The beginning of infant self-regulation: a longitudinal study involving infants, mothers and fathers in the Netherlands and China

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Chapter 3

The Effect of the Still-Face Paradigm on Infant Behavior: A Cross-Cultural Comparison between Mothers and Fathers

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Abstract

Most still-face paradigm (SFP) studies have been done in Western families with infant-mother dyads. The present study investigated the SFP pattern in 123 Dutch and 63 Chinese 4-month-old infants with mothers and fathers. The classic SFP effect was found for positive affect and gaze in both countries. For negative affect, Chinese infants showed a different SFP pattern than Dutch infants. With fathers, infants displayed a less pronounced SFP pattern for positive affect and an increase from still face to reunion for negative affect. Only a minority of infants showed the expected SFP pattern across episodes. Our findings support that infant emotion expression is influenced by parent gender and cultural context. An interesting avenue for further study is the exploration of the origins of within- and between- gender and culture differences in affective communication between parents and infants.

Key words: still-face paradigm, cross-culture, mothers and fathers

Interacting with parents is an important way for infants to develop early social skills. These skills include how to communicate with other people and how to respond to social perturbations, for example an unexpected facial expression from an adult. The still-face paradigm (SFP) was designed to study whether infants are active contributors to social interactions. In the SFP procedure, infants are observed during three brief face-to-face episodes with an adult, starting with a normal interaction baseline, followed by an interruption in interaction in which the adult keeps a neutral still face, and ending with a resumption of normal interaction (Tronick et al., 1978). Research with the SFP has been done almost exclusively with Western families. In only four studies the SFP has been used in non-Western countries, including one mainland Chinese sample (Kisilevsky et al., 1998), one Taiwanese sample (Hsu & Jeng, 2008), one Ecuadorian sample (Lowe et al., 2016) and one Japanese sample (Yato et al., 2008). Three of these studies have replicated the classic still-face effect for positive affect and gaze directed at the parent, in which infants show a decrease in positive affect and gaze from the baseline to the still face episode, and an increase from the still face to the reunion episode (Kisilevsky et al., 1998; Hsu & Jeng, 2008; Lowe et al., 2016). However, findings on negative affect have been inconsistent. For example, Chinese infants showed very little negative affect throughout the procedure and no changes were found in negative affect between episodes (Kisilevsky et al., 1998). In addition, most studies were conducted with mothers and infants and few with fathers and infants (e.g., Forbes et al., 2004; Hernández & Carter, 1996). As infant response patterns can differ between mothers and fathers (e.g., Braungart-Rieker et al., 1998) and these differences may depend on culture (e.g., Striano, & Liszkowski, 2005), it is important to explore parental gender as well as cultural differences in the classic SFP-effects on infant behaviors. We conducted the SFP in infants with both their mothers and fathers in a Western (Dutch) and non-Western (Chinese) sample to fulfil this goal.

The still-face paradigm consists of a face-to-face interaction of an infant, seated in an infant seat with an adult across three episodes: (1) Baseline: the parent plays with the infant without toys or picking up the baby; (2) Still face: the parent shows a neutral face to the baby and is unresponsive; (3) Reunion: the parent resumes normal interaction as in the baseline. A meta-analysis by Mesman, Van IJzendoorn, and Bakermans-Kranenburg (2009) showed that the classic still-face effect from baseline to still face consists of a decrease in positive affect and gaze, and an increase in negative affect. In other words, the infant smiles less, has less eye contact with the parent, and shows more distress when the parent is unresponsive (still-face episode) than when the parent is responsive (baseline). There is a (partial) recovery effect for positive affect and gaze from still face to reunion, namely a significant increase in positive affect and gaze. The meta-analysis showed an absence of 'recovery' with regard to negative affect, i.e., no significant decrease in negative affect was found between the still-face and the reunion episode, showing that the infant does not 'recover' from the perturbation in social interaction when it comes to distress. Moreover, compared to the baseline, infants showed a significant decrease in positive affect and an increase in negative affect in the reunion, which is called the carry-over effect. No differences were found between baseline and reunion for gaze. In addition, there are individual differences in response patterns. Infants' responses to the SFP have been shown to be associated with attachment quality (e.g., Braungart-Rieker

et al., 2001), behavior problems (Moore et al., 2001), emotional regulation (e.g., Lowe et al., 2012), and the quality of the parent-child relationship (e.g., Tarabulsy et al., 2003). For example, 4-month-old infants who showed more positive and less negative affect during still-face were more likely to become secure infants at 1 year compared to infants showing less positive and more negative affect. and 18-month-old toddlers who failed to smile at 6 months in the still-face episode showed more externalizing behaviors than did other toddlers.

Infants normally learn how to show emotions to others by observing and modeling caregivers through daily interactions (e.g., Morris et al., 2007). Particular emotions may be expressed more often than others which may vary by cultures (e.g., Kitayama et al., 2006). The still-face paradigm is an experimental procedure in which differences in emotion expression within and between infants can be observed. Most of the studies using the SFP have been conducted with mothers only. Studies on fathers are also important because fathers play a different role in the development of children's emotion socialization. For example, mothers generally show more positive affect to their infants (Forbes et al., 2004), fathers on the other hand, tend to use more distracting strategies than mothers in their response to fear or sadness of their children (Cassano & Zeman 2010). The SFP allows for observations of how infants respond to parental lack of emotion expression (still-face), and whether this varies depending on parents' gender. As far as we know, six studies regarding the SFP in infants (five in the US and one in China) have been conducted with fathers. Three of these studies found that infants expressed similar negative and positive affect during mother-infant and father-infant still face episodes (Ekas et al. 2013; Forbes et al., 2004; Kisilevsky et al., 1998). One study found that infants showed more negative affect with fathers when they did the SFP with their infant following the SFP by mothers (order was counterbalanced; Braungart-Rieker et al., 1998). However, most of SFP father studies focused solely on infants' behaviors within the still-face episode rather than exploring changes from one episode to the next. One of the four SFP studies with fathers was conducted in China. This study only chose either the father's or the mother's interaction with the infant. They found a classic SFP effect for both mothers and fathers for infant smiling and gaze. However, for grimacing (an indicator of negative affect), no classic SFP effect was found and there was no significant change across episodes for both parents (of different families) (Kisilevsky et al., 1998). Social experience in different countries has an indirect effect on infant emotional expressiveness by influencing the type of environment in which the infant grows up, as well as parents' social goals and beliefs (Halberstadt & Lozade, 2011). Studies with both Western and non-Western samples are important because these studies can help us understand how parents interpret their own socialization values and apply these values to their infants. Contemporary Chinese societies are assumed to be rooted in Confucian cultures which regard social order and stability as the primary goals (e.g., Chen et al., 2002) and encourage individuals to control their personal desires to achieve and maintain social harmony (English & John, 2013). These social goals, which dictate how and when a person should display emotions, are applied by Chinese parents to their caregiving behaviors towards their children. For example, studies have found that Chinese parents are traditionally concerned with emotional restraint and are intolerant of aggressive expression in their children (Chen, 2000; Fiorilli et al., 2015).

Compared to American mothers, Chinese mothers are also less likely to encourage positive emotional expressions (Tsai et al., 2006). Chinese parents on the one hand suppress their own emotions (they do not show emotions, so do not model emotions), and on the other hand discourage children from showing emotions through their socialization practices. Cross-cultural studies among Chinese and European-American infants have shown inconsistent findings regarding positive emotions during the first half year. Some researchers have found that Chinese and Chinese-American infants smiled less than European American infants (e.g. Camras et al., 1998; Kisilevsky et al., 1998), while other studies observed no differences between Chinese or Chinese-American and European American groups (e.g. Kagan et al., 1994). With respect to negative emotions, Freedman (1974) found that, compared to European-American infants, Chinese-American infants showed less reactivity and distress during infant testing procedures. Several subsequent studies confirmed this result (Kagan et al., 1994; Kisilevsky et al., 1998; Kuchner, 1989).

Considering the SFP studies in Asia, three have been conducted in different areas: one in mainland China (Kisilevsky et al., 1998), one in Taiwan (Hsu & Jeng, 2008), and one in Japan (Yato et al., 2008). The mainland Chinese and Taiwan studies found the expected still-face effect on positive affect and gaze; infants showed a decline in both behaviors from baseline to still-face and an increase from still-face to reunion (although there was no recovery for positive affect in infants in Taiwan). In the Japanese study however, the classic still-face effect was not found for gaze during the first three episodes (baseline-still-face-reunion). In the previous mainland Chinese and Taiwan study, infants showed the classic still-face effect in positive affect. Even though Chinese mothers are less likely to express positive emotions within their family (e.g., Camras et al., 2008), this tradition seems not influence the level and response pattern of infant positive affect during the SFP. The results for negative affect were also inconsistent. In the mainland Chinese study, results regarding infants' grimacing (defined as a furrowed brow with or without down-turning of the mouth or crying) have been reported in two out of three sub-studies. One sub-study comparing infants' responses between mothers and fathers indicated that there was an increase in grimacing across episodes but grimacing remained at a low level with both fathers and mothers (of different families). Infants showed more grimacing in the still-face episode compared to the baseline and slightly recovered in the reunion with mother. The other sub-study, comparing infants' responses between mothers and strangers, reported that infants showed almost no grimacing with both mothers and strangers, so there was no change across episodes (Kisilevsky et al., 1998). In the Taiwan study, infants demonstrated an overall linear increase across all episodes in negative affect (Hsu & Jeng, 2008). In the Japanese study, 4-month-old infants displayed a classic still-face effect (more negative affect in the still face than the baseline and no recovery in the reunion) while 9-month-old infants showed a gradual increase in negative affect across all episodes (Yato et al., 2008). Results of Asian studies are thus inconsistent and different from the classic still-face effect regarding negative affect which has been found in Western cultures. Therefore, how negative affect changes from one episode to the next in Asian cultures needs to be investigated further. The present study aims to shed more light on the patterns of infant responses to the SFP conducted with mothers and fathers in Western and non-Western samples. This study is unique because it includes

both a Western and non-Western country, and fathers as well as mothers with the same infant across all SFP episodes, and it tests three effects (the still-face effect, the recovery effect and the carry-over effect). Based on the existing literature we hypothesized that: (1) for positive affect and gaze infants show the classic SFP effect with both mothers and fathers in the Netherlands and in China; (2) Dutch infants display the classic SFP effect regarding negative affect with both parents, while the SFP pattern for negative affect deviates in Chinese infants; (3) infants show the similar positive and gaze towards fathers and mothers but higher negative affect with fathers than with mothers in both countries. Because of inconsistent prior results regarding negative affect in the SFP in China, investigation into the nature of this deviation is exploratory. Following Mesman et al. (2013), we also investigated individual variations within SFP response patterns to test the robustness of the classic SFP patterns. We expected a similar result to Mesman et al. (2013) that only a minority of infants showing the expected pattern for negative affect and gaze.

Method

Sample

The present study included 123 Dutch and 63 Chinese first-time mothers and fathers and their healthy 4-month-old infants. Participants were enrolled in a longitudinal study. In the Netherlands, the mother-infant and father-infant dyads were visited at home when the mother was 36 weeks pregnant and when the child was 4, 14, and 24 months of age. Chinese parents participated at two time points, when the child was 4 and 14 months of age. The 4-months data collection period for Dutch families was January, 2015 – January, 2016 and for Chinese families was July, 2016 – January, 2017. Because of infant sickness or busy schedule of parents, some parents did not finish the SFP task (NL: 3 mothers, 6 fathers; China: 1 mother,4 fathers). For 6 families the SFP procedure was not conducted properly, so we excluded them (NL: 3 mothers, 1 father; China: 2 fathers). The final sample consisted of 117 Dutch mothers and 116 Dutch fathers; 62 Chinese mothers and 57 Chinese fathers. Dutch families were recruited through pregnancy fairs, yoga classes, posters, and midwifery practices in the whole country. Most of the Chinese families (n = 40) were recruited from one maternity and child hospital in Shenzhen, one of the first-tier cities in mainland China. The rest of the Chinese families were recruited via colleagues' friends and online groups. Inclusion criteria for participation of the study were: 1) parents aged 21 years or older during pregnancy, 2) first-time parents, 3) singleton child, 4) neither parent has a major problem of substance abuse or psychotic illness, 5) the mother and baby have not experienced any birth complications or neonatal health problems, 6) the baby was born after 37 weeks gestation, 7) parents are proficient in both written and spoken their own native languages (Dutch, Mandarin or Cantonese Chinese). A power calculation has been performed. Assuming a modest effect size (f^2 = 0.15; Mesman et al., 2009), an alpha of .05, a group size of 186 participants can achieve a power of at least 80% for testing main and interaction effects.

In the Dutch sample (45% boys), see Table 1, the average infant age during the SFP was 4.30 months (*SD* = .46, range 3.22-5.62 months). In the Chinese sample (51% boys), the average age was 4.27 months (*SD* = .35, range 3.34-5.29 months). The average age of mothers was 30 years in the Dutch sample (*SD* = 3.77, range 22-42 years) and 30 years in the Chinese sample (*SD* = 2.80, range 24-37 years). The average age of fathers was 34 years in the Dutch sample (*SD* = 4.40, range 23-49 years), and 31 years in the Chinese sample (*SD* = 3.97, range 24-45 years). Maternal age did not significantly differ between countries (p = .121). Dutch fathers were on average older than Chinese fathers (t (171) = 2.93, p < .01). Regarding education level, most of the mothers (NL: 72%; China: 69%) and fathers (NL: 59%; China: 74%) were highly educated (bachelor degree or higher). Some mothers (NL: 13%; China: 29%) and fathers (NL:14%; China: 22%) had a medium educational level (post-secondary or short-cycle tertiary education). The other mothers (NL: 15%; China: 2%) and fathers (NL: 27%; China: 4%) were low educated (upper secondary degree or less). Chinese fathers had a higher mean educational level than Dutch fathers (t (158.18) = -3.54, p < .01) while no differences in the mean educational level were found between Dutch and Chinese mothers (p = .860). The main source of family income in both countries was around 16% higher than the average national level (the average level in Shenzhen for Chinese families).

Procedure

The still-face paradigm (SFP; Tronick et al., 1978) was used to measure infant behavior at 4 months of age and consists of a face-to-face interaction of an infant with an adult in 3 episodes: (1) Baseline: the parent plays with the baby without toys or picking up the baby (2 mins); (2) Still face: the parent shows a neutral face to the baby and is unresponsive (1 min); (3) Reunion: the parent resumes normal interaction (1min). Mothers and fathers were allowed to touch the child during the baseline and reunion episode, but were not allowed to touch the infant during the still-face episode. The SFP was conducted at home when the infants were alert and awake. The collapsible still-face mirror wall consisted of three boards that were attached to each other with hinges. An infant seat was placed in the middle of the left and right board (60 x 40 cm). The back board measured 60 x 80 cm and a mirror (60 x 40 cm) was glued to the upper half to ensure that the camera could record both faces at the same time: the infant's face directly and the parent's faces from the reflection in the mirror). Infants were seated on an infant chair placed on top of a table (Dutch infants) or on the ground (Chinese infants) facing their parent. Infants sat up with their back supported by the chair. The parent sat on a chair or on the ground in front of the infant. The infant seat did not touch the mirror and the parent sat a little to the side, so that the infant was clearly visible for the camera placed behind the parent at a slight angle. The experimenter stayed behind the camera with no eye-contact with the parent and infant, and used a stopwatch to ensure the exact timing of each episode.

Before the procedure, the parent read an instruction card with explanations of each episode. The still-face episode would not start when the infant was crying. The experimenter said "1" before the baseline to let the parent know that the procedure

had started. During the baseline parents were asked to play with the infant as they normally did, but without taking them out of the infant seat, and without pacifier or toys. Next, the experimenter gave a signal for "2" indicating that the still-face episode started. During the still-face episode they were asked to stop playing with the infant and look at them with a neutral face, without responding to the infant's behavior and without touching the infant. After the still-face, the experimenter gave a signal for "3". Parents could play with the infant as normal again, but without toys, pacifier and taking them out of the infant seat. The introduction card was left next to the parent in case the parent forgot the meaning of the signals. The entire procedure was conducted in a room with only the parent, infant, and experimenter present.

In both the Netherlands and China mothers and fathers were visited separately and each home visit lasted between 90 and 120 minutes. The order of home visits was counterbalanced. In the present study we use the data from 4 months, since this was the visit in which the Still Face Paradigm was conducted. All fathers and mothers signed an informed consent form for their own participation as well as their infants' participation. Families received a small gift for the child and a small amount of money for themselves after each visit. They also received a DVD with a compilation of video footage from different home visits at the end of the study. The study was approved by the Ethics Committee of one Dutch university (both the Dutch and Chinese part of the study) and one Chinese university (only the Chinese part of the study).

Instrument

Infant behavior was coded using the same infant coding system including positive, negative affect and gaze as Mesman et al., (2013) which is an adaption from a previous study focusing on more infant behaviors such as regulatory style, avoidance, arousal, self and object engagement and distress regulation (Miller et al., 2002). Three infant behavior scales were used. Positive affect was defined as the frequency and intensity of infant smiles: 0 = No smiling, 1 = Low frequency and low intensity smile, 2 = Medium frequency, low or medium intensity smile, 3 = High frequency and (or) high intensity smile. Negative affect was defined as the frequency and intensity of infant fusses and (or) cries: 0 = no negative affect, 1 = Low frequency and duration, mostly low intensity negative affect, 2 = Medium frequency, low to medium intensity negative affect, 3 = Few or no periods of non-fussy behavior. Gaze was defined as the duration of infant gazes at or eye contact with the parent: 0 = No eye contact, 1 = Predominantly gaze aversion mixed with looking at the parent, 2 = Consistent gaze at the parent with minimal and very brief gaze aversion, 3 = Consistent gaze at the parent. Each scale was coded for all three episodes separately. The macro-level coding (a global score for mother or infant behaviors during the observation time which is 2 minutes in the current study) was used to code infant behaviors. Coders observed the three episodes separately and gave one overall score on each scale per episode. Coders followed a training and coded a reliability set including both Dutch and Chinese videos before they started coding. A subsample (11%) of videos has been coded to establish intercoder reliability. Intercoder reliability

using Cronbach's alphas was good: mother-infant dyads: .91; father-infant dyads: .89; Dutch sample: .91; Chinese sample: .84.

Data-inspection and Analyses

Z-scores were computed to identify possible outliers. Scores of medium negative affect (score 2) in the baseline, medium positive affect (score 2) in the still-face, or intensive crying (score 3) in the still-face were outliers ($Z > 3.29$). We conducted analyses with and without outliers ($n = 3$), which showed similar results, so we kept the outlying cases. To examine group-level changes in infants across the SFP with mothers and fathers in two countries, three separate repeated measures analyses of variance (ANOVAs) were conducted for each of the three behavior scales (positive affect, negative affect, gaze) with episode (baseline, still-face, reunion) and parent (mother, father) as within-subject factors and country (the Netherlands, China) as the between-subject factor.

To investigate variations in patterns of infant behavior across the SFP, we constructed dummy variables reflecting the absence or presence of each of the three possible patterns (increase, no change, decrease) from baseline to still-face and from still-face to reunion for positive affect, gaze and negative affect. The dummy variables were coded as absence of expected effect (0) or presence of the expected effect (1) based on the increases, decreases, or no change between the three episodes as found in the meta-analysis by Mesman et al. (2009). A change (decrease/increase) was coded when there was a difference between episodes of 1 scale point or more, for example a change from 0 to 1 and from 3 to 1 were respectively coded as increase and decrease. For positive affect, the expected pattern was coded if there was a decrease from baseline to still-face and then an increase from still-face to reunion, and a decrease from baseline to reunion (the carry-over effect). For negative affect, the expected pattern was an increase from baseline to still-face and then a decrease to reunion, and an increase from baseline to reunion. The expected pattern for gaze was similar to the positive affect without the carry-over effect. We then examined the percentage of dummy variable 1 which reflects how many infants showed each pattern with their mothers and fathers in two countries. Chi-square tests were applied to compare whether there were differences in the number of infants showing the expected patterns between parents and countries.

Results

Group-level SFP Effects

Parent order effects were not found for the three infant behaviors. Infants who first did the SFP with their mother showed similar behavior patterns as those who first did the SFP with their father (*ps* >.05). Figure 1 displays behavioral patterns during the SFP of mothers and fathers in both countries.

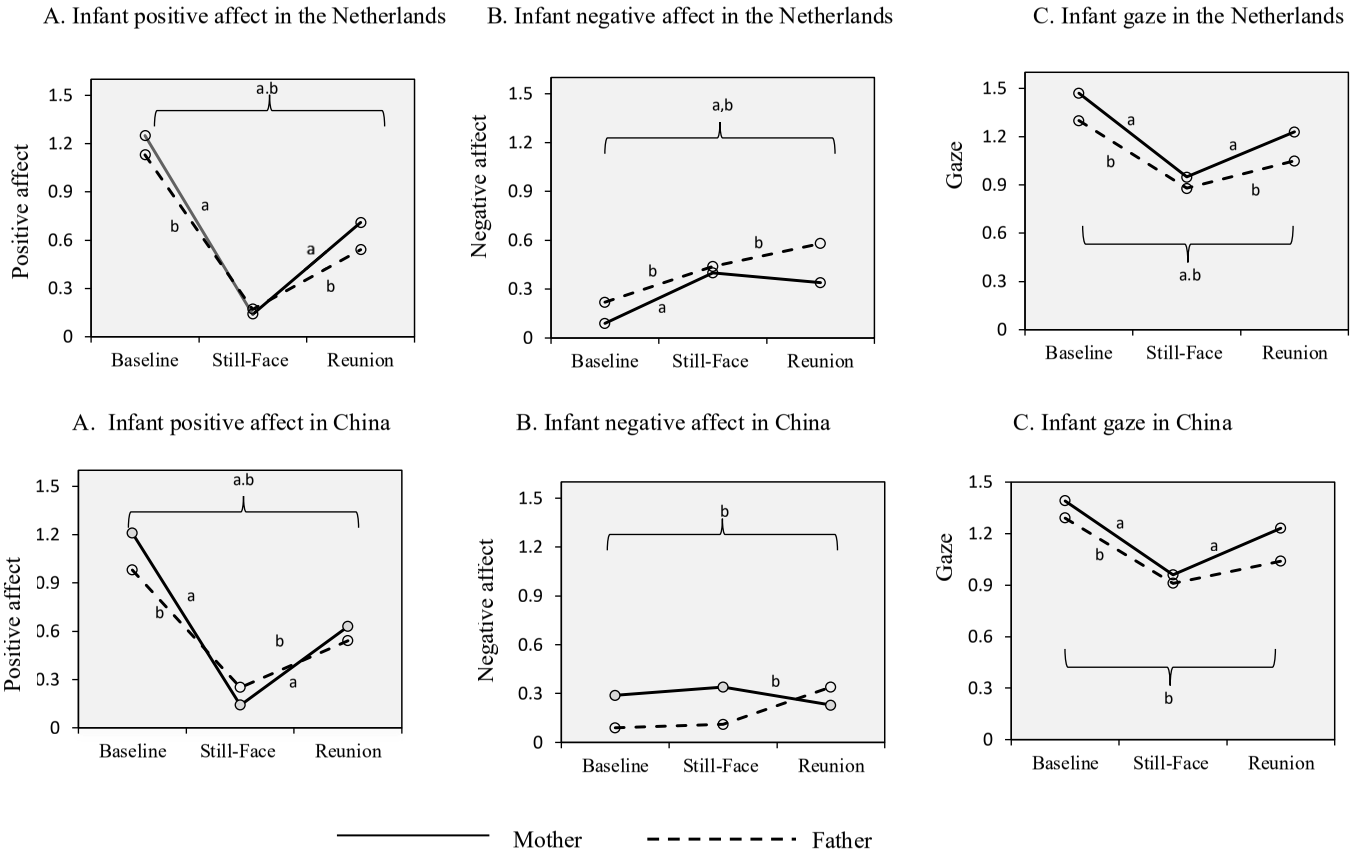

Figure 1. Effects of infants' behavior: positive affect, gaze and negative affect during the still face paradigm with parents in the Netherlands and China.

Note. a = significant change for mothers; b = significant change for fathers. { = carry-over effect.

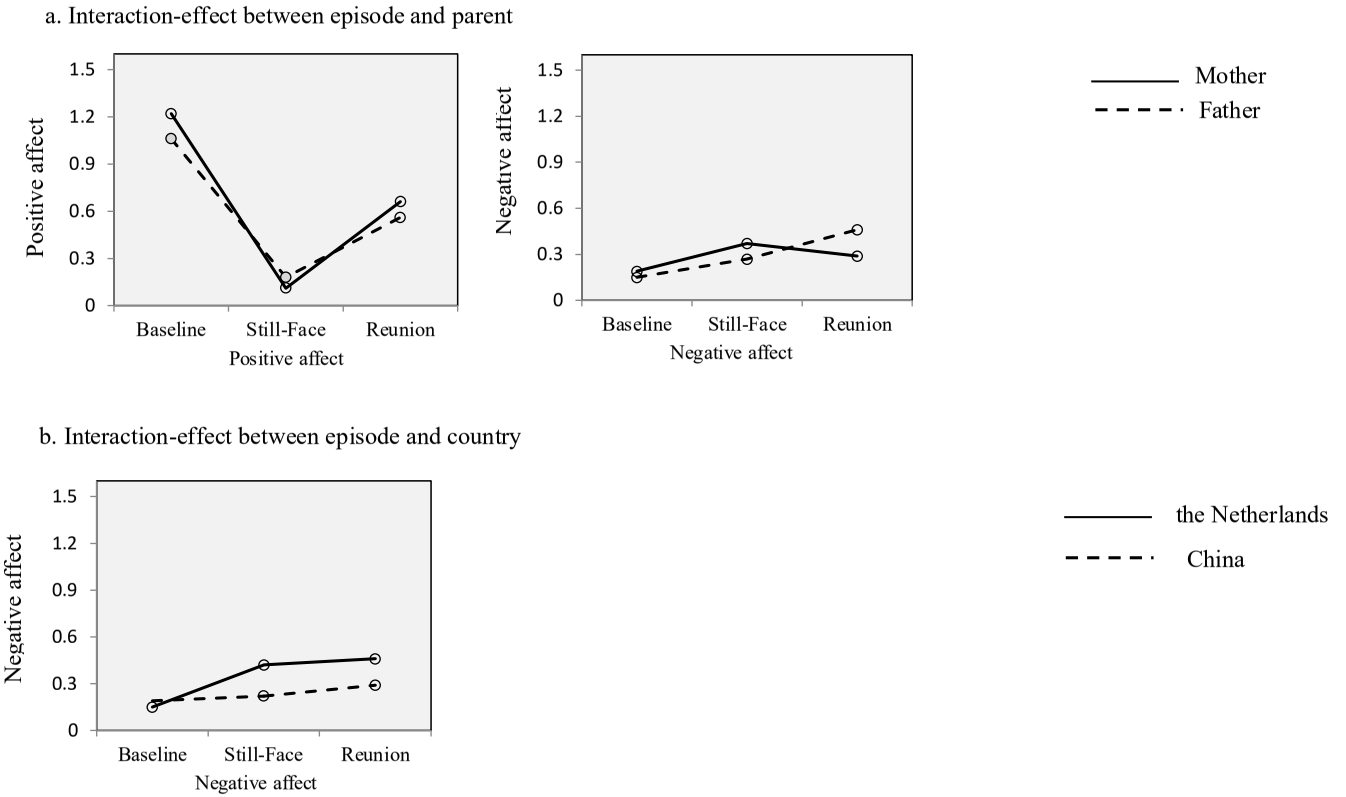

Figure 2. Interaction-effects in positive affect and negative affect

Positive affect. The results showed a significant main effect of episode on positive affect, $F(2,330) = 174.69$, $p < .001$, partial $\eta_p^2 = .51$. Positive affect significantly decreased from baseline to still-face and significantly increased again from still-face to reunion, but remained lower than during the baseline. The difference between baseline and reunion was significant ($p < .001$), meaning there was a carry-over effect. There was no main effect of parent gender. The interaction between episode and parent gender was significant (see Figure 2), $F(2,330) = 3.77$, $p < .05$, partial $\eta_p^2 = .02$. Post-hoc tests for baseline and still-face and for still-face and reunion were performed to check whether the slopes for mothers and fathers were different. Results showed that the interaction between episode (baseline and still-face) and parent gender ($F(1,166) = 5.45$, $p < .05$, partial $\eta_p^2 = .03$) and between episode (still-face and reunion) and parent gender ($F(1,166) = 5.51$, $p < .05$, partial $\eta_p^2 = .03$) were significant. Infants showed a stronger decrease from the baseline to the still-face and a stronger increase from the still-face to the reunion with mothers than with fathers. The general pattern across three episodes was thus steeper for mother-infant dyads than father-infant dyads which can be clearly seen in Figure 2. There was no significant main effect of country, and there were no two-way interaction effects between country and parent (*ps > .05*). The three-way interaction between episode, parent and country was also not significant ($p = .525$), which means that the differences in SFP patterns between mothers and fathers did not depend on country.

Negative affect. A significant main effect of episode was found for negative affect, $F(2,330) = 11.91$, $p < .001$, partial $\eta_p^2 = .07$. Negative affect increased significantly from baseline to still-face and increased again significantly from still-face to reunion. There were significant interactions between episode and parent and between episode and country (see Figure 2), episode × parent $F(2,330) = 6.31$, $p < .01$, partial $\eta_p^2 = .04$; episode × country $F(2,330) = 4.34$, $p < .05$, partial $\eta_p^2 = .03$. Post-hoc tests showed that the interaction between episode (baseline and still-face) and parent gender was not significant ($F(1,166) = 0.76$, $p = .385$) while the interaction between episode (still-face and reunion) and parent gender was significant ($F(1,166) = 14.95$, $p < .001$, partial $\eta_p^2 = .08$). Infants displayed an increasing pattern from the still-face to the reunion with fathers while infants displayed a decreasing pattern across the same episode with mothers. For the interaction between country and infant negative affect, results showed that the interaction between episode (baseline and still-face) and country was significant ($F(1,165) = 6.52$, $p < .05$, partial $\eta_p^2 = .04$) while the interaction between episode (still-face and reunion) and country was not significant ($F(1,165) = .10$, $p = .756$). Chinese infants showed flatter pattern compared to Dutch infants showing a stronger increase from baseline to still-face (see Figure 2). The interaction between parent and country was not significant ($F(1,165) = 3.90$, $p = .05$, partial $\eta_p^2 = .02$). With fathers, infants displayed an increase from baseline to still-face and an increase again from still-face to reunion. With mothers, infants showed increasing negative affect from baseline to still-face, but decreasing negative affect from still-face to reunion. Compared to Dutch infants, who showed a significant increase in negative affect from baseline to still-face and did not recover from still-face to reunion, Chinese infants showed no change in negative affect from baseline to still face and then negative affect slightly increased from still-face to reunion. Dutch infants with fathers displayed higher levels of negative affect than Chinese infants. The main effects for country ($p = .096$) and parent ($p = .820$) and

the three-way interaction between episode, parent, and country (p = .426) were not significant, suggesting that the differences in SFP patterns between mothers and fathers did not depend on country. After controlling for paternal education level and age, the interaction between country and episode regarding infant negative affect remained significant (F(2, 318) = 3.91, p <.05, partial η_p^2= .02) which means paternal education and age did not account for the country difference in infant negative affect.

Gaze. A significant main effect of episode was found, F(2,330) = 41.94, p < .001, partial η_p^2 = .20. There was a significant decrease in gaze from baseline to still-face and an significant increase from still-face to reunion. The difference between reunion and baseline was also significant; infants showed significantly more gaze in baseline compared to reunion. There were no main effects of parent (p = .078) or country (p = .902). No significant two- or three-way interaction effects between episode, parent, and country were found, suggesting that patterns for gaze were similar for mothers and fathers and across countries.

Chi-square tests were used to test whether the percentages of infants who showed the expected overall patterns were similar across parent and country. No significant differences between countries were found (positive affect: mother: χ^2 (1) = 0.00, p =.998, father: χ^2 (1) = 0.00, p =.973; Negative affect: mother: χ^2 (1) = 2.86, p =.091, father: χ^2 (1) = 1.25, p =.264; Gaze: mother: χ^2 (1) = 0.35, p =.553, father: χ^2 (1) = 2.23, p =.136), indicating similar percentages of infants showing the expected patterns for positive affect, negative affect and gaze with both parents in the two countries.

Table 1. Sample in the Netherlands and China

	the Netherlands			China		
	Mean age	**SD**	**Range**	**Mean age**	**SD**	**Range**
Infants	4.30	0.46	3.22 - 5.62	4.27	0.35	3.34-5.29
Mothers	30.00	3.77	22.00-42.00	30.00	2.80	24.00-37.00
Fathers	34.00	4.40	23.00-49.00	31.00	3.97	24.00-45.00

Note. Infant age in months. Parent age in years.

Variations in Patterns of Infant SFP Behavior

In addition to looking at infant behavior patterns at a group level, we were interested in examining individual differences in patterns of behaviors across the SFP. Table 2-4 shows the individual patterns across parent and country. For positive affect, when looking at separate episode transitions, most infants showed the expected patterns (decrease from baseline to still-face, increase from still-face to reunion, and decrease from baseline to reunion), but only a small percentage of infants (8.6-14.5%) showed the total expected pattern across the three episodes. Similarly, for negative affect and gaze only 10.3-16.2% of Dutch infants and 4.8-22.8% of Chinese infants showed the expected overall patterns.

To understand the SFP in terms of individual patterns of infant behaviors, we further examined the scores for these no-change groups. Results showed that for negative affect 62.9% to 70.2% of all the infants in the no-change group showed no negative affect (score 0) and around 21.0% to 26.7% of infants did not show any positive affect at all (score 0) in the three episodes with mothers and fathers (Table 2, 3). This means most of infants did not make any fuss or cry across the three episodes. For gaze, we found a pattern of stable minimal gaze (score 1) across all three episodes for 12.8% of Dutch mothers, 19% of Dutch fathers, 22.6% of Chinese mothers, and 15.8% of Chinese fathers. Overall, among the no-change groups, most of infants showed a non-sad face and average around 17.6% of them made minimal eye contact with both parents across all episodes.

Table 2. Patterns of Changes in Positive Affect across the SFP in Dutch and Chinese Mothers and Fathers

	Dutch Mothers		**Dutch Fathers**		**Chinese Mothers**		**Chinese Fathers**	
	%	***n***	***%***	***n***	***%***	***n***	***%***	***n***
Positive affect								
Baseline to still-face								
No change	27.3	32.0	33.6	39.0	33.9	21.0	35.1	20.0
Decrease (exp)	71.8	84.0	63.8	74.0	66.1	41.0	57.9	33.0
Increase	0.9	1.0	2.6	3.0	0.0	0.0	7.0	4.0
Still-face to reunion								
No change	55.6	65.0	66.4	77.0	58.1	37.0	59.6	34.0
Decrease	1.7	2.0	5.2	6.0	4.8	2.0	12.3	7.0
Increase (exp)	42.7	50.0	28.4	33.0	37.1	23.0	28.1	16.0
Baseline to reunion								
No change	47	55.0	46.6	54.0	38.7	24.0	38.6	22.0
Decrease (exp)	46.2	54.0	47.4	55.0	53.2	33.0	47.4	27.0
Increase	6.8	8.0	6.0	7.0	8.1	5.0	14	8.0
Across 3 episodes								
Expected Pattern	14.5	17.0	8.6	10.0	14.5	9.0	8.8	5.0
No change groups 0 0 0	22.2	26.0	26.7	31.0	21.0	13.0	24.6	14.0

Table 3. Patterns of Changes in Negative Affect across the SFP in Dutch and Chinese Mothers and Fathers

	Dutch Mothers		Dutch Fathers		Chinese Mothers		Chinese Fathers	
	%	*n*	*%*	*n*	*%*	*n*	*%*	*n*
Negative affect								
Baseline to still-face								
No change	72.7	85.0	73.3	85.0	75.8	47.0	87.7	50.0
Decrease	5.1	6.0	6.9	8.0	9.7	6.0	5.3	3.0
Increase (exp)	22.2	26.0	19.8	23.0	14.5	9.0	7.0	4.0
Still-face to reunion								
No change (exp)	82.1	96.0	78.4	91.0	83.9	52.0	80.7	46.0
Decrease	11.1	13.0	5.2	6.0	11.3	7.0	0.0	0.0
Increase	6.8	8.0	16.4	19.0	4.8	3.0	19.3	11.0
Baseline to reunion								
No change	72.7	85.0	66.4	77.0	77.4	48.0	73.7	42.0
Decrease	6.8	8.0	6.0	7.0	12.9	8.0	3.5	2.0
Increase (exp)	20.5	24.0	27.6	32.0	9.7	6.0	22.8	13.0
Across 3 episodes								
Expected Pattern	12.8	15.0	10.3	12.0	4.8	3.0	5.3	3.0
No change groups								
0 0 0	65.0	76.0	62.9	73.0	69.4	43.0	70.2	40.0

Table 4. Patterns of Changes in Gaze across the SFP in Dutch and Chinese Mothers and Fathers

	Dutch Mothers		Dutch Fathers		Chinese Mothers		Chinese Fathers	
	%	*n*	*%*	*n*	*%*	*n*	*%*	*n*
Gaze								
Baseline to still-face								
No change	37.6	44.0	42.2	49.0	45.2	28.0	47.4	27.0
Decrease (exp)	51.3	60.0	47.4	55.0	45.2	28.0	43.9	25.0
Increase	11.1	13.0	10.4	12.0	9.6	6.0	8.7	5.0
Still-face to reunion								
No change	52.2	61.0	61.2	71.0	50.0	31.0	45.6	26.0
Decrease	14.5	17.0	11.2	13.0	19.4	12.0	21.1	12.0
Increase (exp)	33.3	39.0	27.6	32.0	30.6	19.0	33.3	19.0
Baseline to reunion								
No change (exp)	44.4	52.0	49.2	57.0	45.2	28.0	54.4	31.0
Decrease	38.5	45.0	37.9	44.0	35.4	22.0	35.1	20.0
Increase	17.1	20.0	12.9	15.0	19.4	12.0	10.5	6.0
Across 3 episodes								
Expected Pattern	16.2	19.0	13.8	16.0	12.9	8.0	22.8	13.0
No change groups								
0 0 0	4.3	5.0	8.6	10.0	2.6	1.0	3.5	2.0
1 1 1	12.8	15.0	19.0	22.0	22.6	14.0	15.8	9.0

Note. 'exp' refers to the expected changes based on meta-analytic evidence (Mesman et al., 2009). '0 0 0' and '1 1 1' refers to 0 and 1 score for infant behavior across three episodes

Discussion

This study aimed to shed more light on the patterns of infant responses to the SFP conducted with mothers and fathers in the Netherlands and China. Results showed that both Dutch and Chinese infants displayed classic SFP patterns of positive affect and gaze changes across episodes. Average infants showed a more pronounced SFP pattern for positive affect with mothers than with fathers. For negative affect, Chinese infants showed a less pronounced SFP pattern compared to Dutch infants, who showed a significant increase from the baseline to the still-face and did not recover (i.e., did not decline) from the still-face to the reunion. In addition, across countries infants displayed a continued increase from the baseline to the reunion with fathers, but showed a decline with mothers. Individual differences in SFP behavior were also observed. Only a small percentage of infants in both countries showed the expected pattern across the three episodes for all three behaviors. The results will be discussed in more detail below.

Consistent with our hypothesis, the classic SFP effect was found for positive affect and gaze in both the Netherlands and China, which was a decrease in positive affect and gaze from baseline to the still-face episode and an increase from the still-face to the reunion episode. This is crucial because these results underscore the robustness of the SFP effect for positive affect and gaze. In the original paper of Tronick et al. (1978), the SFP effect was attributed as caused by a violation of the reciprocal social rule. The parent and infant are in an interactive setting, but the parent shows a still-face and is unresponsive, which is contradictory and makes infants confused. Later on, Tronick and his colleagues suggested another theory, the Mutual Regulation Model (MRM), to explain the still-face effect in more detail (Gianino & Tronick, 1988; Weinberg & Tronick, 1997). The still-face episode is an intensive and prolonged mismatching communication between the infant and the adult partner. Infants try to repair the mismatch by sending signals such as negative affect. When they fail in repairing (the adult partner keeps a still face), this may lead to self-regulation strategies such as gazing away to avoid distress. Our results suggested that infants displayed less positive affect, more negative affect (only with Dutch infants) and more gazing away during the still-face compared to the other two episodes. The Dyadic States of Consciousness Model (DSCM) was advanced as an elaboration of the MRM (Tronick, 2005; Tronick et al., 1998). According to this model, infants develop a state of consciousness (SOC) when they are successful in mutual engagement in the interaction with the other partner, which helps them know more about this world and their relationship to this world. When the adult partners' SOC coincides with infants' SOC, a dyadic SOC is formed that allows infants to obtain a coherent and positive experience of the social world. Our results indeed showed that infants showed the highest positive affect and gaze at the parents during the baseline. However, a dyadic state of consciousness is impossible during the still-face which forces infants to only rely on their own SOC and lose the coherent interaction with the adult. This in turn leads to loss of positive affect and an increase in negative affect as indeed shown in our study.

We found a carry-over effect for both positive affect and gaze, i.e., these behaviors did not turn back to baseline levels in the reunion. The carry-over effect for positive affect

and gaze are both in line with the meta-analysis of Mesman and colleagues (2009). Although this meta-analysis did not find a carry-over effect of infant gaze in general, age was found to moderate the SFP effect for gaze. From baseline to reunion, young infants (0- to 3-month-old) showed no change in gaze, whereas somewhat older infants (4- to 5-month-old) showed a significant decrease. Infants in our study were 4 months old and showed a similar decrease from the baseline to the reunion which is in line with the results for this particular age group. Another possibility for the carry-over effect for gaze is the development of infants' attention to faces. Previous research has shown that 4- and 5-month-olds showed sustained attentional preferences for faces (Escudero, Robbins, & Johnson, 2013) while 3-month-olds do not look at faces longer than at other distracters (e.g. Di Giorgio et al., 2012). These findings indicate that infants from the age of 4 months onwards prefer to look at and communicate with faces. During the still-face, all communication and facial expressions are stopped. Infants who prefer to look at faces over other distractors may be influenced more by the still-face period than infants who show an equal amount of attention for faces and other objects as observed in our study, infants who are four months do not fully recover from the still-face perturbation and gaze less in the reunion (compared to baseline).

We did not find country differences in SFP patterns for positive affect and gaze. Although this result was in line with Kisilevsky et al., (1998)'s study that Chinese infants showed similar pattern of positive affect as Canadian infants, it is not congruent with the observation that Chinese traditions involve restraining positive emotion expression. This may be because the face-to-face setting with placing infant in the infant seat was not a familiar situation for Chinese parents. They might express more positive emotions in order to help infants feel relaxed and distracted in this unfamiliar setting when they were allowed to play together. In addition, increased "Westernization" is known to have influenced Chinese parents in recent years. Contemporary urban Chinese parents are shifting their child-rearing values to more Western style (e.g., Cheah et al., 2015), which can also include more playful behavior aimed at eliciting positive emotions. but we did find a difference between fathers and mothers in positive affect. This is different from previous research in which infants showed similar SFP effects with both parents (e.g. Kisilevsky et al., 1998). In our study, infants displayed a somewhat more pronounced reaction: A steeper pattern by showing higher positive affect with mothers during both baseline and reunion than with fathers. This result confirms Forbes and colleagues (2004)'s finding that parent gender matters for infants' positive affect in interactions, with infants displaying more positive affect with mothers than with fathers. Mothers in general have more caregiving experience than fathers with young infants, which may mean that mothers have more interaction routines and a wider interaction repertoire to which infants respond positively. A similar pattern was found for gaze. Infants showed higher gaze with mothers than fathers in the baseline and dropped to similar gaze with both parents in the still-face.

We explored the SFP pattern for negative affect in both the Netherlands and China. We only found the classic SFP effect (Mesman et al., 2009) for negative affect (i.e., an increase from baseline to still-face, and no - or little - change from still-face to reunion) for Dutch infants. Chinese infants showed a significantly different SFP pattern regarding negative

affect with no change from the baseline to the still-face with both parents. This difference remained after we controlled for paternal age and education which means these variables did not account for the country difference in infant negative affect. Country differences in emotional expression could be partially attributed to genetic differences. Kim et al. (2011) for example suggested that Asians' oxytocin receptor polymorphism (OXTR) functioning, which is related to emotional suppression, differed from that of European Americans. Koreans with the GG genotype showed more emotional suppression than Koreans groups with the AA genotype, whereas European Americans with the GG genotype showed less emotional suppression compared to European American groups with the AA genotype group. This means that differences between cultures regarding the genetic underpinnings of emotional expression might play a role in explaining different emotional expression patterns in infants.

In addition to genetics, culture and socialization may also play a role in parental behavior and thus influence infants' emotional expressiveness. Chinese parents encourage their children to be behaviorally inhibited and restrain negative emotions (e.g., Huang et al., 2017). In order to be "Guai Hai Zi" which means a well-behaved child in Mandarin, and to get more positive responses from parents, children may learn to suppress their emotions even in a challenging situation at a very young age. Therefore, our finding can be seen as in line with Chinese culture that is still rooted in Confucian and Taoist philosophies, which consider emotional and behavioral inhibition socially acceptable and good for social harmony (Ho & Kang, 1984). Our finding is also consistent with one other still-face study in mainland China which found very low levels of grimacing across all episodes (Kisilevsky et al., 1998), whereas it is inconsistent with the Taiwan study that found an overall linear increase across all episodes in negative affect (Hsu & Jeng, 2008). To properly assess this issue, more studies are needed so that a meta-analysis across different samples can provide a more comprehensive insight.

In both countries, infants with mothers showed a decrease in negative affect from the still-face to the reunion, whereas infants with fathers showed a significant increase from the still-face to the reunion. Mothers appear to be more capable of comforting infants and not letting the distress increase during the reunion, whereas with fathers the infants get increasingly more distressed during that episode. This parental gender difference for negative affect is also in line with what we found for positive affect and gaze (more pronounced pattern for mothers). Infants may be more sensitive and also may have more pronounced reactions to mothers' behaviors. Compared to fathers, mothers are normally more involved in caregiving, especially in early childhood which may make mothers better attuned to their child's signals in both the Netherlands (Sociaal Cultureel Planbureau [SCP], 2011) and China (Zhang, 2017). In addition, females seem to have better skills in recognizing subtle facial expressions than males (Hoffmann, Kessler, Eppel, Rukavina, & Traue, 2010), so mothers may have an advantage over fathers to be more sensitive (e.g., Hallers-Haalboom et al., 2014). It is important to note that effect sizes were small, so only a small portion of the variance in infant behavior was explained by country and parent gender.

In addition to identifying patterns on a group level, we also looked at the occurrence of different patterns on the individual level. Consistent with previous findings in Dutch infants (Mesman et al., 2013), only a small percentage of children showed the patterns of behaviors across episodes that are identified on the group level. Most of infants actually did not show negative affect at all and around 17.6% of infants showed only minimal gaze across the three episodes. Our finding is also partly consistent with a study on Italian infants who found that infants stayed neutral for more than 60% of the time in the reunion (Coppola et al., 2016).

Our study makes an important contribution to the literature by investigating SFP patterns of fathers and mothers in the Netherlands and China, uncovering parental gender and cultural effects on infants' behaviors across the episodes. There are a few limitations of our study. First, the Dutch and Chinese sample included mostly middle-upper-class families with a large percentage of highly educated parents. As individuals of lower socioeconomic status have been observed to suffer from depression more often and show less sensitive parenting compared to higher educated parents, which are both related to infant behavior in the SFP (Field et al., 2009; Weinberg et al., 2006), more studies are needed to test whether our results can be generalized to lower educated families and other cultures. Future studies should include lower, middle and upper class families from different cultural groups. Another important point to mention is that the current study focused on testing country differences in infant behaviors within the SFP. The mechanisms underlying those differences, more specifically negative affect, need to be investigated. In other words, why children behaved differently and what causes the observed difference in negative affect between countries needs to be investigated further. As younger infants spend most of their time with their parents, parental behaviors may have an important impact on infant behaviors during the SFP procedure (e.g., Braungart-Rieker et al., 2014). Future studies should include parenting measures especially on emotional expressions and emotion socialization of parents to explain country differences. Third, although at the group level the SFP effect was found, in line with previous literature (e.g., Lowe et al., 2016), most of the infants actually did not show negative affect at all. Those infants who did not show any negative affect may not have experienced enough stress to use a strategy such as gazing away (Mesman et al., 2013). How stressful the SFP actually is should be explored further. Moreover, in order to extend our knowledge on individual differences in SFP patterns, infants' characteristics such as infant temperament and age, which may in turn influence infants' responses in the SFP (Braungart-Rieker et al., 1998; Mesman et al., 2013), should be considered as moderators in future studies.

In conclusion, our study replicates the robust group-level effect of the SFP for positive affect and gaze in both Dutch and Chinese infants. This finding can add evidence to the potential universality of infants' sensitivity to interactional reciprocity by reacting to an unexpected change in interaction at a attentional and emotional level (DiCorcia et al., 2016). We observed country differences in infants' expressions of negative affect. Chinese infants expressed less negative affect than Dutch infants, which is consistent with emotional inhibition and especially negative emotions in Chinese culture. To our knowledge, this is one of the first studies that compared infant response patterns across

the SFP episodes between fathers and mothers. Similar to a previous study (Forbes et al., 2004), infants displayed more positive affect with mothers compared to fathers. Finally, findings from this study also highlight that although the SFP effect is robust, there is individual variation, with only a minority of infants showing the expected pattern of SFP across episodes. The number of infants who showed the expected pattern was similar with mothers and fathers in both countries. Overall, by including fathers as well as mothers from the same family in the Netherlands and in China in the Still-face Paradigm, we were able to observe similarities and differences in the dynamics between parents and infants in different countries. Our results supported that infant emotion expression is influenced by parent gender and cultural context. An interesting avenue for further study is the exploration of the origins of within- and between- gender and culture differences in affective communication between parents and infants.