001$, $\eta_p^2 = .28$. Pairwise comparisons revealed that gaze decreased significantly from play to still face and increased significantly from still face to reunion. Furthermore, there was no interaction between risk status and gaze, $F(3.40,166.74) = .43$, $p = .75$. Furthermore, there was no main effect of risk status for gaze, $F(1,49) = 2.15$, $p = .15$.

Predicting maternal behavior from maternal reflective functioning

Correlations among the study variables are shown in Table 2. Reflective functioning was positively correlated with sensitivity in the play, but not the reunion episode and negatively with intrusiveness in the play, but not the reunion episode. Maternal sensitivity in both the play and reunion episode correlated negatively with maternal intrusiveness in play, and maternal sensitivity in the reunion episode was inversely correlated with maternal intrusiveness during play and reunion. Linear regression analyses were carried out to investigate if maternal reflective functioning plays a role in the prediction of maternal sensitivity and intrusiveness during play. Since the level of maternal sensitivity and intrusiveness during play is different for both groups, separate regression analyses were carried out for low risk and high risk mothers as well. The results of the regression analyses are shown in Table 3. Reflective functioning significantly predicted sensitivity during play for the entire sample ($p < .001$) and the low risk group ($p < .05$), but not the high risk group. This indicates that mothers with higher levels of reflective functioning display more sensitive behavior during the play episode of the SFP, an effects that was not found for mothers with a high risk background. Likewise, reflective functioning significantly predicted intrusiveness during play for the entire and low risk, but not the high risk sample, $p < .05$. These results

indicate that mothers with higher levels of reflective functioning display less intrusive behavior during the play episode of the SFP, an effects that was not found for mothers with a high risk background.

Table 3
Regression analyses predicting maternal sensitivity and intrusiveness from reflective functioning.

	Dependent variable	R^2	*b*	*SE*	ß	*p*
All participants (*N* = 50)	Sensitivity play	.26	.35	.09	.51	< .001
	Intrusiveness play	.08	-.23	.11	-.28	< .05
Low risk (*n* = 27)	Sensitivity play	.33	.44	.13	.57	< .01
	Intrusiveness play	.24	-.44	.16	-.49	< .05
High risk (*n* = 22)	Intrusiveness play	.03	.14	.16	.19	.39
	Sensitivity play	.04	.10	.13	.17	.46

Predicting infant behavior from maternal reflective functioning

Maternal reflective functioning was positively correlated with positive affect in the first and second part of the still-face episode, but not with any of the other infant behavioral indices. The positive affect variables of the still face had only the values 0 and 1 (no or minimal positive affect), and was therefore considered a nominal variable. Logistic regression analyses were used to predict if infants showed no or minimal positive affect during the SFP.

Table 4

Results of the binary logistic regression model predicting positive affect during the first part of the still-face from reflective functioning

		B	S.E.	Wald	*df*	*p*	Exp(B)	95% CI	
								Lower	Upper
Block 0	Constant	-1.39	.35	15.37	1	< .001	.25		
Block 1	RF	1.04	.46	5.07	1	< .05	2.84	1.14	7.04
	Constant	-5.47	1.94	7.99	1	< .05	.004		

Note. RF = reflective functioning

Maternal vocabulary was significantly correlated to both reflective functioning and infant positive affect during the first part of the still face. However, the variable was not included in

the analysis, because a minimum of 50 cases is needed per predictor (Burns & Burns, 2008)**.** Table 4 shows the results of the binary logistic regression model predicting positive affect during the first part of the still-face from maternal reflective functioning. The cut-off value of the predicted probability was set on .2, close to the event rate of minimal positive affect (21%), in order to improve the sensitivity by increasing the probability of detecting infants who display a minimal level of positive affect (IBM, 2013). The model with reflective functioning was significantly different from the constant only model, which indicates that reflective functioning distinguishes between infants showing minimal and no positive affect during the first part of the still-face, Model $\chi^2(1) = 5.97$, $p < .05$. The Hosmer and Lemeshow statistic was non-significant, indicating a good fit of the model, $\chi^2(2) = .191$, $p = .91$. The model successfully predicted membership in either the no or minimal positive affect group in 56% of the cases. The value of Exp(B) indicates that when maternal reflective functioning goes up with one unit the odds ratio is 2.84 as large, which indicates that infants are 2.84 times as likely to display minimal rather than no positive affect. Because positive affect in second part of the still-face was significantly associated with reflective functioning and maternal intrusiveness during play a mediation model of the association between maternal reflective functioning and positive affect during the second part of the still face by intrusiveness during play was tested, using the guidelines for mediation analysis with categorical variables of (Iacobucci, 2012). Maternal reflective functioning significantly predicted positive affect during the second part of the still-face in the first step using logistic regression analysis in the first step, Wald $\chi^2(1) = 5.07$, $p < .01$ (see also Table 5). Reflective functioning significantly predicted intrusiveness during play using linear regression analysis in the second step, $\beta = -.23$, $t(48) = -2.04$, $p < .05$. A logistic regression analysis was carried out with intrusiveness during play and reflective functioning as independent variables to test the third and fourth step of the mediation model. The third step, the prediction of positive

affect during the second part of the still face by intrusiveness during play, controlling for maternal reflective functioning was not significant, Wald $\chi^2(1) = 1.31$, $p = .25$. Reflective functioning did significantly predict infant positive affect controlling for maternal intrusiveness in the fourth step, Wald $\chi^2(1) = 4.15$, $p = < .05$. This pattern of results indicates that the association between maternal reflective functioning and infant positive affect during the second part of the still-face is not mediated by maternal intrusiveness. Table 5 shows the results of the binary logistic regression model predicting positive affect during the second part of the still-face from maternal reflective functioning (step 1). The cut-off value of the predicted probability was set on .2, close to the event rate of minimal positive affect (17%). The model with reflective functioning as predictor differed significantly from the constant only model, indicating that reflective functioning discriminates between infants who show minimal and infants who show no positive affect during the second part of the still-face, Model $\chi^2(1) = 8.21$, $p < .01$. The Hosmer and Lemeshow statistic was not significant, which indicates that the model fits the data acceptably well, $\chi^2(2) = .76$, $p = .68$. The model successfully predicted infants to show no or minimal positive affect in 86% of the cases. The value of Exp(B) indicates that if maternal reflective functioning goes up with one unit, infants are 4.01 times as likely to display minimal rather than no positive affect.

Table 5

Results of the binary logistic regression model predicting positive affect during the second part of the still-face from reflective functioning

		B	S.E.	Wald	*df*	*p*	Exp(B)	95% CI	
								Lower	Upper
Block 0	Constant	-1.66	.39	18.48	1	< .001	.19		
Block 1	RF	1.39	.55	6.28	1	< .05	4.01	1.35	11.89
	Constant	-7.24	2.40	9.08	1	< .01	.001		

Note. RF = reflective functioning

The role of infant temperament

Because both infant regulatory capacities as reported by mother and gaze during the second part of the still-face were different for high risk than for low risk mothers, it was investigated if the association between infant regulation and infant gaze during the second part of the still-face was moderated by maternal risk status. An analysis of covariance (ANCOVA) was carried out with the main effects of infant regulation and risk status in the first step, and the interaction between infant regulation and risk status added in the second step. The interaction between risk status and infant regulation was not significant, ($F(1,43) = 0.06$, $p = .79$), which indicates that risk status did not moderate the association between infant regulation and infant gaze during the second part of the still-face. Because there was no moderation, the main effects from the first step are reported ($R^2 = .26$). There was a significant main effect of infant regulation, $F(1,44) = 10.66$, $p < .01$. Infant regulation significantly predicted infant gaze during the second part of the still face, with infants with higher regulatory capacities showing less gaze at mother during the still-face, B = -.42, $t(45) = -3.27$, $p < .01$. Furthermore, there was a significant main effect of risk status, ($F(1,44) = 9.38$, $p < .01$), with infants from the high risk group showing less gaze at mother, B = .49, $t(45) = -3.06$, $p < .01$. Results from linear regression analyses revealed that infant regulation predicted infant gaze during the first part of the reunion ($\beta = -.49$, $t(45) = -3.06$, $p < .01$, $R^2 = .09$), indicating that infants with higher regulatory capacity show less gaze at mother during the first part of the reunion. Furthermore, infant negativity significantly predicted maternal sensitivity during the reunion episode ($\beta = -.34$, $t(45) = -3.06$, $p < .01$, $R^2 = .10$), which indicates that mothers who rate their infants as having more a negative temperament show less sensitivity during the reunion episode. Additionally, infant negativity significantly predicted infant negative affect during the second part of the still face, with infants who are

rated as having a more negative temperament showing more negative affect, β = -.35, $t(45)$ = 2.52 $p < .05$, $R^2 = .12$.

Discussion

The current study sought to investigate the association between maternal reflective functioning and maternal and infant behavior during the Still-Face Paradigm (SFP) (Mesman et al., 2009; Tronick et al., 1978). Both the classic still-face effect and the carry-over effect from play to reunion were largely replicated in the current study (Mesman et al., 2009). As expected it was found that infants from a high risk background display more negative affect during the play episode and gazed less at their mother during the second part of the SFP. No differences between infants from high and low risk groups were found for the still-face and reunion episode. Children from the high risk group were rated by their mothers as having a more negative temperament. In concordance with the hypotheses, higher reflective functioning was found to be associated with more sensitive behavior during play and reunion and less intrusive behavior during the play episode SFP. However, the associations between reflective functioning and maternal behavior were only found for low risk mothers. As expected, maternal reflective functioning played a role in predicting minimal display of positive affect during the both episodes of the still-face. Mothers who show more reflective functioning have infants who are more likely to show some positive affect in the still-face episode. Contrary to expectations, the association between maternal reflective functioning and infant positive affect in the still-face episode was not mediated by maternal sensitive or intrusive behavior, and no associations were found between maternal reflective functioning and infant positive affect during play and reunion, negative affect or gaze during the SFP. Regarding infant temperament it was found that infants who have higher regulatory capacities show less gaze at mother during the second part of the still-face, as did infants from the high risk group. Infants with higher regulatory capacities showed less gaze at mother during the

reunion episode as well. Furthermore, mothers who rated their infants as having a more negative temperament displayed less sensitive behavior during the reunion episode. These infants also displayed more negative affect during the second part of the still-face.

Classic still-face effect

The classic still-face effect was partly confirmed, with a decrease of positive affect, and decrease of gaze from the baseline play episode to still-face. No significant increase of negative affect was found from play to still-face. However, the carry-over effect with reduced positive and increased negative affect from play to reunion episode was confirmed. Future studies should not only address group differences, but also individual differences in patterns of behavior across the SFP. For example, Mesman et al. (2013) found that only a limited number of infants shows the classic still-face effect regarding negative affect and gaze. Reflective functioning should be investigated in relation to these differences in reaction patterns, in order to investigate early differences in emotion regulation.

Differences between high risk and low risk

No differences in infant positive or negative affect and gaze were found between a high and low adversity group over the full course of the SFP. However, it was found that infants from high risk mothers showed more negative affect during play and less gaze towards mother in the second part of the still-face episode. The first finding is in concordance with a study of Gunning et al. (2013), who found that infants from a high adversity background showed higher rates of dysregulated behavior, consisting of, among others, increased crying and decreased gaze, during the play episode. They did not investigate gaze aversion separately, and so far no other studies reported a difference between gaze at mother in the second part of the still-face for infants for high-adversity dyads. Regarding maternal behavior, it was found that high risk mothers scored lower on a task measuring vocabulary, displayed

lower levels of reflective functioning, and displayed less sensitivity during play and reunion and more intrusiveness during the play, but not the reunion episode of the SFP.

Reflective functioning and maternal behavior

It was found that maternal reflective functioning plays a role in the prediction of maternal sensitivity and intrusiveness during play. However, the association between maternal reflective functioning and maternal behavior only comes into play for mothers from a low risk background, who also show higher rates of reflective functioning than mothers from a high risk background. Mothers from a high risk background may have limited reflective abilities to begin with, which is important to consider when designing interventions aimed at improving reflective functioning in this population. An example of an intervention that is aimed at improving reflective capacity in mothers from a high risk population is 'Minding the Baby, a program in which mothers receive help in learning the physical as well as the emotional needs of their infants, starting during pregnancy and continuing for the first two years of the infant's life (Slade, 2007). Further longitudinal research should evaluate such programs and evaluate if maternal reflective functioning can be successfully improved, and if this in turn leads to more favorable maternal behavior and better emotion regulation in infants. Care should be taken with interpreting the finding that maternal reflective functioning predicts maternal behavior, because the current sample was relatively small. Nonetheless, the findings do implicate that reflective functioning about the relationship with a mother's unborn infant seems to be related to later maternal behavior in interaction with her infant. Rosenblum et al. (2008) argued that the differences in maternal reflective functioning create different opportunities for infants to learn about internal experiences. Future research should establish if these results will be replicated with longitudinally acquired data, for example with maternal intrusiveness and sensitivity measured prior to the SFP in different settings, such as the play and teaching tasks used by Rosenblum et al. (2008). No associations were found between

reflective functioning and maternal behavior in the reunion episode, which indicates that reflective functioning is related to maternal behavior in interaction in a typical play situation, while it does not seem to predict to maternal interactive behavior following the stressful still-face situation.

Maternal reflective functioning and infant behavior

Maternal reflective functioning was found to play a role in predicting if infants show no or minimal positive affect during the both episodes of the still-face. Mothers who show more reflective functioning have infants who are more likely to show some positive affect in the still-face episode. Maternal reflective functioning thus seems to be associated with more favorable infant emotion regulatory behavior in a stressful situation such as the SFP, as was also found by Rosenblum et al. (2002) It is difficult however, to determine if the positive affect displayed in the still-face episode reflects joy or not. Emotions should be interpreted in the context in which they occur (Cole, 2004). In the context of the still-face episode, displaying small of rates positive affect might be an adaptive way of coping with the stress of an unresponsive caregiver and act as a way of attracting attention of the mother or regulating one's own emotions. The fact that the infants who show little positive emotion do not show more intense positive affect indicates that their smiles does not reflect the sincere joy and laughter that often seen the play and reunion episodes. The current study did not find maternal reflective functioning to be related to infant behavior during non-stressful situations. Grienenberger et al. (2005) argued that maternal reflective capacity acts as a buffer against breakdowns in infant emotion regulation in times of stress. The association between maternal reflective functioning and infant positive affect in the still-face episode was not mediated by maternal sensitive or intrusive behavior, contrary to findings by Rosenblum et al. (2002) who found that maternal behavior mediated the association between maternal representation about the relation with their infant and infant positive affect during the reunion episode. Likewise,

Grienenberger et al. (2005) reported that maternal behavior mediated the association between reflective functioning and infant attachment. However, the findings are in concordance with their findings for other indices of infant and mother behavior during the SFP. The results indicate that reflective functioning might play a specific role in promoting satisfactory development of infant emotion regulation, apart from maternal caregiving behaviors, as was also suggested by Fonagy et al. (1995, as cited in Slade, Grienenberger, Bernbach, Levy, & Locker, 2005), who proposed that reflective functioning might play a role in explaining the transmission gap from maternal attachment representation to infant attachment. A first possible explanation for the differences in findings concerning the mediation of maternal behavior lies in the fact that the current study measured maternal reflective functioning about the envisioned relationship with an yet unborn child, whilst Rosenblum et al. (2002) assessed the maternal representation of the ongoing relationship with her infant. Further research should address the different ways of measuring reflective functioning and evaluate differences in outcome measures such as infant and maternal behavior. A second explanation for the limited findings on the association between maternal reflective functioning and infant behavior might be that other differences in emotional regulation might come into play later in development, since associations between maternal reflective functioning and mentalizing abilities, the rate of problem behaviors and physiological regulation abilities have been reported later in development (Fonagy et al., 1998; Gottman et al., 1996; Priel et al., 2000). A third explanation for the difference is findings is the fact that the current study comprised a small and heterogeneous sample with mothers from low risk as well as high risk backgrounds. The results of the current study should thus be regarded as preliminary and be interpreted with caution. However, the fact that subtle differences in emotion regulation seem to emerge already this early in development for different levels of reflective functioning underlines the

importance of the opportunity of targeting early interventions to specific high risk groups (Slade, 2007).

The role of infant temperament

Contrary to the meta-analytic data of Mesman et al. (2009), who did not find a direct association between infant temperament and infant reactivity during the SFP, it was found that infants with higher regulatory capacities show less gaze at mother during the still-face episode, and infants with higher negative temperaments show more negative affect during the still-face episode. The findings concerning regulatory capacities contradict the findings of Mesman et al. (2013), who reported that infants with more easy temperaments displayed more positive affect during play and more gaze during the still-face. The fact that both infants from high risk backgrounds as infants with better regulatory capacities show less gaze at mother during the still-face might indicate that there are different ways of coping with stressful situations such as the still-face. Gazing away from mother when a mother remains unresponsive might serve as a down-regulation strategy (Ekas, Lickenbrock, & Braungart-Rieker, 2013). However, for infants from high risk backgrounds showing less gaze towards mother might indicate that they are used to unresponsiveness from their mother and automatically direct their attention towards their selves. In favor of this notion, Mesman et al. (2013) reported that only a small group of infants show the classic response to the SFP, and they discuss that infants who show less attention towards mother during the SFP are less likely to display the classic still-face effect, because they are not surprised by maternal unavailability. Further research should take these individual trajectories of behavioral reactivity during the still-face into account, and assess how these differences relate to differences in maternal behavior and reflective abilities. The finding that infants who are rated as having a more negative temperament show more negative affect in the still-face is in concordance with findings from Yoo and Reeb-Sutherland (2013), who reported that infants

with negative temperament show more negative affect during the reunion and do not recover from still-face to reunion. However, care should be taken with interpreting these results, since infant temperament was rated by mothers from high risk backgrounds. Forman et al. (2003) found that depressed mothers and less experienced mothers were less accurate in describing their infant's temperament at six months, and the fact that young mothers from high risk background have lower reflective capacity might also influence their capacity to adequately rate their infant temperament in a questionnaire. The current finding that mothers who rated their infants as having more negative temperament displayed less sensitive behavior during the reunion episode is supported in the literature, and indicates that difficult temperament combined with reduced maternal sensitivity constitutes a risk for developing problems in emotion regulation (Gunning et al. 2013; Tarabulsy et al., 2003).

Limitations and future implications

A limitation of the current study is that maternal and infant behavior were assessed in a short time frame, therefore, replication and longitudinal assessment of both maternal and infant behaviors is needed to disentangle the role of maternal reflective functioning and maternal behavior in the early development of infant emotion regulation. A second limitation is that the current study was conducted on a small as well as heterogeneous sample, which limits the generalizability of the results. However, the findings do stress de importance of further research into the relation between maternal reflective functioning and maternal caregiving behavior and infant development of emotion regulation. A third limitations of the current study is that infant behavior across the episodes of the still-face were only examined on group level, and individual patterns of behavior were not taken into account. A fourth limitation of the current study is that the contribution of maternal verbal abilities were not taken into account, while maternal vocabulary was found to be related to reflective functioning, maternal sensitivity and intrusiveness, and risk status. Due to a small sample size

it was not feasible to disentangle the contribution of maternal vocabulary in the prediction of infant behavior during the still-face. Further research should address this issue and investigate the similarities and differences between maternal reflective functioning and pure verbal abilities.

Conclusion

An important contribution of the current study is that it is the first study that reports that reflective functioning about the relationship with an yet unborn infant is already predictive of later maternal and even some infant behaviors. This provides important implications for early deployment of interventions aimed at improving reflective functioning, especially for infants who are at risk for developing early problems with emotion regulation. Further research should assess larger samples and add longitudinal measures of infant as well as maternal behavior, in order to disentangle the relations between these constructs. Moreover, research should address individual differences in infant reactivity during the still-face and relate these differences to maternal reflective functioning and behavior. Furthermore, research should evaluate the effectiveness of interventions aimed at improving reflective functioning for mothers with a high risk background.

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